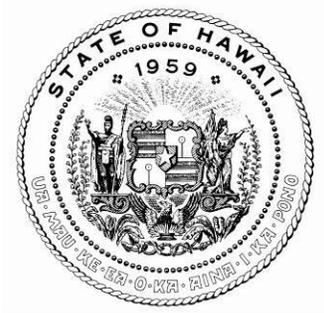


REPORT TO THE TWENTY-FIFTH LEGISLATURE
REGULAR SESSION OF 2010

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

November 2009

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BUDGETARY AND OTHER ISSUES REGARDING INVASIVE SPECIES

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, DBEDT chairs the Resources Working Group, and DOT chairs the Public Outreach Working Group.

COORDINATION OF INVASIVE SPECIES EFFORTS

Summary of Key HISC Activities

Over the past calendar year, HISC met once to review and approve actions related to fulfillment of responsibilities identified by Chapter 194, HRS, and now detailed under the updated HISC Strategy 2008-2013. <http://www.hawaiiinvasivespecies.org/hisc/strategicplan.html>

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.

HISC Measures of Effectiveness

- Advice and recommendations to Governor or Legislature. **Detailed in this report.**
- Reports to the Legislature regarding invasive species. **This report.**
- Approval of annual budget. **This report, see HISC Budgetary Matters below.**
- Meeting reports (including working groups). See list of meetings below and <http://www.hawaiiinvasivespecies.org/hisc/>
- Attendance at meetings of member and collaborating agencies. **This report** and <http://www.hawaiiinvasivespecies.org/hisc/>
- Agency adoption of innovative projects, rules and policies against invasive species. **This report.**
- Number of new invasive species detected at ports of entry. **This report.** See Prevention below.
- Names and numbers of priority pests threatening Hawaii. **This report, see HISC working group areas of accomplishment, and the overview of the invasive species problem in Hawaii below.**
- Working group goals achieved. **This report, see HISC working group areas of accomplishment below.**

HISC Meeting Resolutions

On September 18, 2009, HISC approved a spending plan for Fiscal Year (FY) 10 for a budget of \$2,000,000 that addresses three of the four interrelated plan components:

- Prevention \$740,000
- Response and Control \$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.

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 to begin with. Given the needs of HDOA, however, budgets in Response and Control, Public Outreach, and Research and Technology were significantly reduced.

HISC working groups were also active in FY09:

- Considered and approved budget and project proposals for 2009-2010.

HISC and working group meetings held between November 2009 and November 2010

Meeting	Date	Lead Agency	Main issues
1. Public Outreach*	November 19, 2009	DOT	Biocontrol outreach & project updates
2. Public Outreach*	February 26, 2009	DOT	Review of outreach progress.
3. Public Outreach*	July 27, 2009	DOT	Updates on outreach projects including biocontrol and restoration.
4. Prevention*	September 10, 2009	HDOA	Proposals for Prevention projects in HISC FY10 budget submitted and reviewed. DLNR, and HDOA presented proposals.
5. Research & Technology*	September 10, 2009	UH	Review of FY09 R&T project progress. Budget constraints and lack of funding for R&T in FY10. No proposals were presented.
6. Public Outreach*	September 14, 2009	DOT	Proposals for Public Outreach projects in HISC FY10 budget submitted and reviewed. Proposals from Invasive Species Committees, HISC, PBIN considered. Review of FY09 projects and spending in light of FY10 reductions.
7. Established Pests*	September 14, 2009	DLNR	Proposals for Established Pest projects in HISC FY10 budget submitted and reviewed. Invasive Species Committees, DLNR, and HDOA presented proposals.
8. Resources*	September 17, 2009	DBEDT	Overall reduction in HISC budget from \$4 to \$2 million. Formulation of a balanced budget the HISC budget FY10 see HISC Budgetary Matters below.
9. HISC	September 18, 2009	HDOA/DLNR	Approval of budget recommendation made by the Resources Working Group FY 10.
10. Public Outreach*	September 28, 2009	DOT	Invasive species outreach projects, budget and spending FY09 and FY 10, distribution of funds given reductions, staffing, and projects.

* All HISC working group meetings are interagency groups that meet to discuss issues related to invasive species management. Agenda and minutes are posted at: <http://www.hawaiiinvasivespecies.org/hisc/>

HISC WORKING GROUP AREAS OF ACCOMPLISHMENT

Accomplishments within the four HISC program areas: Prevention, Response and Control, Research and Technology, Public Outreach and Resources, as accomplished by the working groups established by the HISC Strategic Plan, are summarized below. Measures of effectiveness are taken from the HISC Strategy 2008-2013.

Prevention

Goals: (1) Review risks of pest/invasive species entry into the State; and (2) 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. A more detailed list of goals for the Prevention Working Group is in the HISC Strategy 2008-2013.

The lead agency and chair for the Prevention Working Group (PWG) is HDOA.

The main prevention projects were:

- Implementation of a Weed Risk Assessment (WRA) system screening for plants led to the adoption of voluntary Codes of Conduct by the Landscape Industry Council of Hawaii (see details below Hawaii Pacific WRA). This \$97,700 project was managed through DLNR in cooperation with the UH, Maui Invasive Species Committee and the Bishop Museum.
- DLNR's Division of Aquatic Resources (DAR) implemented a hull fouling and ballast water prevention and early detection program in conjunction with the Aquatic Invasive Species Team (AIST)
- DOH implemented a \$307,300 project to undertake West Nile Virus (WNV) surveillance, analysis, and improve response capabilities, through the purchase of traps, test kits, insecticide sprayers, insecticides, staff training, and computer hardware and software.
- HDOA hired an Invasive Ant Coordinator who began improving response plans as well as researching technologies to address invasive ant issues including Little Fire Ants and Red Imported Fire Ants. They are also in the process of hiring an apiarist to assist in addressing the varroa mite infestation.

DAR/AIST Ballast Water and Hull Fouling Program



AIST continued to support DAR's Ballast Water and Hull Fouling Program minimizing the introduction and spread of AIS into Hawaii from vessels. Ballast water is being managed by Hawaii's Administrative Rules, Chapter 13-76, relating to Non-Indigenous Aquatic Species. Rules have allowed the State to manage ballast water on a local level, by working with the shipping industry to limit the amount and reduce the risk of ballast water discharged in Hawaii's waters. Further verification is in the planning stages with the recently acquired sampling tools including a Ballast Water Assurance Meter which was recently approved by the United States Coast Guard (USCG) as the first tool to accurately check for ballast water exchange.

Hull fouling, which is responsible for the majority of AIS introductions to Hawaii's waters, is being addressed as a high priority. DAR also continues to work with the Alien Aquatic Organism Task Force (AAOTF) to develop a comprehensive plan for preventing the introduction and dispersal of alien aquatic organisms found on the hulls of vessels. AAOTF includes representatives from state and federal agencies, shipping industries, the scientific community and non-government organizations. DAR is currently reviewing how others are managing this vector as well as conducting studies, such as an assessment of recreational vessels in Hawaii, to get a better understanding of how to address hull-fouling issues.

The Program is conducting AIS inspections using new technologies such as a remotely operated vehicle, a variety of pole cameras, and underwater drop cameras. Inspections are conducted on high-risk events such as unexpected arrivals, vessel groundings or vessels that may carry AIS. DAR is also assisting The Papahānaumokuākea Marine National Monument with inspections of vessels that enter one of the largest protected marine areas in the World. This Program requires that 100% of the vessels (excluding USCG and military vessels) entering into monument waters undergo a hull inspection and certification. The Monument has very few non-native species and rigorous inspection of vessel hulls, ballast water, ancillary and scientific gear is done to maintain the biosecurity of this potential World Heritage Site.

DOH WNV Surveillance, Prevention and Response

Objective: Continue implementation of effective surveillance, prevention, and control of WNV in Hawaii.

DOH continued to maintain and improve its current surveillance and prevention efforts, and established greater capacity for responding if WNV was detected, in order to prevent the establishment of the virus in the State.

WNV poses a serious threat to Hawaii for several reasons. Given the tropical climate of the State, mosquito populations are present throughout the seasons, suggesting the potential for year-round transmission and prolonged human disease outbreak. Direct medical costs will be significant. With regards to wildlife, WNV will probably extinguish several endangered and endemic bird species in Hawaii, and may cause irreversible damage to the ecosystem. Additionally, Hawaii's economy is dependent on tourism, and its beautiful and safe environment

is attractive to many visitors. Establishment of a mosquito-borne disease with no cure or prophylaxis currently available would have a negative impact on the state's economy.

DOH focused its efforts in various areas:

1. Prevention activities continued to focus on source reduction, and source treatment with larvicides. Hawaii's mosquito species are container breeders, so reducing the number of water-collecting items from property reduces the breeding sites for the mosquitoes. Public outreach is critical for source reduction, and is discussed below. In addition, treatment of standing water with larvicides greatly enhances the reduction of the adult mosquito population, especially because standing water cannot be eliminated in many areas. Mosquito suppression is targeted so that if the virus is introduced, there will not be a sufficient mosquito population to establish the disease cycle.
2. Educating the public was another significant activity for prevention of WNV. DOH shared WNV information through various venues, including health fairs, pet shows, neighborhood boards, association and group meetings, and the main public library. Other outreach activities included radio public service announcements, production and dissemination of informational brochures. Outreach efforts will continue with the first basic concept of informing the public of the need for mosquito control. DOH seeks HISC funds to maintain its level of effort.
3. Source reduction. DOH's Vector Control Program continued to implement strategies of reducing mosquito populations to a level of no more than 5 mosquitoes per trap per night, with surveying for breeding sites triggered by higher counts. Maintaining low mosquito counts has proven more difficult in some areas than others. Surveillance of an approximate radius of two miles of all major ports of entry, to detect and reduce breeding sites continues. As a significant focus on prevention, DOH seeks HISC funds to maintain our level of effort in the area of source reduction. Ports of entry, both air and sea, will continue to be the primary focus of DOH mosquito surveillance and reduction.
4. Dead bird surveillance is accomplished through a contract established with Aloha United Way (AUW) to operate a public hotline, accessible statewide, to report dead birds. Due to cost and potential for test failure, DOH discontinued the RAMP (Rapid Analyte Measurement Platform) test for screening mosquito pools in February 2009. Specimens were sent to the Hawaii State Laboratories Division (SLD) of DOH for real-time reverse transcription polymerase chain reaction (RT-PCR). Testing for antibody to WNV was an alternative to screen live birds for exposure to West Nile Virus, so SLD maintained capabilities using Blocking Enzyme-Linked Immunosorbent Assays (ELISA) and hoped to have developed methods on MicroImmunoAssay (MIA) but lacked resources.
5. Detection of WNV in a timely manner is critical in preventing the establishment of WNV or, if it is established, minimizing the public health impact in humans and animal species. Due to the Hawaii's relative remoteness, efforts have been made to ensure that a full menu of WNV testing is available within the State. Protocols for performing ELISA for WNV antibody in humans were established at SLD, and will continue to be used for the

diagnosis of WNV human infections. A more sensitive alternative to the ELISA was established in October 2008 by SLD. MIA was established for human testing and could have been used for live bird testing had there been resources (see 4 above). SLD is prepared to continue performing tests to detect WNV in human cerebral spinal fluid specimens, dead bird organs, and mosquito pools if funding is available for FY 10, which appears unlikely. Without HISC or some other source of funding, the laboratory capabilities for WNV testing in dead birds, mosquito pools, and live birds will be eliminated by the end of 2009.

DOH – Measures of Effectiveness

Vector Control Branch

Goal: Enhance capacity to identify WNV in mosquitoes and dead birds, prevent establishment of WNV by maintaining a state-wide integrated mosquito management (IMM) program, and maintain and provide resources for a ground-based response to WNV introduction.

Measures of Effectiveness:

Objective	Measure	Responsible
Maintain gravid traps at major ports of entry for collection of mosquitoes	Number of gravid traps at each port of entry	A total of 59 gravid traps are maintained on the four major islands. In addition, 122 New Jersey mosquito light traps monitor the <i>Culex</i> and <i>Aedes vexans</i> populations statewide.
Sort and pool mosquitoes for WNV testing	Number of mosquitoes sorted, number of mosquito pools submitted to SLD	174,373 mosquitoes were sorted. 4,075 pools were submitted to SLD.
Necropsy dead birds for WNV testing	Number of dead bird necropsies with tissues submitted to SLD	127 birds were necropsied and submitted to SLD.
Identify sources of mosquito breeding within 2-mile radius of major ports of entry	Number of new mosquito breeding sites identified during surveys, total number of mosquito breeding sites	Oahu, Hawaii and Maui are conducting surveys within a 2-mile radius of ports of entry at the present time. All new breeding sites are documented, treated and added on to the routine list of treatment sites. Survey was last done in 2004.
Remove or eliminate sources of mosquito breeding	Number of mosquito breeding sites removed/ eliminated	This data is unavailable. Eliminated sites are not archived as to date of removal.
Treat (larvicide) mosquito breeding sources	Number of mosquito breeding sites treated	More than 1,000 mosquito breeding sites were treated.
Maintain database of mosquito trap data, and	Ongoing maintenance of database	Statewide maintenance of the Vector Control Management System (VCMS)

mosquito breeding sources (location, inspection, treatment)		database is ongoing.
Report mosquito trap results in a timely manner	Mosquito trap results are reported to appropriate personnel monthly.	Results were reported to appropriate personnel.

State Laboratories Division

Goal: Enhance laboratory capacity to identify WNV in humans and other species (dead birds, equine, live birds mosquitoes).

Measures of Effectiveness:

Objective	Measure	Jan to Aug 2008 data	Responsible
Maintain real-time RT-PCR testing for avian samples and mosquitoes	Number of dead birds, mosquito pools tested for the year, statewide	99 Dead birds 2,097 Mosquito pools	SLD
Maintain Blocking ELISA test in support of live bird surveillance	Number of Blocking ELISA test performed	1,837	SLD
Maintain Plaque Reduction Neutralization Test (PRNT) for the confirmation of West Nile Virus detection by ELISA or MIA	Number of Proficiency testing performed and passed. Number of PRNT testing performed to rule-out West Nile Virus (WNV).	5 PT samples for IgG; 5 PT for IgM ; 10 PT for rti RT-PCR 10 PRNT PT tests Passed All PT	SLD
Validate the MicroImmunoAssay (MIA) test in support of live bird surveillance activities	Validation/verification studies for the MIA performed within the budget period	Not performed due to the loss of one HISC-funded Microbiologist. Pandemic A H1N1 outbreak	SLD
Establish MIA as part of the live bird surveillance testing algorithm	Number of MIA tests performed on live birds sera	Not accomplished due to the loss of one HISC-funded Microbiologist. Pandemic A H1N1 outbreak	SLD
Maintain database of all laboratory results (surveillance, diagnostic tests)	Submit monthly lab data and post this on the DOH website.	Database maintained and updated regularly; monthly lab data are posted on the DOH website.	SLD

Timely reporting of lab results.	90% of WNV Blocking ELISA results are reported to the submitters within 2 business days from the date suitable specimens are received in the Lab. 90% of WNV RT-PCR results are reported to the submitters within four business days from the date suitable specimens are received in the Lab.	Please see notes below	SLD
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Turn-Around Time (TAT) for WNV RT-PCR : From January to August 2009

Desired TAT of 4 business days for testing mosquito pools and dead birds by reverse transcriptase inhibitors (rti) RT-PCR was not met for the period Jan to Aug 2009. Of the total specimens tested, only 19% (411/2,198) met the 4-day TAT.

Reason for not meeting the TAT:

The loss of the contract Microbiologist (contract ended on January 12, 2009) who performed the rti RT-PCR testing had a significant impact on the TAT. Further, the Bioacoustic Research Lab (BRL) was not able to hire a replacement Microbiologist because of lack of funds.

WNV rti RT-PCR testing for mosquito pools was delayed due to increase in mosquito pool samples submitted by the Neighbor Islands. This resulted from elimination of the Rapid Analyte Measurement Platform (RAMP) test on Neighbor Islands. Samples were directed to the SLD-BRL for rti RT-PCR testing.

TAT for WNV Blocking ELISA : From January to August 2008

Of the 1,837 birds sera received for testing, 1,791 (97%) met the 2-day TAT.

Reason for 3% not meeting the TAT typically was improper coordination for shipment of samples, which resulted in the delay in testing.

Outreach

Because of a reduced budget, no funds were used from 2009 for information development. Extra funds from 2008 were used to develop products for dissemination. In 2009, outreach participation was done at community fairs, the Pet Expo, and classroom presentations. HISC outreach staff on the neighbor islands helped to insure statewide coverage.

2009 funds were used to partially pay for the hotline number through AUW. Due to budget reductions at AUW, the 211 hotline reduced hours of operation from 24 hours a day to 7:00 am.

To 9:00 p.m. on weekdays. The State Veterinarian from the Disease Outbreak Control Division (DOCD) was responsible for coordinating with AUW.

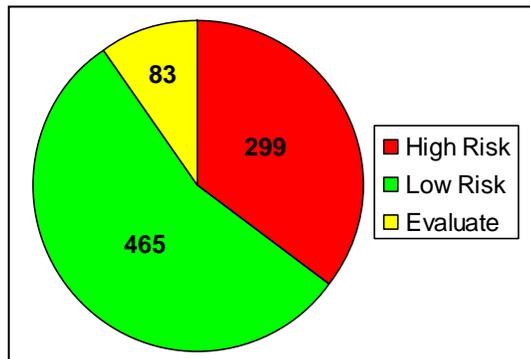
Measures of Effectiveness:

Objective	Measure	Accomplishment	Responsible
Produce informational items to give out at community events	Number of products distributed	2,500 fans with mosquito control information were distributed	EPO/HISC Public Outreach Working Group (POWG)
Hotline for dead bird pick-ups	Number of calls received at 211		DOCD
Develop outreach network for disseminating information	Number of community events statewide where WNV info was given out	Approximately 25 events where WNV information was disseminated by HISC and DOH staff	HISC POWG

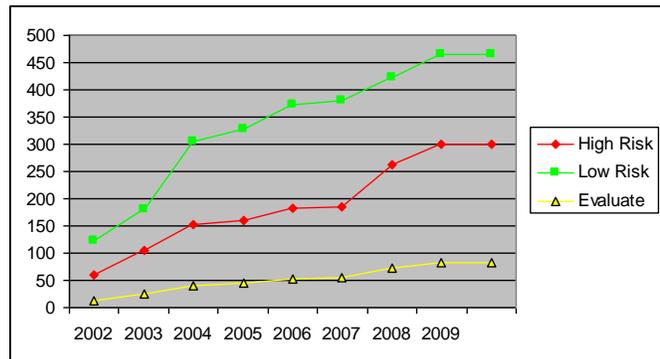
Hawaii-Pacific Weed Risk Assessment (HPWRA)

Two ongoing objectives of the HISC Strategic Plan for 2008-2013 are to “develop a comprehensive ‘approved planting list’ to ensure that invasive species are not being planted in State projects or by any state contractors, e.g. screened by the WRA protocol” and to “develop collaborative industry guidelines and codes of conduct, which minimize or eliminate unintentional introductions.” In accordance with these objectives, two WRA Specialists are presently employed through funding provided by the HISC. Charles Chimera, based in the Maui Invasive Species Committee Office on the Island of Maui, was hired in September 2007 and has continued in that capacity to present. Patricia Clifford, based out of the Bishop Museum on the Island of Oahu, has been employed as a WRA Specialist from August 2008 to present.

Continued effort is being put into assessments so that a growing number of the 10,000+ species in Hawai'i and the many other species that could be introduced from around the World can be assessed and documented. As of September 2009, 847 assessments, assigned to categories of “High Risk”, “Low Risk”, or “Evaluate”, have been completed and posted on the website at: <http://www.botany.hawaii.edu/faculty/daehler/wra/default2.htm>). An additional 34 assessments have been completed and will be posted pending review by Dr. Curt Daehler.



847 posted 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 Sep 2008 through September 2009:

WRA REQUESTS BY AGENCY AND ORGANIZATION

Department of Tropical Plants and Soil Sciences, CTAHR, and Botany Department, UH at Manoa

WRA specialists continued working with Dr. Andy Kauffman and graduate student Alberto Ricordi to identify a selection of viable ornamental trees and shrubs to replace ones currently on the invasive species list. The plants identified as low risk will be promoted for use in both private

and public landscape planting projects. Assessments have also been provided upon request from UH Botany Department students interested in the invasiveness of medicinal ginger species.

WRA Specialist Patti Clifford worked with the College of Tropical Agriculture and Human Resources at UH to have the WRA incorporated into three documents. The documents are available online at:

<http://www.ctahr.hawaii.edu/ctahr2001/PIO/FreePubs/FreePubs06.asp#Landscape>

The publications are: Barrier Plants, Green Plants for Hawaii's Tropical Landscapes and Salt and Wind Tolerance of Landscape Plants for Hawaii.

Island Invasive Species Committees (ISCs)

WRA Specialists have screened requests from Oahu, Kaua'i, Maui and the Big Island ISCs 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. Detection of the invasive milk thistle (*Silybum marianum*) by retired forester Bob Hobdy was followed by a rapid weed risk assessment and presentation by Charles Chimera to the MISC, and the ultimate inclusion of milk thistle as a target species for localized control. Another assessment for Spanish Heath (*Erica lusitanica*) was completed upon request from MISC outreach staff to provide supplementary information for the monthly newspaper column "Kiai Na Moku O Maui Nui (Guarding the Islands of Maui County)" in March 2009.



Milk thistle (Photo by F.&K. Starr)
WRA Score = 17.5 (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 ISC and has provided assessments on over 40 requests from Oahu, Maui and Big Island early detection staff.

Pacific Islands Outside Hawaii



Other Pacific Islands continue to actively use the HPWRA Program to make plant importation, propagation and control decisions. In the previous year, WRA Specialists have provided assessments on behalf of the quarantine services of the Federated States of Micronesia for such species as *Tradescantia spathacea*, *Festuca arundinacea* and *Poa pratensis*, among others. WRA Specialist Patti Clifford also gave a presentation at the Pacific Invasives Learning Network (PILN) workshop to raise awareness and encourage adoption of the HPWRA by workshop attendees from Micronesia, Polynesia, Melanesia and Hawai'i

Federal Agencies

Assessments have been completed and technical information provided for federal government agencies including the United States (US) Fish and Wildlife Service (USFWS), the US Forest

Service, the O`ahu Army Natural Resource Program (OANRP) and the Pōhakuoa Training Area Ecosystem Management Program. Of particular importance was an assessment by Patti Clifford for *Sphagnum palustre*, a native moss invading bog habitats in the Mount Ka`ala Natural Area Reserve on the Island of Oahu. Results of this assessment, completed on behalf of OANRP staff, were included in a poster presentation at the 2009 Hawaii Conservation Conference.

Watershed Partnerships

Several assessments have been completed on behalf of the various island watershed partnerships to aid in prioritization and management decisions for known and potentially invasive plant species. An important assessment of *Paraserianthes lophantha* (Mountain albizia) was also recently completed on behalf of the Leeward Haleakala Watershed Restoration Partnership, to raise concern for and awareness of this incipient watershed invader spreading out of the Polipoli Forest Reserve on Haleakala, Maui.

Private Organization, Individual Plant Growers, Landscape Professionals, Environmental Consultants

The HPWRA Program is continuing to receive plant information and screening requests from plant growers and landscape professionals, including several requests from Maui Land and Pineapple Company, Haleakala Ranch, the Honolulu Botanical Gardens, Regenerations Botanical Garden, Carol Kwan Consulting LLC, the Nature Conservancy of Hawaii and others to assess individual species as well as new development planting lists for known or potentially invasive plant species.

BIOFUELS ASSESSMENTS & PUBLICATIONS

The WRA System has been utilized as an objective tool to identify both low and high risk crops proposed for biofuel development in the Hawaiian Islands and other tropical island ecosystems. WRA Specialists have continued to attend meetings and have given presentations to inform the public and conservation agencies of the biofuel assessments and findings. These include a presentation on invasive biofuels by Charles Chimera at the native meeting of the Native Hawaiian Plant Society in March 2009 and a poster on biofuel risk assessments presented by Chris Buddenhagen, Charles Chimera and Patti Clifford at the 2009 Hawaii Conservation Conference. 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)”.

Chris Buddenhagen, Charles Chimera and Patti Clifford also published the results of an analysis of risk and invasiveness of biofuel crops in the April 2009 edition of the on-line peer-reviewed journal PLoS One (Buddenhagen C. E., C. Chimera, and P. Clifford. 2009. Assessing Biofuel Crop Invasiveness: A Case Study. *PLoS ONE* 4(4): e5261. doi:10.1371/journal.pone.0005261).

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Assessing Biofuel Crop Invasiveness: A Case Study

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Abstract

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 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 a widely accepted weed risk assessment system, we analyzed a comprehensive list of regionally suitable biofuel crops to show that seventy percent have a high risk of becoming invasive versus one-quarter of non-biofuel plant species 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.

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. Other evidence supports the contention that propagule pressure created by extensive plantings will 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.

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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).

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., 38)).

Status	biofuel	random
Present in Hawaii	38 (95%)	40 (100%)
Naturalized in Hawaii	22 (58%)	5 (13%) **
Invasive in Hawaii	12 (32%)	5 (13%) **
Invasive elsewhere	24 (60%)	8 (20%) **

**Binomial proportion tests significant at the 0.001 level.



Majority of images courtesy of Forest & Kim Starr

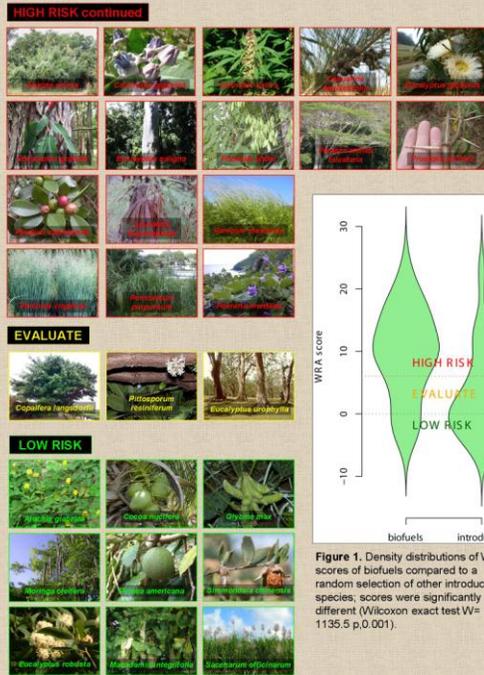


Figure 1. Density distributions of WRA scores of biofuels compared to a random selection of other introduced species; scores were significantly different (Wilcoxon exact test $W = 1135.5$, $p < 0.001$).

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.

Majority of images courtesy of Forest & Kim Starr

Biofuel Poster Presentation at 2009 Hawaii Conservation Conference

HPWRA OUTREACH

To continue to promote awareness and encourage adoption of the HPWRA system, WRA Specialists Charles Chimera and Patti Clifford have been involved in additional outreach activities with partner agencies, signatories of the Codes of Conduct and other interested parties. As previously mentioned, Chimera gave an invasive biofuel presentation to the Native Hawaiian Plant Society in March 2009 and wrote a Maui News article in August 2009, and Clifford gave an informative talk on the HPWRA at the PILN workshop in June 2009. In addition, Chimera and Clifford attended a meeting of the Kauai Landscape Industry Council in Lihue, Kauai on December 2008 in which information was presented both on the WRA and on species included in the "Do Not Plant" list.

Introducing biofuel plants: It isn't all good

Kia'i Moku
By Chuck Chimera



A visit to the Maui Botanical Garden reminded me of how lucky I am to be able to come home to the islands. I continue to fall for some pretty flowers from people's sensitive reactions when I tell them I'm returning to Maui.

With reasonable forecasts to live in such a beautiful place, but living on an island also comes with some costs. One of those costs is an invasion of the plants and tree species at the pump. That's not to mention why the idea of producing our own energy and becoming more self-sufficient is so appealing.

Biofuels could play a part in reducing our need for imported fuel. Biofuels are plant-derived sources of energy, and include converted into liquid or gaseous fuels.

One biofuel Maui residents know well is ethanol produced from the starch, sugar or cellulose of plant like corn, and added as a gasoline supplement. Another biofuel on Maui comes from seed cooking oil, converted into biodiesel.

Although these fuels provide a great way to recycle, our crops are not needed to help meet our energy needs. To do this, we need plants that are high yielding and fast growing, both in Hawaii and elsewhere. These plants commonly have



seeds that are off-spread for conversion to biofuels.

In addition to providing renewable, alternative sources to produce ethanol, planting biofuel crops in large-scale agricultural production could further increase the risk of certain plants escaping and becoming weeds.

Corn plants, like Canebrake, are notorious invaders on the Hawaiian and related archipelago islands. Corn is not native to Hawaii, and its introduction to the island is a clear example of a plant that has escaped and is invading along with its seeds.

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As submitted to *The Maui News*, Published August 9, 2009, Page C5.

Maui News, August 9, 2009

Pam Clifford has been active in contacting agencies about the HISC Resolution to have state agencies consult the HPWRA before using a plant in landscaping. She has also created maps and wrote the section on Global Positioning System (GPS) quality for a grant that the Bishop Museum has submitted to USFWS for a botanical survey on the Oahu National Wildlife Refuge. She has further collaborated with HISC and the Herbarium Pacificum to arrange a field trip to the herbarium and the entomology department at the Bishop Museum for the PILN Workshop. Clifford's efforts on behalf of the Bishop Museum are provided in exchange for use of office resources and space in the museum facilities.

In collaboration with the Maui Invasive Species Committee, Chimera has led multiple backcountry trips with MISC staff into Haleakala National Park's Kipahulu Valley. On these trips, he has provided training in field identification of invasive species targeted for control as well as of native rainforest flora. He also gave a talk to high school science teachers in August 2009 on island biota as part of MISC's Ho'ike environmental curriculum.

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.

CURRENT 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 and answer technical questions relating to particular species and their invasive potential. WRA Specialists also provide recommendations on utilization of low risk alternatives to invasive plants in both public and private landscape and horticultural projects.

FUTURE NEEDS

At present, all HPWRA data continues to be entered into Excel spreadsheets. Incorporating all data into a searchable database such as 'Access' would help in analysis of general data trends and would be a first step towards assessing how HPWRA could better serve the conservation and nursery communities. The contract to design this HPWRA database and convert existing spreadsheet-based data to the new format was awarded in the summer of 2008. Work is currently proceeding on the database development and an end user interface is expected to be ready in November or December 2009. WRA Specialist Chimera has enrolled in a database application and design class at Maui Community College for the Fall 2009 semester in anticipation of continued work and manipulation of the prototype WRA database.

Development of a user-friendly web interface is still recognized as a critical need for the promotion and adoption of the HPWRA. A grant to design and develop such a website was submitted in the early spring of 2009 but was not funded at that time. WRA staff will continue to explore other funding possibilities in pursuit of this worthwhile endeavor.

Due to budget restrictions and the State's recent economic crisis, only one WRA position has been funded beyond February 2010. WRA collaborators and staff are actively pursuing additional sources of funding so that core productivity is maintained at current levels. As such,

Patti Clifford submitted a grant proposal to the Horticultural Research Institute for the weed risk assessment of species in the Acanthaceae family, members of which can be both popular ornamentals but also naturalized and invasive weeds. Notification of grant awards is expected by late November 2009. Other avenues and alternative, non-HISC sources of funding continue to be sought.

Prevention Measures of Effectiveness

Number of new invasive species detected at ports of entry.

See Invasive Species Overview below.

Current measures in place to prevent invasive species arrival and establishment

HDOA implements a plant and animal quarantine facility and runs a whole team of biosecurity inspectors; this is in addition to standard federal measures at the border for international goods. As regulations and logistics permit efforts are coordinated between, Homeland Security, US Department of Agriculture (USDA), DLNR and HDOA. For incipient invaders, invasive species committees and HDOA work together to prevent establishment. In this report see the following sections: Coqui Frogs, Invasive Species Committee reports, AIST's implementation of the Aquatic Invasive Species Plan, WNV Program with DOH, WRA and Outreach.

Names and numbers of priority pests threatening Hawaii.

See Invasive Species Overview below.

Current status of priority pests for which there is an established prevention program.

Red Imported Fire Ant Plan

Between FY09 and FY10 a total of \$120,000 was approved for the ant coordinator position to implement The Hawaii Ant Plan <http://www.hawaiiantgroup.org/hawaiiantplan/> and to work with invasive ants generally (supervised by HDOA staff). See HISC Budgetary Matters section. The Ant Coordinator was hired, and has been improving the ant response plan, coordinating prevention, early detection, and researching new technologies to address Little Fire Ant and other invasive ant threats. This plan is cross cutting and applies to management of little fire ant an invasive species already present in Hawaii (Established Pests) and the prevention and rapid response plans related to the as yet absent red imported fire ant.

Avian Bird Disease Coordinator

WNV and emergent disease inter-agency response coordination was implemented using HISC funds from FY08 to avoid the impacts of WNV through detection and prompt eradication of outbreaks. Funding from the HISC in FY09 was not requested because funds from federal sources continued to maintain the position. This coordinator continues to improve inter-agency coordination and response preparedness and will work with the existing WNV Inter-Agency Working Group. This person also works cooperatively with USFWS to detect avian influenza.

See other sections of this report about coqui frogs below and DOH WNV surveillance, prevention and response, and DAR's Ballast Water and Hull Fouling Program reported above. In addition specific programs are in place for brown treesnake and avian influenza, which are not reported in detail here. A research program seeks to determine the risks posed by other strains of ohia rust (*Puccinia psidii*) that may be present in other parts of the World. So far, the strain found in Hawaii has not been shown to be very virulent on native ohia forests, but it impacts rose apple forests and other rare native forest trees (see below for more information).

Response and Control (Established Pests)

The lead agency for the Established Pests Working Group (EPWG) is DLNR.

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. More detailed list of goals is given in the HISC Strategy 2008-2013.

FY 2009 AIST: Highlights

- **Sea Urchin Biocontrol Used in Conjunction with Mechanical Removal Suction Devices (“Supersuckers”) in Kaneohe Bay, Oahu**
- **Development of Sea Urchin Culture Ability at Anuenue Fisheries Research Center (AFRC), Oahu for Use as Biocontrol Agents**
- **Rapid Response to *Gracilaria salicornia* Report from Kona Resort on the Big Island**
- **Molokai Community-Based Invasive Species Control Project**
- **Molokai Upside-Down Jellyfish Removal Project at Kaunakakai Harbor.**
- **AIST Partnership with UH Researchers, The Nature Conservancy (TNC) and Malama Maunalua; Working to Remove Invasive Mud Weed (*Avrainvillea amadelpha*) and Restore Seagrass Habitat in Maunalua Bay**
- **AIST Surveys and Distribution Maps for Alien Species**
- **Rapid Response to Grounded Vessel Carrying Documented New Species in Hawaii**
- **AIST Assistance to DAR Ballast Water and Hull Fouling Program; Acting to Help Prevent Movement of Potential AIS**

FY09 HISC support to AIST funded a supervisor, eight technicians, two student hires and one AmeriCorps intern based on Oahu and the Big Island. In September 2009, HISC approved \$240,000 to support the AIST’s work in FY10 compared to the \$411,400 in for FY09. The FY10 budget restrictions are going to trigger a reduction in work force and will the limit the AIST to core functions. HISC funds are being used for a wide variety of AIS projects that are outlined in the State of Hawaii Aquatic Invasive Species Management Plan.

Mechanical Removal via the “Supersucker” in Kaneohe Bay with Native Sea Urchin Biocontrol



The Supersucker barges are a fleet of mechanical tools used to assist in the control of alien invasive algae. They consist of a floating platform equipped with suction pumps and hoses which divers utilize to remove alien algae from the reef. With support from HISC, AIST began overseeing operations of the Supersucker Project in 2009. Although AIST/DAR is overseeing operations, the project is still managed as a partnership with UH and TNC.

In July 2008 a small patch reef, roughly 3000 m² in Kaneohe Bay, was cleared. Consequently, the algae re-grew to baseline levels in six months without any further intervention. In July 2009 re-clearing began on the reef using Supersucker Sr. along with help from its smaller version, Supersucker Jr. AIST is studying the combined effects of mechanical removal and increased native herbivory using the native collector urchin, *Tripneustes gratilla*, on the biomass re-growth of invasive algae. Experiments are being conducted to determine the urchins' effectiveness in grazing the alien algae and inhibiting its rapid re-growth after mechanical removal on a scale larger than previous studies. Urchins were collected from Z-slab artificial reefs along the West Coast of Oahu and then transported to the State of Hawaii's AFRC to be quarantined. Upon completion of quarantine, the animals were transported and carefully placed onto newly cleared sections of the reef. The urchins' progress and/or the possible re-growth of alien algae will be monitored to determine required stocking densities and the efficiency of using collector urchins as a native biocontrol agent.

The artificial Z-slab reefs will be monitored to measure any impacts from urchin removal as well as urchin population recruit and migration in the area.

Biocontrol Development and Sea Urchin Rearing



Further investigation is underway to determine long-term utility of native grazers, such as sea urchins, to assist in the control or elimination of invasive algae. The culture and outplanting of native sea urchins may allow managers to control the growth of invasive algae without endless mechanical removal. Previous research at UH has shown this method to be a highly effective tool on a small scale. Larger scale experiments would allow the tool be monitored and altered to test further success. In order to pursue larger scale experiments, a source of urchins must be developed. Collecting a large number of urchins from the reef may cause harm to the donor area. So, the solution is to raise urchins for the purpose of outplanting. Urchin rearing trials will take place at AFRC utilizing the infrastructure already in place. The rearing of large quantities of sea urchins will be implemented in conjunction with the Supersucker project in order to address invasive algae issues in a comprehensive approach. Once urchins are available in sufficient numbers, outplanting trials will begin to test for effective outplanting densities as well as strategies for density manipulation. All activities will be closely monitored for algal abundance, coral health, and reef improvement.

Rapid Response to *Gracilaria sp.* in Kona



In 2008, AIST was notified by a pond foreman at one of Kailua Kona's resorts. The gentleman expressed concern about an algal species overtaking the substrate of one of the ponds at the resort, and inquired about removal techniques. AIST investigated the concern in August 2008. It was observed that a *Gracilaria sp.* population was restricted to a single man-made, lined, self-contained brackish water pond. In order to properly identify this *Gracilaria* species, preserved samples were sent to the University of Hawaii Botany department for genetic identification. The alga was positively identified as *Gracilaria salicornia*. The source was traced back to an aquaculture facility in Kona at the Natural Energy Laboratory of Hawaii Authority (NELHA). AIST/DAR worked with the resort to eradicate the population through a variety of techniques. The resort was able to lower the salinity in the pond by altering its well source and the population has subsequently been eliminated. AIST will continue communication to ensure the eradication remains successful from the area. This project was a positive example of government and private sector maintaining good communication and collaboration when dealing with the impacts of invasive species.

Molokai Community-Based Invasive Species Control



AIST initiated a Molokai community-based invasive species control project with funding from The National Fish and Wildlife Foundation and HISC. AIST will conduct a year-long project consisting of mechanical algae removal, community clean-up events, educational workshops, and outreach activities. *Gracilaria salicornia* is the primary species targeted for removal efforts. A bio-secure protocol for the processing and recycling of the alien algae is being developed; insuring that there will be no reintroductions and that algae biomass is utilized in a beneficial manner. Algae re-growth monitoring will measure the success of the algae removals. This project will serve as a model for community-based invasive species control across Hawaii and will take place at four locations: Kaunakakai Harbor, Keawanui Fishpond, Ualapue Fishpond & Kaloko eli Fishpond. This project has demonstrated a positive collaboration between government and community groups and individuals in accomplishing invasive species control.

Molokai Upside Down Jellyfish (*Cassiopeia* sp.) Removal Project



In June 2009, AIST collaborated with the Molokai Invasive Species Committee (MoMISC) to remove approximately two hundred upside down jellyfish (*Cassiopeia* sp.) from Kaunakakai's recreational swimming area. Both organizations decided to remove the invasive jellies from the area due to the mild sting that these species cause when disturbed. The site will be monitored over the next year to determine removal success. Previous efforts in Hawaii have shown the manual removal of this species may be effective in its long-term control or eradication.

Maunalua Bay Alien Algae Removal and Seagrass Habitat Restoration



A study currently underway by AIST assisted by UH monitors the succession of native macroalgae/seagrass cover after the removal of *Avrainvillea amadelpha* in a plot site containing a mosaic of *A. amadelpha*, *Halophila hawaiiiana*, and other native and nonnative algal species. The restoration area is a 40-m diameter (1,256 m²) circle plot located approximately 225 meters offshore Paiko Lagoon, Oahu. An estimated 235 human hours were required to remove an estimated 3000 kgs of *Avrainvillea amadelpha* from the plot. AIST has also assisted in community cleanup events organized by TNC & Malama Maunalua to scale up the alien algae removal effort in Maunalua Bay. These efforts and studies have help support TNC and Malama Maunalua's acquisition of economic stimulus funds from National Oceanic and Atmospheric Administration's Restoration Center.

AIS Surveys and Distribution Mapping for Five Alien Algae Species



AIST has been conducting visual surveys for five major invasive marine macroalgae species (*Gracilaria salicornia*, *Kappaphycus/Euchuma* spp. complex, *Acanthophora spicifera*, *Avrainvillea amadelpha*, *Hypnea musciformis*) around the State since 2005. Since that time, over 40,000 data points have been collected from Oahu, Molokai, Hawaii, and Kahoolawe. Surveys typically extend from shore to the barrier reefs of potential habitats and are conducted on snorkel, making straight line swims from beach to reef. Portable global positioning system devices are used to record spatial data along with relative algal abundances. Data points are imported into ArcGIS software allowing the generation of accurate maps that project algal abundance and distribution. These maps are essential for determining further algal management strategies and are being used to develop and implement a comprehensive approach to remove

and control the spread of non-native algae by utilizing mechanical removal, native grazers and the reintroduction of native species.

Rapid Response to Grounded Vessels



In June 2009 AIST responded to a sailing vessel which ran aground in shallow waters East of Kapapa Island in Kaneohe Bay, Oahu. The vessel had traveled from Washington State to Mexico, the Marquesas, and finally to Hawaii. AIST worked with experts to identify hull fouling organisms attached to the hull. Three different taxa of algae were collected from the bottom of the hull. It was determined that two out of the three were new alien species to Hawaii and represent a new introduction. Among a number of invertebrates collected that are currently established in Hawaii, two types of barnacles were also found to be alien species. The grounded vessel left two scars in the reef. The grounding and resulting scars represent a good example of a potential pathway for alien species' introduction to Hawaii. These scars and surrounding reefs will be further monitored in future months to determine if any of these alien species were able to colonize the reef. If these introductions are detected in the environment, a rapid response eradication will be attempted.

O'ahu Invasive Species Committee (OISC): Highlights



In FY 2009, OISC continued work toward fulfilling the objectives of the HISC Response and Control working group by controlling priority invasive species and detecting and evaluating newly introduced species. OISC received \$437,200 from HISC and leveraged \$271,352 in additional funds. OISC was founded by volunteers in the late 1990's and many of those volunteers serve on OISC's steering committee to this day. In FY 09, OISC continued to stop the spread of miconia, fountain grass and blackberry through systematic surveys and removal. OISC worked with HDOA to prevent coqui frog from establishing on O'ahu. The O'ahu Early Detection (OED) Program completed surveys of City and County managed roads and documented several species of concern. The OISC field crew has begun initial removal for some of these species. OISC also conducted outreach events across the island.

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.

OISC and the Bishop Museum have partnered together to implement OED Program. The team has completed surveys of all roads managed by the City and County and discovered 131 new island records—plants never documented as being on O‘ahu. These species are currently being evaluated as part of a prioritization process for plants that OISC should target in the future. The evaluation process will take into account the threat the species poses with the feasibility of eradication.

An example of the usefulness of this Program is the discovery of Cape Ivy (*Delairea odorata*) in the Wai‘anae Mountains. This species is a severe problem in other temperate and tropical climates and was not previously known to be present on O‘ahu. Initial control work has taken place and the species is being evaluated with the rest of the OED Team’s findings. In FY10 with assistance from HDOT, the OED Team will be surveying state roads.



OISC field crewmember Keoki Kanakaokai controlling miconia in Ka‘alaea Valley.

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, 2007 and August 31, 2008, OISC surveyed for and controlled 33 different plant, vertebrate and invertebrate species, including miconia and coqui frog, over 6,838 acres. The drop in acreage from last year’s number reflects the loss of staff due to anticipated budget cuts in 2010. Species activity highlights are described below:

- OISC crew completed 2,992 acres of miconia surveys during this period and removed 1,392 trees and saplings from the Ko‘olau Watershed. Four mature trees were found this year; one in Kahili and three in Ka‘alaea valley. No mature trees were found in the 20 other valleys in which surveys were conducted. Suitable habitat for miconia exists in the entire 100,000 acres of the Ko‘olau Watershed. It is mostly restricted to low-elevation disturbed forests, but could easily move into the native forests of the Ko‘olau summit if not constantly controlled. Volunteers contributed 294 hours to miconia work. OISC’s work protects the summit forests and the endangered flora and fauna dependent upon that ecosystem.
- Forests and summit regions of Pālolo and Maunawili Valleys are protected from Himalayan blackberry (*Rubus discolor*). This species of blackberry is only found in Pālolo Valley and was creeping toward the native forests of the Ko‘olau summit. OISC has been systematically controlling it, removing 2,255 plants over 176 acres during the reporting period.
- Following the discovery of O‘ahu’s first and only known naturalized pampas grass (*Cortaderia selloana*), OISC conducted surveys around the plant and increased its efforts

at removing all populations in cultivation. In 2009, 23 plants were removed. Pampas grass has a wide elevational and environmental range. By removing this species now, summit areas of both the Ko'olau and Wai'anae mountains will be protected.

- OISC has protected homes and natural areas along the Wai'anae Coast from the increased risk of fire that an invasion of fountain grass would bring. OISC monitors and controls all populations west of Punchbowl and north of Lanikai.

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 accordance with Section 194-2 (a) (4), HRS, OISC aims to reduce and control coqui frog infestations on public lands that are near or adjacent to communities by working with HDOA to keep all coqui frogs off O'ahu. Control efforts implemented between 2004 and 2006 removed the Island's only naturalized population of coqui frogs. No frog has been heard there since November of 2006. However, coqui frogs are continually re-introduced to O'ahu via plants from coqui infested areas on other islands.

In partnership with HDOA, OISC did the following during 2009 to keep public lands and residential areas on O'ahu free of coqui frogs:

- Monitored nurseries that import plants from coqui infested areas on other islands;
- Hand captured 13 frogs at the nurseries and private homes.
- Cooperated with HDOA to conduct spray operations at 4 nurseries with more serious infestations;
- Set up remote monitors at nurseries to increase efficiency of monitoring efforts.
- Conducted outreach with coqui calls to ensure the public knows how to identify the coqui call and that they should call HDOA's pest hotline (643-PEST) if they hear one.

HISC Public Outreach Measures of Effectiveness:

1) Agency adoption of rules and policies against invasive species

- OISC, along with HDOT, submitted comments to and met with Honolulu Rail Transit to discuss measures to decrease the likelihood that construction of the proposed rail system will introduce new invasive species to O'ahu. Transit officials agreed to use the Hawai'i WRA when choosing plants and to require that construction companies bringing heavy equipment to O'ahu ensure that it is free of dirt, insects and plant parts.

2) Number of educational materials produced.

The OISC Outreach Specialist created the following educational materials:

- Information about remote monitoring for coqui frogs that will be used by nurseries.
- A video showing OISC removing miconia.
- Updated "It's easy to be Weed Wise" brochure that informs people about the WRA and which plants to avoid in landscaping.

3) Number of people reached through talks and displays.

- OISC's Outreach Program incorporates the HISC outreach objectives and messages into all outreach activities. In 2009, OISC reached 4,547 people through public events and

talks. OISC facilitated news coverage about miconia and is using social networking tools to reach a wider audience.

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

- OISC's volunteer program garnered 1,096 volunteer hours to work on invasive species removal projects

Other activities:

- Participated in state-wide service trip that included personnel from each ISC to remove invasive species from Koke'e State Park. The combined crew of 64 people removed 28,927 Kahili ginger, 1701 smoke bush, 891 privet and 4,682 strawberry guava.
- Participated in the 2009 International Miconia Conference in Hāna, Maui. Organized by the Maui ISC and funded by multiple donors including HISC, the Conference brought together leading invasion biologists and miconia specialists from around the world. Information gathered there has already assisted OISC to fine-tune its strategy and be more effective.
- OISC participated in the Americorps program and the HIPA/PIPES (Pacific Internship Program for Exploring Science) programs that introduce students to conservation work.

Maui Invasive Species Committee (MISC): Highlights

MISC detected and controlled invasive plants and animals across the islands of Maui and Lāna'i, while also providing administrative oversight to work on Moloka'i. Strong partnerships and a supportive community provided the foundation for successful efforts during FY2009.



MISC's work focused on achieving the Response & Control goals and objectives of the Hawai'i Invasive Species Council's Strategic Plan. The Committee is highly engaged and held six meetings throughout the period to set and review priorities for the control of pests in Maui County. An annual priority-setting meeting helped focus limited resources on incipient pests and established pests that cause the greatest harm and are feasible to control. MISC's partners, especially at the county and federal level, helped bring significant funding to MISC's efforts, making state dollars provided to Maui County the most highly leveraged of all counties. Staff from partner agencies also worked side-by-side with MISC staff in the field during pampas grass sweeps, on aerial control missions, and during vertebrate control operations.

Response and Control: Measures of Effectiveness

Number of species detected and evaluated for feasibility of eradication:

Early detection and rapid response to incipient invasive species included roadside surveys and surveys at a select number of landing zones on Maui. Committee members and staff also reported on newly discovered plant species.

- A repeat of the roadside surveys first conducted in 2000 for Maui was initiated using a target list of 100 species. Two botanists drove an estimated 850 miles of roads.

Specimens from 17 species were collected, including two new state records, seven new records of naturalization, three new island records, two range extensions, and three unknown species. A total of 14 species have been identified as potential candidates for eradication.

- Trained botanists also conducted surveys for incipient plant species at 18 landing zones to assess whether conservation workers might be inadvertently vectoring seeds into high-value natural areas. To date, no major problems have been detected at the sites surveyed.

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

Control and eradication efforts centered on 23 plant species, two vertebrate species (coqui frog (*Eleutherodactylus coqui*) & veiled chameleon (*Chamaeleo calytratus*), and one plant disease (banana bunchy top virus).

- Efforts concentrated on keeping miconia (*Miconia calvescens*) out of the native rainforests of East Maui, controlling pampas grass (*Cortaderia jubata* and *C. selloana*) in both East and West Maui Watersheds, and eradicating coqui frog populations across the island of Maui.
- Over 26,000 acres were searched for miconia during ground and aerial operations, which also controlled 115,407 plants, of which 1,569 were

mature. The efficiency of pampas grass operations was greatly improved by the establishment of a remote camping platform in a wet area of East Maui.

- Opportunistic discoveries of new plant species included Spanish heath (*Erica lusitanica*) and milk thistle (*Silybum marianum*). Eradication efforts were undertaken and initial results look promising. An infestation of milk thistle was described by Charles Darwin in 1833 as “impenetrable to man or beast” and “[o]ver the undulating plains, where these great beds occur, nothing else can now live.” The roadside surveys noted above did not turn up any new locations of milk thistle or Spanish heath.
- No detections of the veiled chameleon were made during searches of 53 properties in suspect areas over 9 different nights. While it would be unrealistic to claim eradication of this species, which is capable of preying on small forest birds, it appears to have been effectively limited to a single area on Maui.
- Efforts to control banana bunchy top virus took place across the island. Recent surveys indicate good success in Lahaina and at the County Agricultural Farm in upcountry Maui. No BBTV has ever been detected during the annual survey of over 300 properties on Lāna‘i.
- Additional efforts on Lāna‘i focused on two target plant species: the smothering ivy gourd (*Coccinia grandis*) and the fire-loving fountain grass (*Pennisetum setaceum*). A total of 1,212 fountain grass plants were removed, including 177 mature plants.



Pampas grass in Haleakalā National Park

Prioritization processes identified and in place:

Each year, MISC conducts an annual prioritization meeting to review progress on the current list of target species. This process follows the general prioritization protocols established in New Zealand. It is adaptive, allowing MISC to add new species on the fly if available information indicates that immediate action would help prevent costly containment in the future.

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

MISC participates in regular review of the statewide management plan for the coqui frog.

- MISC has successfully eradicated coqui frogs at eleven population centers and contained frogs at five other areas. Three nurseries are categorized as “revolving door” sites, underscoring the need for improved inter-island quarantine.
- Work in the challenging Māliko Gulch has included deployment of a high-volume citric acid sprinkler system, creation of access trails, continued surveys to delimit the extent of the infestation, and intensive work with local landowners to ensure cooperation. Much of the infestation in the gulch is on state land.
- On Maui, MISC staff developed and implemented a coqui-free certification program to help stop the spread of frogs across the island. This project was initially funded by a HISC Research & Technology Grant. A total of 28 nurseries on Maui are now certified as coqui-free and have received relevant marketing materials. A list of coqui-free nurseries is published on a website maintained by MISC to promote the program: www.coquifreemaui.org.
- Responded to reports of dead birds and dead feral chickens and submitted them for testing for WNV and Avian Influenza.



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

- Target species are chosen for the threat that they pose to Maui County’s high-value natural areas or to agricultural production. The Island of Maui has 79 federally-listed threatened and endangered plant species and at least as many additional candidate species and species of concern. The Island of Lāna’i has 37 endangered or threatened plant species.
- MISC’s work occurs in residential areas where many introduced species first become established, but also involves ground and aerial surveys over the remote inaccessible areas of the East and West Maui Watersheds. MISC’s work also helps protect the unique resources of Haleakala National Park, the only intact summit-to-the-sea reserve in the State of Hawai‘i.
- Work on banana bunchy top virus is helping to protect both agricultural and domestic production, and also preserve the diverse numbers of Polynesian varieties that are found on Maui.

Other activities:

Additional activities also helped achieve HISC objectives.

Capacity development: Four additional field workers were hired with support from the National Park Service, helping to offset reductions associated with decreased state funding. Staff capacity was enhanced by planning and implementing the following training events: certification as a rappelling instructor, rappelling training, pesticide and fish and wildlife resources workshop,



botany workshop, and ArcGIS training. MISC staff also participated in a joint exercise with other ISCs on Kauai, which helped develop the overall statewide capacity of the ISCs.

Infrastructure improvements: Infrastructure improvements included the development and deployment of a high-volume citric acid sprayer to control coqui frogs in the most heavily infested area of Māliko Gulch. Because of the high densities of frogs in the gulch, these spray stations are likely to be used over several years.

Biocontrol: MISC worked to create positive public perceptions about the use of biocontrol by including biocontrol messages in monthly articles in the *Maui News*. Staff helped arrange and host a public meeting on the issue of strawberry guava biocontrol agents and also participated in the release of *Eurytoma erythrinae*, a biocontrol agent for the wiliwili gall wasp (*Quadrastichus erythrinae*). Committee and staff members helped draft and support a Maui County resolution in support of biocontrol for forest pests, which was passed unanimously by the Maui County Council.

Snake Response: All staff from MISC's five-person vertebrate crew attended a four-day training on O'ahu, further strengthening the on-island capacity to respond to snake sightings.

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

In FY 09, funds from HISC supported work on Moloka'i to achieve the goals and objectives of the HISC Response and Control Working Group. MoMISC was successful in continuing its efforts to eradicate 7 of its 8 priority target species: albizia, giant reed, Australian tree fern, Barbados gooseberry, fountain grass, New Zealand flax, rubber vine and tumbleweed. MoMISC also concentrated on responding to reports from the public to address a wide variety of pest issues affecting human health and the environment.

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.**

In FY09, MoMISC evaluated and added albizia (*Falcataria moluccana*) as a priority species for eradication from Moloka'i. Common to most other islands and featured in the movie "Jurassic Park," initial suppression of this large invasive tree began in March 2009 at the only known population on Moloka'i.



MoMISC and partners preparing for a day of albizia control.

MoMISC also conducted a survey for bo tree (*Ficus religiosa*) to determine spread and feasibility of removal. This *Ficus* is now spreading because of the recent introduction of a pollinating wasp. Unfortunately, control of bo tree at this time is not feasible in part due to fiscal constraints. Any considerations for adding a species to MoMISC's target list is determined through an evaluation process by MoMISC .

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.

MoMISC continued to work on eradicating eight invasive species. Survey and treatment activities also focused on 16 other plant or animal species and covered over 14,644 acres, which included aerial surveys for *Miconia calvescens*. MoMISC assisted partner agencies, HDOA and USDA Plant Protection & Quarantine, in the distribution surveys and monitoring of traps for stinging nettle caterpillar and light brown apple moth throughout Moloka'i. MoMISC recorded all data for the traps. MoMISC continued to collect, voucher, and submit pest specimens to Bishop Museum botanists and the Maui HDOA Entomologist. MoMISC's FY09 species highlights included:

- No detection of miconia during aerial surveys covering over 5,000 acres.
- No fountain grass was found. There has been zero detection of fountain grass on Moloka'i for more than 4 years.
- A single pampas grass clump was detected and removed from a residence before flowering. The clump had been grown from seed ordered through the postal service. Prior to that, pampas grass on Moloka'i was at zero detection for over 8 years.
- Initial suppression of MoMISC's newest target, albizia, was completed. Over 330 acres were surveyed and over 483 hours spent on chemical treatment and maintenance of 885 mature and 1,000 immature trees at Moloka'i's only known population.
- Over 568 acres were surveyed and 126 hours were spent treating banana bunchy top disease.
- Over 6,500 acres were surveyed and 363 hours were spent monitoring for early detection of the agricultural pests, stinging nettle caterpillar and light brown apple moth.

HISC Response and Control Measures of Effectiveness:

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

In FY09, reports from the public of being stung by "jellyfish-like" organisms in the designated swimming area at the Kaunakakai harbor prompted MoMISC to take immediate action to protect human health.

- A total of 380 mangrove jellyfish were removed from the Kaunakakai pier in partnership with DAR.
- There were zero detections of the coqui frog on Moloka'i.



- There were zero detections of red imported or little fire ants.

Other activities:

- MoMISC continued to support work done in the East Moloka'i Watershed Partnership as well as work done in TNC's Kamakou and Mo'omomi Preserves.
- MoMISC continued to educate, survey, and control banana bunchy top disease with partners from the College of Tropical Agriculture and Human Resources (CTAHR) because it is important to our community to control this agricultural threat.
- MoMISC was instrumental in assisting partner agencies USFWS, USDA Plant Protection & Quarantine, HDOA Plant Quarantine in the education, outreach, and implementation of their projects, one of which included the eradication of rats from Mokapu Island.
- MoMISC continued to facilitate positive relationships with all major landowners by assisting with information and help in managing their lands for invasive species.

Kaua'i Invasive Species Committee (KISC): Highlights



In FY 09, 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 \$375,100 from HISC and leveraged \$244,826 in additional funds. KISC has been successful in stopping the spread of Miconia, with the last known mature plant removed in late 2004. 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. Early detection work continues with follow-up to a roadside survey conducted in late 2007. 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.

KISC conducted delimiting surveys following up an extensive island-wide roadside survey. These surveys prioritized eight plant species that are considered high risk. Approximately 458 acres were surveyed and 30 plants were removed and thought to be eradicated.



KISC crewmember treating cattails in Makaweli Valley

Once a species has been identified as a possible new introduction to Kaua'i, expert, on-island, advice is solicited to determine if other populations exist beyond the roadside. KISC's website is also utilized to generate input from the general public as to feasibility of control. See: <http://www.hawaiiinvasivespecies.org/iscs/kisc/ed.html>.

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, 2008 and August 31, 2009, KISC surveyed for and controlled 20 different plant, vertebrate and invertebrate species, including miconia and coqui frog, over 7,992 acres. Species activity highlights are described below:

- KISC crew completed 381 acres of miconia surveys during this period and removed 296 trees and saplings from the Halelea Forest Reserve and the Wailua River State Park. No mature trees have been found since 2004 emphasizing that strategies for miconia work on Kaua`i have been successful. No helicopter surveys were conducted during this reporting period. All plant found were within the known infestation buffer.
- 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 Kaua`i, but also conducts all of the control work at the one infestation site in Lawa`i near Aepo Reservoir. During this reporting period KISC crews treated 3,458 acres and expended 2,441 person hours. During this period there were approximately 10 frogs confirmed and killed outside of this Lawa`i site as new arrivals to Kaua`i.
- KISC was successful in partnering with the Marriot Kaua`i Lagoons to remove Kaua`i's last known population of pampas grass (*Cortaderia selloana*) as their feature ornamental plant on the golf course. Approximately 93 plants were removed over 206 acres using 122 person-hours. KISC was also able to solicit donations of native plants, from the National Tropical Botanical Garden, to re-plant the removal sites. KISC continues to work with the Marriot as they strive to make this course an Audubon Cooperative Sanctuary Program certified course which involves removing invasive species.
- 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 treat over 256 acres of cattails (*Typha latifolia*), removing 4,213 plants.



KISC crewmembers removing pampas grass from Kaua`i Lagoons Golf Course

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 2009 to keep public lands and residential areas on Kaua`i free of coqui frogs, WNV, and various agricultural pests.

- Monitored nurseries island-wide for little fire ant, nettle caterpillar, and a new naio thrips. These survey areas totaled 129 acres with none of these pests detected;
- Responded to and eliminated 10 coqui frogs that were new introductions at nurseries and private homes;
- Assisted Hawai`i Department of Health and USFWS with picking up dead birds reported to 211 and submitted them for testing for WNV and Avian Influenza.

Other activities:

- Organized a state-wide ISC service trip working to assist Kaua`i State Parks and Koke`e Resource Conservation Program with invasive weeds threatening Kaua`i's pristine forest.
- KISC participated in the UH Pacific Internship Program for Exploring Science (PIPES) that introduces students to conservation work. KISC partnered with both local and federal partners to produce an outreach event showcasing the last of the Hawaiian ducks, the Koloa Maoli, whose numbers are threatened by crossbreeding with Mallards.
- KISC successfully participated in Hazard Analysis Critical Control Point (HACCP) planning to develop a protocol for working with the invasive weed, *Miconia calvescens*. This plan was the first plan submitted nationally from the State of Hawai`i. It can be viewed at: http://www.haccp-nrm.org/Plans/HI/HACCP_Miconia_KISC.pdf.

Big Island Invasive Species Committee (BIISC) Highlights

BIISC surveyed 4,006 acres for key target species, including incidental and early detection species. A total of 9,218 individual plants were treated, and a total of 8,156 worker hours were used. An additional 291 miles of road were surveyed by the early detection crew looking for and mapping 198 potentially incipient invasive species.

Miconia calvescens

BIISC continues to focus containment strategy along a 40-mile containment buffer between Malama Ki in lower Puna to Ninole in the Hamakua districts. Surveys focused in the Hilo, Hamakua and Puna districts.

- Completed survey and control efforts between the 1,600' to 1,800' elevation at various sites in Hamakua, including Lapahoehoe, Akaka Falls, and the area above the core population in Onomea.
- Completed Phase 1 *Miconia* control work in the Wao Kele O Puna Forest Reserve in partnership with the Office of Hawaiian Affairs and DLNR. Crews surveyed a total of 1,454 acres controlling a total of 609 *Miconia* plants. Most of BIISC efforts for *Miconia* in FY09 was spent on this specially funded project.
- Expanded and completed additional control blocks in the Maku'u Forest Reserve to expand the control buffer. DHHL assisted BIISC in permitting us to utilize their lands as a landing zone to load and off load the crew. Crew controlled a total of 1,572 plants in this area of which 140 were considered mature plants, ground surveying a total of 397 acres.



- Completed aerial surveys of Maku'u Forest Reserve surveying a total of 646 acres.
- Completed control efforts of an outlier populations in South Hilo and Lapahoehoe, controlling a total of 960 plants of which 139 were considered mature plants, surveying a total area of 206 acres.

Plume Poppy (*Macleaya cordata* formally *Bocconia frutescens*)

Survey and control activities focused in the Wood Valley area of Kau, and Honomalino area in S. Kona.

- Completed surveys in Wood Valley, surveying a total of 769 acres, and controlling a total of 134 individual plants which were all adults.
- Honomalino has proven to be extremely difficult to get a handle on, particularly with pulling information from the community on potential outlier populations in order to create a containment buffer zone. BIISC ceased ground operations in late FY08 when it was determined that the control effort had considerably exceeded our allowable budget when more and more plants were found. It became obvious once crews were on the ground, that the population was much larger than original estimated, particularly from aerial surveys completed in early FY08. The strategy has since re-focused on developing a containment plan with assistance from the community hoping to define a clear buffer area for containment. Unfortunately, after multiple attempts to enlist community assistance this never came to fruition. After advertising in local media, and attempting to hold a community meeting, which no one attended, the decision was made to pull back and reassess our efforts. BIISC will now control areas closest to the Honomalino Forest Reserve to protect this high value resource.

Fountain Grass (*Pennisetum setaceum*)

BIISC scaled back fountain grass considerably during this reporting period, with higher priority projects taking precedence. However, this remains a joint effort with key partners including Hawaii Volcanoes National Park and the Natural Area Reserve staff of DLNR's Division of Forestry and Wildlife (DOFAW).

- The crew pulled two (2) plants, both mature surveying less than an acre. This was an incidental find of a previously treated area.

Pampas Grass (*Cortaderia jubata*)

BIISC focus for Pampas grass is full eradication island wide.

- Completed control of the core population in Waimea, controlling a total of 35 adult plants.



- Completed road surveys within the buffer region of Waimea covering a total of 114 acres. No additional plants were found.
- Recommendation for FY10 is to monitor any potential new plants within the Waimea core.
- Surveys in the Volcano area yielded three adult plants on private parcels, which the crew successfully controlled with owner assistance.

Wax Myrtle (*Morella cerifera*)

BIISC began an aggressive control effort of wax myrtle, a close relative to the faya tree which has invaded forests in Hawaii's Volcano National Park and surrounding areas. BIISC continues to expand on this project with additional funding assistance from the USFWS. These funds were used to control plants found on private parcels adjacent to the core population located on State lands (unencumbered). BIISC strategy remains full eradication for the entire island.

- Crews controlled a total of 4,023 plants of which 1316 were considered mature, and 2702 considered immature plants. Ground surveys covered a total of 368 acres on both State and private parcels. The primary work took place in and around the Mohouli and Komohana area above downtown Hilo. Two smaller populations were located just off Steinback Hwy above the Hilo Zoo and below N. Kulani Road.
- BIISC anticipates expanding survey and control efforts onto additional private parcels with an expected addition of funds from the USFWS in FY10.

Other plant species

Mexican Sunflower (*Tithonia diversifolia*)

- BIISC controlled a total of 133 plants in three different districts (Ka'u, Hamakua and Puna) of the Big Island, covering a total of two acres.

Devils Backbone (*Bryophyllum daigremontianum*)

- Continued roadside survey and control efforts of this species in the District of Ka'u. Crews controlled a total of 134 plants covering a combined total of one acre.

Cuban Oregano (*Plectranthus ambonicus*)

- Continued roadside survey and control efforts of this species in the District of Ka'u. Crews controlled a total of 723 plants covering a combined total of one acre.

Early Detection

- The BIISC Early Detection (ED) Team completed roadside surveys of major, secondary and tertiary roads within the Kau, S. Kona and Upper Puna districts, surveying a total of 291 miles of roadside. Current roadside surveys are taking place in N. Kona and should be completed by December 2009.

- The ED Team has made 92 collections, to date, of invasive plant specimens in Ka‘u, South Kona, North Kona, and Upper Puna, submitting a report to Bishop Museum’s Occasional Papers of seven new island records and one new naturalized record for the State of Hawai‘i
 - Next year’s report is anticipated to discuss more than 30 new island records.
- BIISC met with partners to assess and update the early detection species list. The early detection invasive species list for the Big Island has increased to a total of 192 species, up from 52 species 2-yrs ago (1997) when the BIISC early detection program first began. The ED Team continues to work with WRA staff in Honolulu to assess a small number of unranked species on the current species list.
- Identified 7 rapid-response species for immediate control efforts.
- Conducted Little Fire Ant (LFA) surveys and outreach at 12 Kona nurseries.
- Assisted USDA Entomologists with mapping population extent of new thrips species affecting the native groundcover, Nai‘o (*Myoporum sandwicensis*).
 - Surveyed resorts, subdivisions, condominium communities, and nurseries in North Kona, South Kohala, and North Kohala.

Coqui

BIISC assist the State Coqui Coordinator by providing office space, equipment (including computers) and administrative assistance to its project and personnel. In addition BIISC assists with all hotline calls and provides citric acid to community members through its citric acid matching program (CAMP). BIISC efforts also include:

- Providing two (2) cell phones to communities in the Volcano and upper Puna areas to respond to hotline calls directly. The community hotline calls total 96 to which community teams responded and treated 75 areas.
- Received a total of 1,275 hotline calls between BIISC and USFWS, all of which were implemented into the coqui database.
- Provided a total of 448 50-lb. bags of citric acid to community members as part of CAMP.
- BIISC provided technical assistance to 9 community groups wanting training on application and spraying techniques. These were in addition to training programs given by Hawaii County.
- BIISC assisted the Volcano community with putting in coqui street signs the group purchased with a grant from the Hawaii Island Economic Development Board.
- BIISC crews assisted DOFAW/Natural Area Reserves System (NARS) with aerial control activities at the Manuka Natural Area Reserve in Kau.

The State Coqui Coordinator is responsible for:

- Maintaining the interagency databases and develops maps for the coqui hotline calls, road surveys and control efforts.
- Maps and reports are used to track progress and strategize State efforts.
- The control operations are contracted to the USDA-Wildlife Services Branch.
- Targets high-value natural areas and state land near residential areas.

Coqui Community Outreach

- Coordinated the establishment of a coqui barrier fence around the Kulani Prison parking lot to prevent the spread of frogs into the prison area.
- Conducted nursery support in Waimea.
- Supplied community support for organizations in Honokaa and Volcanoes area.
- Sprayed buffer zones around state park parking lots to prevent spreading the frogs on vehicles

Response and Control (Established Pests) Measures of Effectiveness

The HISC Strategy 2008-2013 mentions the following measures of effectiveness for the Established Pests Working Group.

Number of species detected and evaluated for feasibility of eradication.

All of the invasive species committee target species see list below, have been evaluated for the feasibility of eradication.

Invasive Species Committees Target List.

ISC's have a total of 34 active target species. Classification as a target species is dependent on many organizational and environmental factors that are unique to each ISC and this classification can and will change over time. Therefore, this target species list only represents a snapshot in time. This Target Species List does not constitute a complete list of species that a particular ISC works on, only a subset of species. There are other species classifications, such as Early Detection (approximately 200 species), eradicable and opportunistic, that define work on a wide range of other species. Many projects and species targets are controlled in cooperation with collaborators in the community or with HISC member agency staff.

<i>Latin Name</i>	Common name	Invasive species committee for which species is a target
<i>Aratinga mitrata</i>	mitred conure	MISC
<i>Arundo donax</i>	giant reed	KISC, MISC, MoMISC
<i>BBTV</i>	banana bunchy top virus	MISC, MoMISC
<i>Chamaeleo calyptratus</i>	veiled chameleon	MISC
<i>Coccinia grandis</i>	ivy gourd	KISC, MISC
<i>Cortaderia jubata</i>	pampas grass	MISC
<i>Cortaderia selloana</i>	pampas grass	BIISC, KISC, MISC, MoMISC, OISC
<i>Cryptostegia grandiflora</i>	rubber vine	BIISC, MISC, MoMISC
<i>Cyathea cooperi</i>	Australian tree fern	MoMISC
<i>Eleutherodactylus coqui</i>	coqui frog	BIISC, KISC, MISC, MoMISC, OISC
<i>Falcataria moluccana</i>	albizia	MoMISC
<i>Macleaya cordata</i>	plume poppy	BIISC
<i>Maclura pomifera</i>	osage orange	MISC

<i>Miconia calvescens</i>	velvet tree	BIISC, KISC, MISC, MoMISC, OISC
<i>Morella cerifera</i>	wax myrtle	BIISC
<i>Morella faya</i>	fire tree	OISC
<i>Pennisetum setaceum</i>	fountain grass	BIISC, KISC, MISC, MoMISC, OISC
<i>Pereskia aculeata</i>	Barbados gooseberry	MoMISC
<i>Phormium tenax</i>	New Zealand flax	MoMISC
<i>Piper auritum</i>	false awa	KISC, OISC
<i>Pittosporum undulatum</i>	Victorian box	MISC
<i>Pittosporum viridiflorum</i>	cape pittosporum	MISC
<i>Prosopis juliflora</i>	long thorn kiawe	KISC, MoMISC
<i>Rhodomyrtus tomentosa</i>	downy rose myrtle	MISC
<i>Rubus ellipticus</i>	yellow Himalayan raspberry	MISC
<i>Rubus discolor</i>	Himalayan blackberry	OISC
<i>Salsola kali</i>	tumbleweed	MoMISC
<i>Schizachyrium condensatum</i>	bushy beard grass	OISC
<i>Senecio madagascariensis</i>	fireweed	KISC, OISC
<i>Tibouchina urvilleana</i>	lasiandra, princess flower	OISC
<i>Typha latifolia</i>	common cattail	KISC
<i>Ulex europaeus</i>	gorse	MoMISC
<i>Verbascum thapsus</i>	common mullein	MISC
<i>Wasmannia auropunctata</i>	little fire ant	BIISC, KISC

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

See text above for each invasive species mentioned for each county.

Prioritization processes identified and in place.

Experts and managers are consulted in the setting of invasive species committee target priorities. The weed risk assessment system see below is used to determine if alien plants are likely to become invasive plants/weeds.

Implementation of the priority response and control actions of the aquatic invasive species, West Nile virus, coqui frog, and red imported fire ant plans.

See report about coqui frog work under heading Coqui Frogs in this report and notes from each of the working groups.

Red Imported Fire Ant Plan

Between FY09 and FY10 a total of \$120,000 was approved for the ant coordinator position to implement The Hawaii Ant Plan <http://www.hawaiiantgroup.org/hawaiiantplan/> and to work with invasive ants generally (supervised by HDOA staff). See HISC Budgetary Matters section. A position was advertised and hired in 2008 that will coordinate prevention, early detection, research and other technical issues as appropriate to address this important issue. This plan is cross cutting and applies to management of the little fire ant, an invasive species already present in Hawaii, and the prevention and rapid response plans related to the as yet absent red imported fire ant.

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

Invasive species control, and related work on prevention, research and outreach programs reported here influence or potentially influence the whole state. They serve to protect people's livelihoods, cultural, aesthetic and natural resources that are held dear in Hawaii, and basic human health. Benefits may be direct or indirect as the State seeks to protect watersheds, endangered native species, crops, animal and plant health, marine ecosystems. Numbers and names are too numerous to count, though specific benefits are generally evident where each project is described.

Research and Technology

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. More detailed goals are outlined in the HISC Strategy 2009-2013.

Research and Technology in 2009-2010

The funding for Research & Technology was reduced by the HISC to \$0 in FY10. This was done in order to maintain existing staff and capacity in the other components of the HISC. Future restoration of Research & Technology funding was recommended even under continuing budget restrictions.

Research and Technology in 2008-2009

In FY09 the Research and Technology Working Group was allocated \$500,000 of fund new research and technology projects in three areas.

- a. \$10,000 – An international workshop has been funded and scheduled for November 2009. It is intended to develop collaborative projects with other countries in the South Pacific to do research on biocontrol agents for shared pests, with the desired end point of obtaining biocontrol agents for priority pests at reduced cost.
- b. \$160,000 – Bishop Museum’s Hawaiian Biological Survey project for the Alien Species Database was started in FY09 and is intended to provide up-to-the-minute information about the status of alien and invasive plant and animal species present in Hawaii, as well as identification services for introduced species. There are already 5,314 alien species documented as established in the wild, many thousands more are known to occur. This supports one of the HISC’s legal mandates: “For those species that do arrive in Hawaii, identify and record all introduced and invasive species present in the State.” Extra attention will be given to incipient species, and the information is expected to support management efforts and regulatory and policy issues that require agencies to know which species are present in Hawaii.

When completed the database will provide the following benefits:

- Provide single, compiled source of information on all alien species in Hawaii
- Provide summary statistics about invasives and their trends in Hawaii
- Provide real-time updating of information from management and research communities
- Meet HISC strategic plan goal of identifying and compiling information on all invasive species in the state
- Serve entire invasives-management community by providing information useful for:

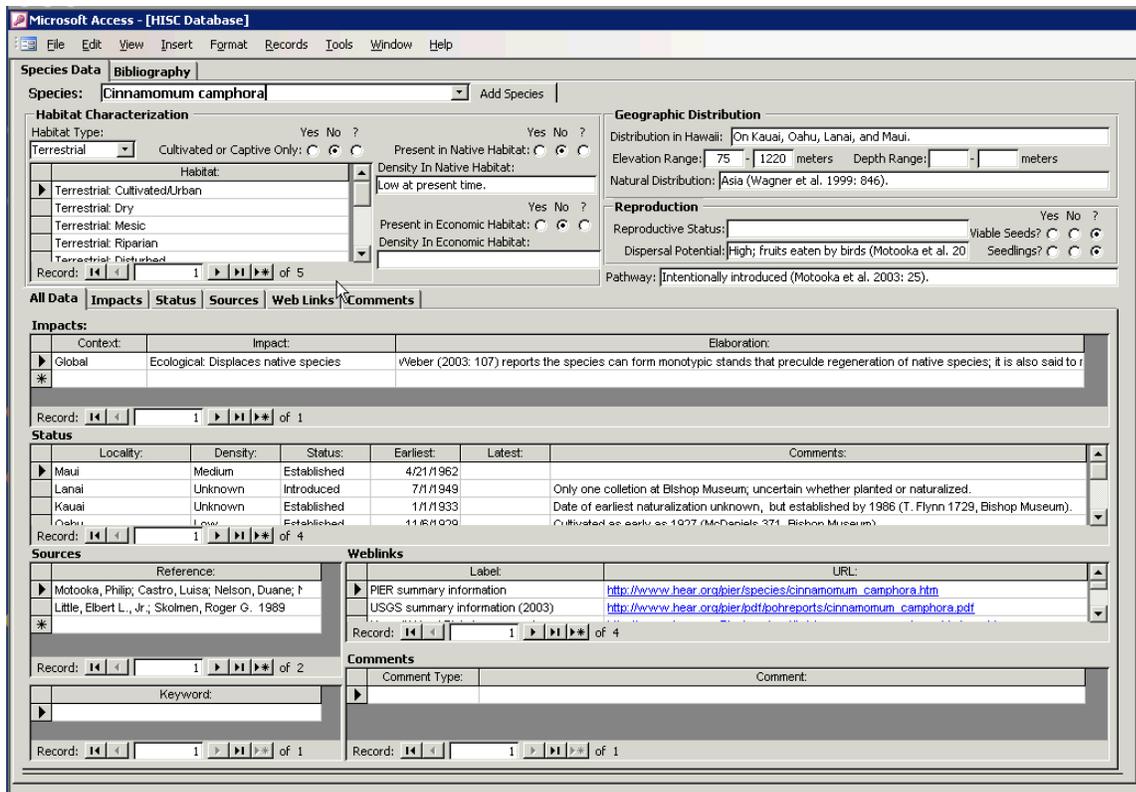
- Preventing inter-island movement of known invasives
- Identifying invasives at high risk of movement within the state
- Identifying which species justify triggering private-property access provisions for control purposes
- Identifying incipient populations liable to rapid eradication
- Sharing among all stakeholders relevant information to assist in management of invasives
- Taxonomic identification
- Informing Legislature and general public of management needs and progress

HISC Alien Species Database Project

Bishop Museum has designed, tested, and implemented a database of scientific information for alien species within Hawaii. It is planned that this database will serve to better identify those aliens that are invasive, help identify new incipient invasions, indicate available information supporting these assessments, and highlight taxa for which data are deficient.

The database entry fields were designed to accommodate both plants and animals, as well as deal with terrestrial and aquatic ecological parameters. In the initial stages of the database, test entries were made to work out most potential user problems. In late March/early April, assertive data entry efforts began. To date, 266 of the target 300 species have been entered into the database with detailed and up-to-date biological, habitat, and other ecological information.

A screenshot of the data entry page of the database is appended below showing the fields that were selected for entry. All data entered is based on published literature. Unpublished data is annotated in the “Notes” field. Literature sources and web links to additional information are included for each species.



Relevant to ecological parameters, two master databases residing at Bishop Museum are being tapped into for data entry in addition to the data entered for each species: 1) species names database (a nomenclatural database that includes the name of most plants and animals occurring in Hawaii); and 2) a master literature database. In addition, we are working with other agencies, such as the United States Geological Survey (USGS) National Biological Information Infrastructure (NBII) Pacific Basin Information Node (PBIN) to synchronize data residing in our respective databases and have been collaborating with our local, state and federal partners to integrate data from recent nonnative plant and animal surveys they have funded throughout the Hawaiian Islands.

An interactive database website (see figures below of the front page to all of the Bishop Museum's "Alien Species" resources and the "in development" query form being designed for the database) will transform the project's data information into a useful public service tool for both online queries as well as also allow the public to enter updated information or corrections via a quality-control buffer. [http://hbs.bishopmuseum.org/invasives/]



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Alien Species in Hawai'i

Nonnative species of plants and animals within the Hawaiian Islands have a deleterious effect on human health and well-being, agriculture, commerce, and the environment. It is estimated that more than 5,000 species of plants and animals occur in the Hawaiian Islands, including more than 1,300 non-indigenous vascular plant species. The **Hawaii Biological Survey** is working to provide resources for the identification and documenting the distribution of nonnative species, especially those that are invasive, helping to prevent further introductions and protecting the remaining unique native plants, animals, and ecosystems of Hawaii.

Funding for these projects comes from many sources, including the Hawaii Invasive Species Council & Partnership, Office of Mauna Kea Management, and the Edmondson Foundation.

Identification keys

- [Hawaii's Invasive Plant Species: a noxious weed identification key](#)

Databases

- [Introduced marine species of Hawai'i](#)

Publications & Reports

General

- Staples, G.W. & R.H. Cowie, editors. 2001. Hawaii's invasive species: a guide to the invasive alien animals and plants of the Hawaiian Islands. Mutual Publishing and Bishop Museum Press, Honolulu. 118 p.

The screenshot shows a web browser window with the following content:

- Browser title: Alien species in Hawai'i - Mozilla Firefox
- Address bar: http://hbs.bishopmuseum.org/invasives/databases/index.html
- Navigation buttons: Back, Forward, Home, Reload
- Search bar: google
- Bookmarks: Most Visited, Hotmail, Flickr, Bishop Museum, NSF FastLane, Plants of Hawai'i - Mail..., WordPress - Blog Tool..., UH library, PLANTS Database, Kew: World Checklist, Tropicos - Home, WebVoyage
- Header: Hawaii Biological Survey and Bishop Museum banner
- Section: Alien Species in Hawai'i Information Portal
- Form fields:
 - Species name:
 - Family:
 - Common name:
 - Hawaiian Island:
 - Type of organism:
- Buttons:
- Footer:
 - Problems with this website? [Contact us](#) | [Privacy Policy](#) | [Linking Policy](#) | [日本語](#)
 - All media are for the personal use of students, scholars and the public. Any commercial use or publication of them is strictly prohibited.
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A list of the names and island distributions of 3,000 nonnative species is being prepared for uploading to the database and website.

The project team includes Bishop Museum scientists entering species data in botany, entomology, marine invertebrates, and snails, and vertebrates.

c. \$330,000 – Research and Technology Grants. See details below.

Research and Technology Grants in 2008-2009

In FY09 \$330,000 was designated for Research and Technology Grants. Projects addressing invasive species were solicited via a public notice of Request for Proposals. The HISC Research and Technology Evaluation Committee completed a review of the 29 research and technology proposals submitted in response to the Requests for Proposals. A total of 14 reviewers evaluated some or all of the proposals, including staff from DOA, DBEDT, DOH, DLNR, HISC, USDA, UH, Bishop Museum, USGS etc. A core group met at Lyon Arboretum on Oahu on January 30, 2009 to review the top ranked projects. Ten projects were selected and funds requested came to a total of \$329,737, slightly below the \$330,000 allotted for research and technology projects in the FY09 HISC budget.

The following ten research and technology projects were matched with \$366,949 in non-state dollars. They were funded to the levels indicated here:

	Amount	Title	Research Provider	Type of agreement
1.	\$50,000	Control of arboreal Little Fire Ants (Wasmannia auropunctata) in Hawai’ian agricultural systems	HDOA – Plant & Pest Control	Contract
2.	\$23,805	Development of Herbicide Ballistic Technology as an effective incipient weed mitigation tool	UHi	Contract or LOA
3.	\$12,100	Assessing the risk of Jackson's chameleon, Chameleo jacksonii, to native animal communities in Hawaii	Bishop Museum	Contract
4.	\$47,000	Evaluating methods for the eradication of invasive tilapia from Hawaiian wetlands	PAHIO Development, Inc.	Contract
5.	\$34,440	Improving the Spatial Accuracy of Image-Based Weed Mapping Technology to Evaluate Weed Control Efforts	TNC	Contract or LOA
6.	\$43,000	The potential for the biological control of wild ginger (Hedychium spp.)	CABI UK or Tri Isle Conservation	Contract
7.	\$22,719	The Value of Preventing Solenopsis invicta from Invading Hawaii	UH	Contract or LOA
8.	\$27,433	Evaluating Policy Options to Reduce the Risk of Ohia Rust in Hawaii	UH	Contract or LOA

9.	\$27,620	Invasive species management using prevention and control technologies in the West Maui mountains.	Malama Kahalawai, Inc	Contract
10.	\$41,620	Applying state of the art remote sensing technology to invasive species management in East Maui	Tri Isle Conservation	Contract

Research and Technology Measures of Effectiveness

- **Number of new technologies developed and adopted for invasive species management.**
 - Ant control — New methods tried at Haleakala and on offshore islets near Oahu; eradication of a population on an offshore island appears successful.
 - Coqui control — Hot shower good for controlling frogs in plant shipments; new delivery methods tried and rates of application shown to be effective for citric acid, evidence collected that introduced predators like mongoose are not effective at controlling frogs.
 - Brown tree snake control — Pheromones and long lasting baits developed and tested only.
 - Nettle caterpillar pheromone developed for detection of male moths and delimiting population ranges.
 - See this year’s research projects which may identify new technologies developed.

- **Number of biological control agents tested and introduced, as well as the effectiveness of control they provide.**

HISC-funded projects for the biocontrol of the following environmentally damaging invasive species-research continues:

Target pest for biocontrol	Agents considered and ruled out	Agents undergoing full testing	Agents recommended for release	Agents approved for release
<i>Rubus ellipticus</i>	>50	3	0	0
<i>Miconia calvescens</i>	>75	10	0	0
<i>Tibouchina herbacea</i>	35	2	0	0
<i>Quadrastichus erythrinae</i>	39	3	2	1

- **New technology developed for prevention and control of invasive marine species.**

Already reported last year was the success of the Supersucker. Research approved in 2008 about marine invaders see above. A remote operated vehicle is used for inspecting ships hulls in certain situations, see above.

- **Number of taxa screened using standardized science-based risk assessment systems.**

See below WRAs (731 completed to date). A HISC project funded in 2005 has just been completed. A database has been compiled of global reptile and amphibian introductions for use in identifying introduction pathways and analyzing how these pathways vary spatially and temporally. Approximately 3900 literature citations are documented for 675 taxa of reptiles and amphibians outside of their native ranges, 322 of which have established new wild populations.

Public Outreach

Report on Efficacy of Public Outreach on Invasive Species

The coordinated effort to educate the public about invasive species by the HISC Public Outreach Working Group (HISC POWG) staff and member agencies has been successful, as measured by public awareness surveys, target audience surveys and additional measures of efficacy listed in the Strategic Plan. HISC POWG utilized \$312,000 to support outreach staff and activities in each county. HISC POWG funds partially supported four county-based positions (the remainder of their salaries supplied by ISC); part of the funds for one part time person to manage the HISC website and electronic information; and two full time statewide positions to focus on bigger picture outreach projects.

HISC POWG funds and staff add needed capacity to statewide invasive species programs in three ways: it **provides funds for dedicated outreach staff positions in each county**, funding for **outreach materials and media services**, and a mechanism to **coordinate outreach messages and actions across the state**. Outreach staff persons in each county brought invasive species information to communities via booths at public events, public presentations, print and electronic news articles and stories, radio and television ads and programming. Additional outreach to specific groups leveraged our overall efforts, including conducting teacher training sessions on invasive species curriculum for schools, working with landscape and nursery groups to promote the use of the WRA and voluntary codes of conduct, and working with existing groups such as the Sierra Club and Hawai'i Trail and Mountain Club to promote awareness and report forest pests.

HISC POWG worked to promote the following messages/concepts:

- 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, or www.gotdeadbird.org.
- Don't Sell or Buy a Pest.
- Keep Pets Contained.
- Buy Local.
- Plant Native Species.

Outreach resulted in a reduction in importation, planting and sale of invasive ornamental plants.

HISC POWG continued statewide outreach to the plant industry on the benefits of using the Hawai'i Pacific Weed Risk Assessment (HPWRA), which asks 49 questions about a plant to determine if it might become invasive if planted in Hawai'i. Unlike the import rules for animals, most species of plants are allowed to be imported into Hawai'i without review to determine if they might be invasive. Furthermore, the difficulty in listing known invasive plants on the State

Noxious Weeds List ensures that known pest plants continue to be grown and sold. In the absence of protective laws and rules, the HISC POWG identified outreach to the plant industry as one of the most important outreach projects. The HPWRA technicians and project is sponsored by the HISC Prevention Working Group.

A plant industry personnel survey of Landscape Industry Council of Hawai‘i participants was conducted in May-June of 2008 to gauge awareness and support for the various initiatives to slow the introduction and spread of invasive ornamental plants. Results from 104 completed surveys show that industry members are largely aware of one or more of the current voluntary initiatives to reduce invasive plant species in Hawai‘i, and that receiving this information has changed their plant use.

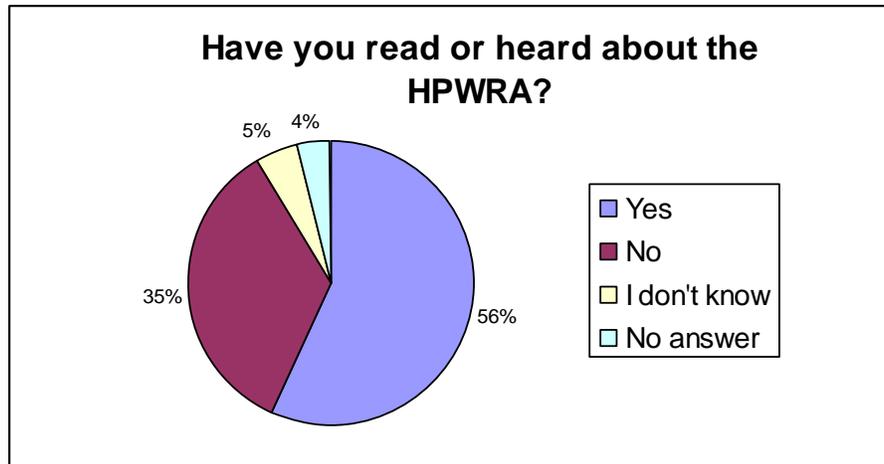


Figure 1. 56% of those that answered this question had heard of the HPWRA. Of these, 91% believe that the HPWRA can provide useful information about potential invasiveness of plants in Hawai‘i and **30% said that receiving HPWRA information resulted in a change in their plant use.**

Outreach builds public reporting networks:

1. Statewide public reporting network for snake sightings and other invasive species

One of the findings of public awareness surveys by the CGAPS was that people largely did not know whom to call to report invasive species such as snakes. In addition, HDOA’s pest hotline was an O‘ahu number, which was a toll call for neighbor islanders, and neighbor island offices were not open on evenings or weekends to answer calls. HISC funds supported the set-up costs for 643-PEST, a direct-dial hotline number that uses a computer program to route calls to the nearest HDOA office during normal work hours, and forwards calls to the HDOA office at the Honolulu International Airport for response during evening and weekend hours. This hotline is toll-free for callers and is staffed at least 20 hours per day.

The HISC POWG continued engaging the public in monitoring for and reporting of invasive species to the hotline. An informed public can be the crucial link in the early detection and rapid response to unwanted species like snakes, and can prevent new infestations of currently localized pests such as coqui frogs and little fire ants.

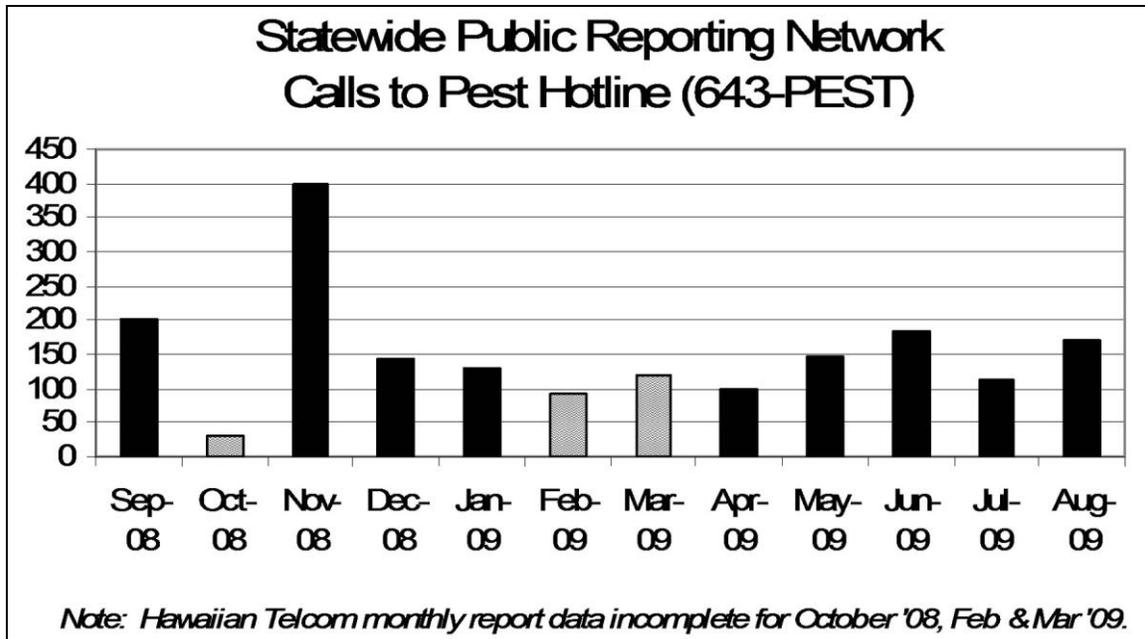


Figure 4. News of coqui detected in Kailua, O‘ahu resulted in 273 calls to 643-PEST on November 4, 2008 alone. HISC funds supported the implementation of a new statewide pest hotline phone number in 2005. Since then, the HISC POWG has worked to increase awareness and use of the number to report sightings of invasive pests.

The pest hotline number is featured in every talk given by POWG outreach staff statewide, and at community booths and on materials such as magnets, pencils and pens for the public. As part of a HISC-funded outreach project to encourage plant industry personnel to report sightings of new insect pests, a pest hotline logo was created in 2009. Outreach funds have also been used to continue to air a pest hotline radio jingle sung by Frank DeLima.



2. Public participates in early detection program for WNV and Avian Influenza.

Building the State’s ability to quickly detect new diseases such as WNV and Avian Influenza (AI) has been a HISC priority, with portions of the program funded by the Prevention Working Group (DOH sampling and lab costs) and the Established Pests Working Group (delivering dead birds to labs for testing). Arrival of either of these diseases could happen anywhere in the state, and it would result in birds becoming sick and dying. HISC POWG worked to inform the public and engage them in the early detection and reporting network by asking them to report dead birds to the 211 hotline, or online at www.gotdeadbird.com. HISC POWG staff and participants assisted with outreach for this message, and USFWS supported the statewide radio broadcast of a 30-second radio ad which began on May 12, 2008 and aired on alternate weeks through November 30, 2008.

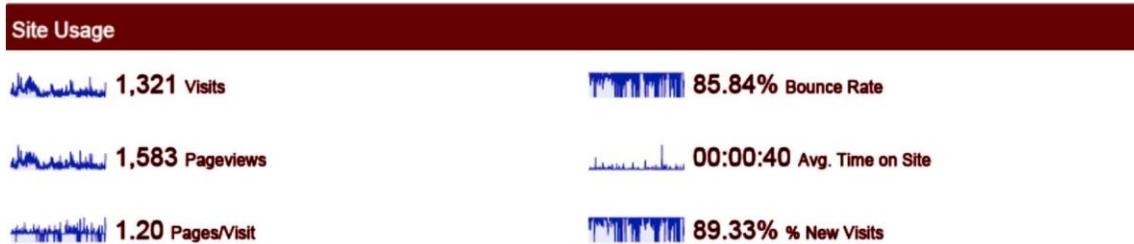
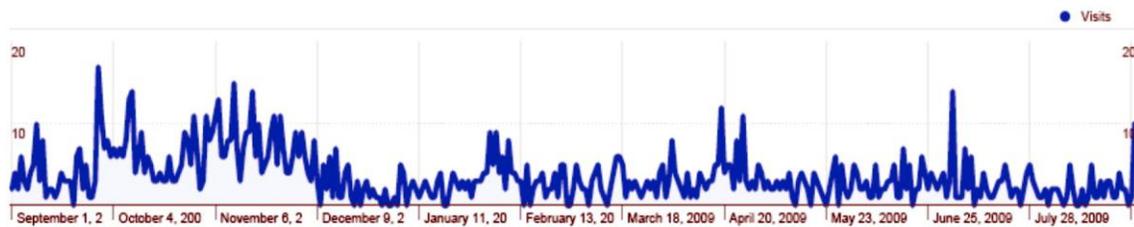


Figure 3. With articles and television news media stories waning, the HISC POWG turned to radio ads to increase awareness and reporting of dead birds. Website visits increase between May 12 and November 30, 2008 with statewide radio ads (funded by USFWS). Dead bird reports also rose during that time period.

3. Outreach in communities reached over 50,000 people

The value of direct community outreach via staffed displays at community events, school presentations and similar venues is not easy to calculate. At community events and presentations, staff field questions about the importance of biosecurity, of detecting and reporting pests such as coqui frogs, little fire ants and other pests, and people are provided with outreach materials for future reference. Presentations to groups like the nursery industry, school teachers, hiking and diving clubs continue to be a high priority. More than 50,000 people were reached in this manner between September 2008 and August 31, 2009.

4. Electronic media supports HISC messages

The HISC website, www.hawaiiinvasivespecies.org received more than 10,000 visits over the year ending August 31, 2009. Outreach funds also provided partial support for posting materials to the website and list serves, and for implementing other electronic media methods.

5. Number of education materials produced.

Materials range from refrigerator magnets, key rings, and pens to posters, brochures, displays and printed and portable document format (PDF) newsletters, as well as a statewide HTML email newsletter. See details in project sections below.

6. Number of people reached through talks and displays.

Various public events provide opportunities for engaging the public on invasive species issues. Logged estimates of people reached through talks and displays total 25,270. See details in project sections below.

7. Public awareness surveys.

In 2004, 2006 and 2007 outreach efficacy has been measured by CGAPS and the HISC POWG using professional research companies to conduct periodic telephone surveys of a representative number of residents statewide, to gain a sense of public awareness, concern, and support. Funding for the 2007 survey was provided by the HISC POWG, and results may be found at <http://www.hawaiiinvasivespecies.org/cgaps/whitepapersreports.html>.

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

Logged number of educational programs and events totals 58. For details see APPENDIX 1.

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

A statewide total of over 2,572 volunteer hours have been logged. This does not account for all volunteer hours from staff and partners who have given time to invasive species efforts which could add up to several hundred more hours.

10. Number of people reached through media.

It is difficult to gauge how many people are actually reached through the print and broadcast media. Over the past year there have been over 50 mentions of the HISC or HISC projects in the media. Given the combined estimated audiences of radio, newspaper, magazine, and television coverage, the potential number of people reached more than 250,000.

Other Outreach Measures of effectiveness by project:

OISC

1) Agency adoption of rules and policies against invasive species

- OISC, along with DOT, submitted comments to and met with Honolulu Rail Transit to discuss measures to decrease the likelihood that construction of the proposed rail system will introduce new invasive species to O‘ahu. Transit officials agreed to use the Hawai‘i WRA when choosing plants and to require that construction companies bringing heavy equipment to O‘ahu ensure that it is free of dirt, insects and plant parts.

2) Number of educational materials produced.

The OISC outreach specialist created the following educational materials:

- Information about remote monitoring for coqui frogs that will be used by nurseries.
- A video showing OISC removing miconia.
- Updated “It’s easy to be Weed Wise” brochure that informs people about the Weed Risk Assessment and which plants to avoid in landscaping.

3) Number of people reached through talks and displays.

- OISC’s outreach program incorporates the HISC outreach objectives and messages into all outreach activities. In 2009, OISC reached 4,547 people through public events and

talks. OISC facilitated news coverage about miconia and is using social networking tools to reach a wider audience.

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

- OISC's volunteer program garnered 1,096 volunteer hours to work on invasive species removal projects

Other activities:

- Participated in state-wide service trip that included personnel from each ISC to remove invasive species from Koke'e State Park. The combined crew of 64 people removed 28,927 Kahili ginger, 1701 smoke bush, 891 privet and 4,682 strawberry guava.

KISC

1) Agency adoption of rules and policies against invasive species

- KISC collaborated with the Kaua'i Landscaping Industry Council (KLIC) to host a workshop in December at the National Tropical Botanical Garden to review the statewide Hawaii Chapter of the American Society of Landscape Architects (HASLA)/ Landscape Industry Council of Hawaii (LICH)-approved WRA list of invasive ornamentals resulting in an adoption of the a new list, adding over 125 new plants to the "don't sell list" from the original Voluntary Codes of Conduct signed by KLIC in 2006 (also facilitated by KISC).

2) Number of educational materials produced.

The KISC/Kaua'i HISC outreach specialist created the following educational materials:

- Several "Weed of the Week" fliers highlighting various KISC target and invasive ornamentals in conjunction with radio program.
- Fliers in English and Hawaiian about rodent control operations on Lehua Island near Ni'ihau
- Fliers for Arbor Day with web resources on horticultural invasives and native species alternatives for landscape use
- Assisted with the production of a student-produced PSA on snowflake coral
- Designed agricultural specific invasive species photos and trivia for the "Wheel of Invasive Misfortune."
- Distributed X amount of Coqui Notification Fliers
- Published X amount of KISC newsletters
- Native and invasive species "memory game" cards for aina-based education initiatives, such as Malama Kaua'i, also given to local teachers as a resource

3) Number of people reached through talks and displays.

- KISC's outreach program incorporates the HISC outreach objectives and messages into all outreach activities. This year, KISC reached 5,133 people through public events such as Garden Fair, Kaua'i County Fair, Banana Poka Roundup, and Ag Awareness Day. KISC also had displays at the local library and assisted with an environmentally focused display mentioning invasive species as a threat to Kaua'i's native treasures in the airport.
- KISC reached 924 people through talks to groups like rotary clubs, school visits, direct audiences like boat dive operators and fishermen, hiking tours, Governor's Advisory

Council, DLNR sponsored private landowners workshop, Agricultural Forum, and volunteers and staff for many Kaua‘i based organizations.

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

- In all KISC presentations, information for volunteer opportunities with Koke‘e Resource Conservation Program and the National Tropical Botanical Gardens is given out for invasive removal work in natural areas and restoration sites.

5) Events

KISC helped to implement and/or coordinate several community-based efforts that helped to raise awareness about invasive species.

- Assisted with the coordination of the Pacific Invasives Learning Network Biosecurity workshop on O‘ahu in June, focusing on strengthening communications between Hawai‘i’s top trading partners
- Chaired the Arbor Day committee, an event attracting over 400 people, with an invasive species bounty, educational booths, over 1,500 native species given away
- Assisted in the coordination of the annual Newell’s Shearwater blessing, reaching out to Native Hawaiian student communities and raising awareness about invasive species threats to seabirds

6) Media Hits

- Assisted with all press releases for the Lehua Restoration Project
- Submitted releases (all with invasive species mentions) for arbor day, shearwater blessing, the ISC staff retreat, pampas grass removal, and the KLIC adoption of WRA list. Stories appeared in The Garden Island, Kaua‘i People, Honolulu Advertiser, and the Hawai‘i Landscaping magazine
- KISC appeared on Kaua‘i public radio 27 times this year. There are about 950 listeners of the Garden Show, where KISC would talk about the weed of the week and other invasive species issues.

MoMISC

1) Agency adoption of rules and policies against invasive species.

MoMISC’s Field and Outreach Coordinator recommended and was successful in getting several private and government projects to incorporate invasive species protocols in their projects. A current DOT bridge project for Moloka‘i valued at \$7.4 million dollars was conditioned to incorporate DOT’s invasive species protocols in its project. A part of the agreement includes \$20,000 dollars for mitigation of accidental invasive species spread from the project.

2) Number of educational materials produced.

MoMISC has only two full time staff, but provides outreach and data management services as well. Despite limited time to create outreach products, a recent survey contracted by USFWS showed that the residents of Moloka‘i ranked the highest in the state in their knowledge of invasive species and protecting the environment. MoMISC has produced the following products, many of which can be downloaded off the www.hear.org website:

- Over 40 MoMISC pest fliers, including new target species and other pests of concern

- Several power point presentations for educational outreach for public and private groups, MoMISC/MISC meetings and Maui Community College botany class.
- Invasive species outreach materials for the Moloka‘i Airport kiosk as well as the MoMISC Invasive Species Board at the Kaunakakai harbor. Sample topics included “Stop Buying and Stop Planting” and “Here / Not Here,” a showcase of pests on island and pests for prevention.
- A display and interactive invasive species game for the annual Earth Day event.

3) Number of people reached through talks and displays.

In FY09, MoMISC reached over 3,000 people through public and private displays and presentations.

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

MoMISC prioritizes its time in working to foster long-standing assistance from other conservation partners and their professional trained staff. By facilitating positive professional partnerships, MoMISC’s small staff is able to be successful in fulfilling its mission.

- MoMISC was successful in securing over 847 contributed partner hours.

AIST

The AIST has participated in four education and outreach events since April 2009. For Earth Day, AIST set up a booth at the Waikiki Aquarium, with educational pamphlets and a poster about super sucker and the algae problem in Kaneohe Bay. Children were reminded to malama the ocean by creating fish crowns with limu attached to them. Other events included teaching in two separate classrooms at Kamiloiki Elementary, giving a talk about invasive species distribution and abundance on Oahu. AIST also participated in a Navigating Change Outreach Fair at Maunalua Bay Beach



Park, where team members helped the children sculpt the Hawaiian Island chain and plot out locations of alien algae. The other classroom event created informative posters about the algae pull in Maunalua Bay and the impacts of *Avrainvillea amadelpha*. In early 2009 the New York Times ran an article on the Supersucker program and their work in Kaneohe Bay. See link for video



<http://video.nytimes.com/video/2009/02/19/science/1194837960943/vaccuuming-the-reef.html?th&emc=th>

Resources Working Group

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. A more detailed list of goals can be found in the HISC Strategy 2008-2013.

Resources Measures of Effectiveness

Reports to the legislature regarding invasive species spending and resource shortfalls.

This is legislatively mandated. See this report: Organizational and Resource shortfalls. Last year's report on spending was not updated.

Approval of annual budget for recommendation to the Council.

A budget recommendation was made by the Resources Working Group chair to HISC following an interagency meeting on August 14th 2008 to consider budgets recommended by all of the working group chairs. Demands on the budget were higher than available funds and agreeing on a balanced budget required a collaborative approach. The final budget recommendation was approved by the Council on September 3, 2008. Details are presented below in HISC Budgetary Matters.

Attendance at meetings of member and collaborating agencies.

All member agencies attended meetings of the Resources Working Group.

Agency adoption of innovative projects initiated through HISC.

HISC and its working groups will and support the implementation of the HISC Strategy 2008-2013. It preferentially supports innovative projects and those that target gaps in capacity, rather than the simple augmentation of existing invasive species management capacity.

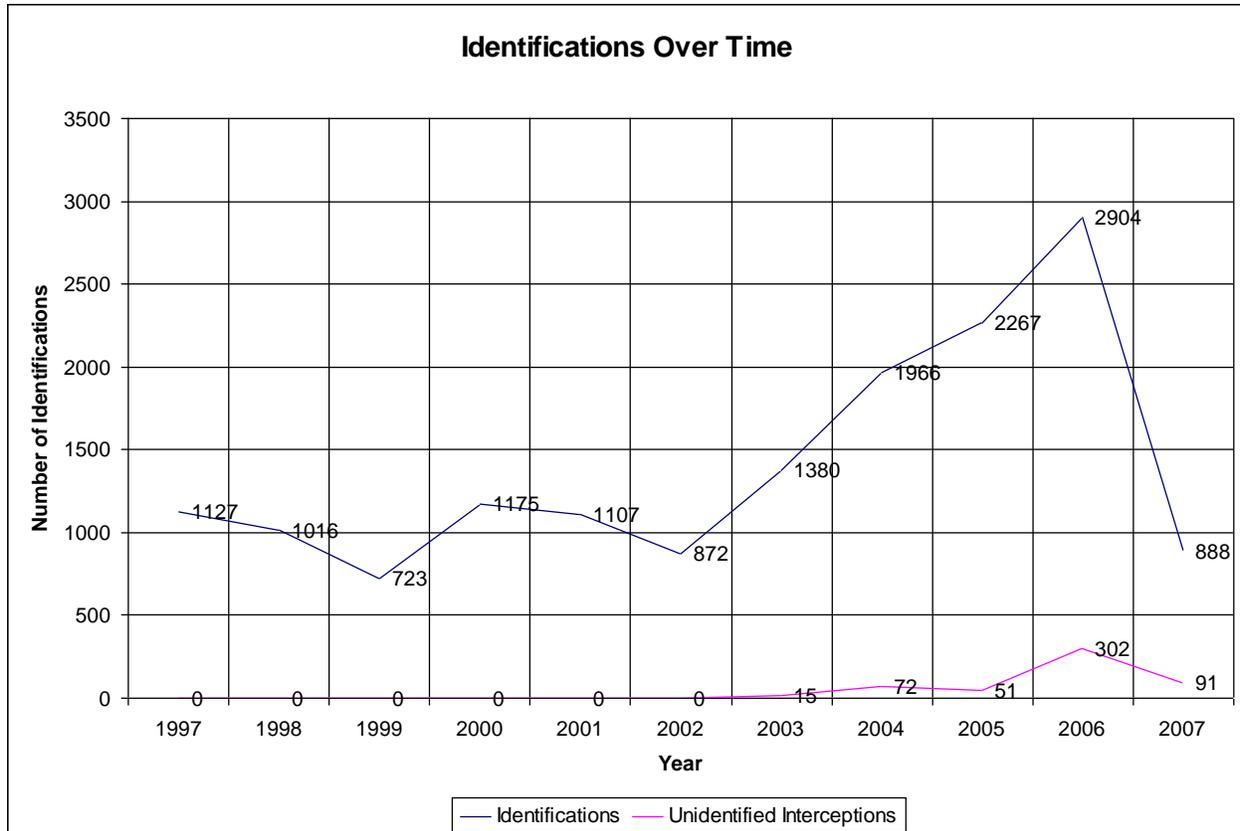
The long-term goal is that successful innovative projects funded by the HISC will eventually be adopted by lead agencies within their budgets. The resources working group seeks to consider this in its oversight of the budget recommendations that are made to HISC. In this way, HISC funds can continue to be available to address gaps and provide innovation via funding of demonstration projects. This was demonstrated by HDOA's biosecurity initiative which was initially supported via HISC funds and later was adopted and directly funded by the Legislature.

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 evolutionary isolation from continents and its modern role as the commercial hub of the Pacific make these islands particularly vulnerable to destruction by alien pests. Much progress has been made lately but gaps remain in current pest prevention systems and a lack of public and institutional awareness exacerbates the problem.

For example, approximately 3,400 insects, spiders or mites are confirmed established in 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.

Invasive arthropod pests new to Hawaii in the last 10 years

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

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. WRA systems have been developed in recent years that allow us to predict which species are likely to cause problems (see *WRA*).

At least 19 alien mammals are established in the wild. A few feral species have far reaching impacts in natural areas altering forest composition and structure; damaging and consuming rare species that occur only in 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 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 in the initial stages and results of these first surveys will be available next year. 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 continues in 2008-2009 to determine which species may become invasive and if they may be eradicable. County early detection programs for potentially invasive and incipient plants included searches for 90 species on Kauai, Oahu (140 species), Maui (150+ species), and the Big Island (134 species).

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 since 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 good 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.

House Bill 2843 was passed into law (Act 3, Special Session Laws of Hawaii (SSLH), 2008). It expands the items subject to an inspection fee to include any freight brought into the State and requires the inspection fee to be assessed based on net weight of imported freight. It designates the person paying the freight charges to a transportation company as the party responsible for paying the fee and clarifies that the transportation company is not liable for the fee in the event the party responsible for the fee fails to pay it. This new law is consistent with the recommendation of the Governor's Economic Momentum Commission report.

Control of alien species affecting native forest ecosystems

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

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 nesting birds; for example, introduced ants have been documented killing nestlings.

Disease Carriers, Disease and Pathogens

The introduction of mosquitoes (*Culex quinquefasciatus*) to the Hawaiian Islands in 1826 had a profound effect on native forest birds and continues to affect the distribution and abundance of many bird species. By serving as vectors for avian malaria (*Plasmodium relictum*) and avian poxvirus (*Poxvirus avium*), mosquitoes effectively spread these diseases throughout lowland areas. Many species of introduced birds now present in 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 fibropapilloma, which may also be caused by an introduced disease. With little natural resistance to disease, the Hawaiian fauna is expected to be highly susceptible, and prevention of the establishment of new diseases is a top priority need.

Biocontrol

USDA and HDOA are the only two agencies with capacity in this area at present; so, to a lesser extent, is UH. 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 since researchers must ascertain the agent's specificity and safety. However, the control of target organisms is continuous once an agent is successfully established in Hawaii, and the method is cost effective, removes the need to use harmful pesticides, and allows us to better live with invasive species and pests that are present in Hawaii.

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

In 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. At the present time, foreign exploration is limited to one exploratory entomologist in the state of Hawaii. Foreign exploration has an annual budget of \$50,000 a year. 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

Often invasive species 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. In the 2008-2009 budget, HISC approved funds (\$53,400) for HDOA to implement more inspections and control efforts for bee pests. 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 plans to move the entire military base at Okinawa to Guam will lead to the creation of whole new towns in Guam. A large increase in the movement of people and cargo to and from Guam is expected to exceed the capacity of current inspection teams. USDA is working with DOD to manage the issue and

increase prevention efforts. This issue continues to be addressed in 2009-2010.

HISC STRATEGIC PLAN

- 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

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 3 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. The ecological effects are not fully realized though negative effects have been documented via research funded by HISC. A high priority for management is to prevent their establishment into high value natural areas and keep them off islands where they are not yet established.

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

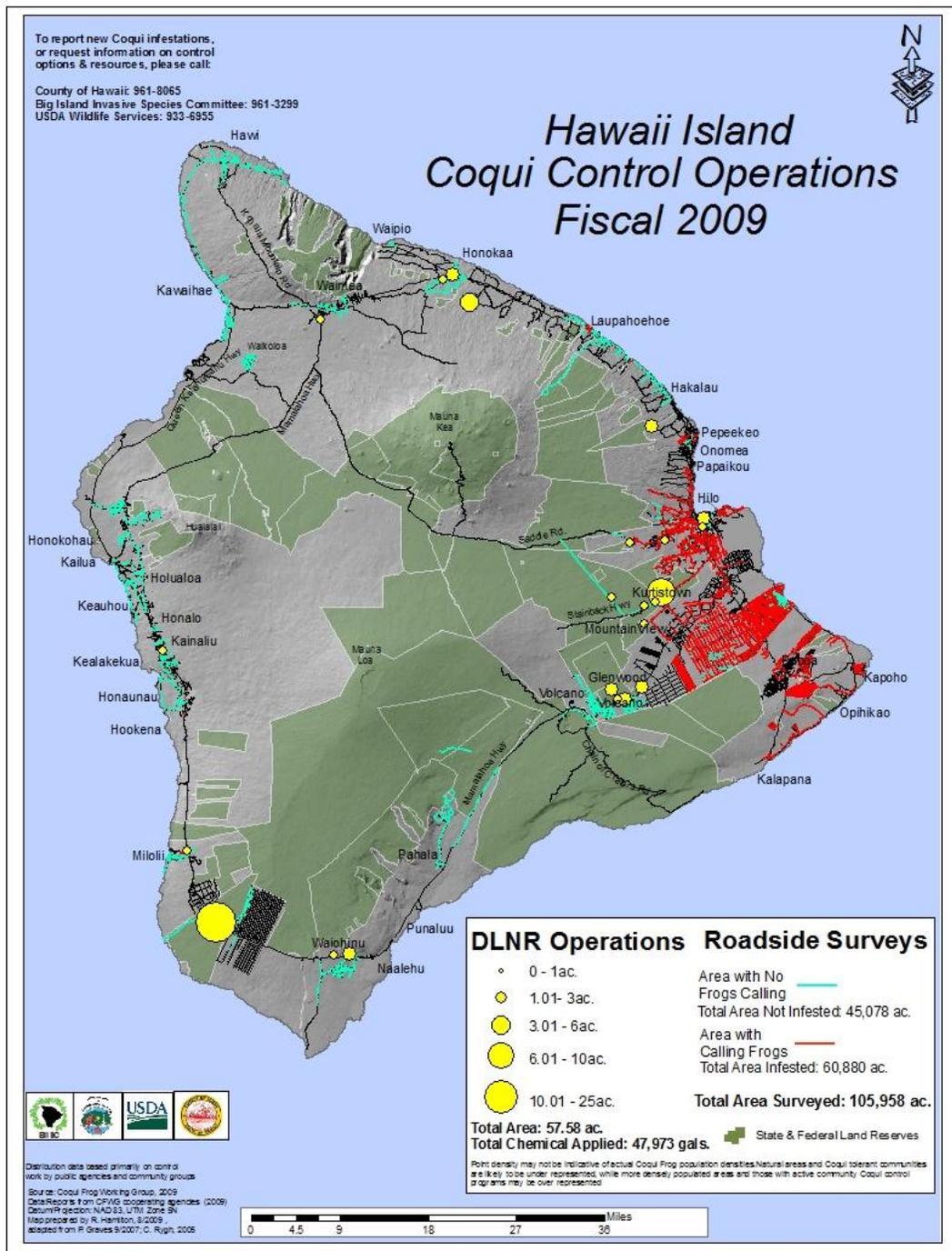
<http://www.hawaiiinvasivespecies.org/hisc/pdfs/20071217coquiplandraft.pdf>.

By far, the worst coqui frog problem is on the Big Island, but Maui has a long-established population in a limited area; work on Oahu and Kauai has so far kept populations from establishing. The main goal on the Big Island is to keep pristine natural areas free of the frogs, and to help the community control frogs around residential areas. On the other islands, the aim is to prevent the establishment and to eradicate all known populations of frogs. 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 now in use 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 funding situation for coqui has changed statewide over the last three years. In FY07, \$2 million dollars were sent to the Big Island and elsewhere to control frogs and special appropriations were made in FY08 \$800,000 and \$400,000 in 2009. In FY09, budget restrictions reduced frog funds from \$400,000 to \$100,000 and DLNR decided to allocate those funds to the Big Island. Originally, the \$400,000 was to be shared among Big Island (\$200,000) Maui (\$125,000) and Kauai (\$75,000).

During Fiscal Year 2009, the State DLNR/DOFAW Coqui Control Program controlled a total of 68 acres across the Island of Hawai‘i. These areas include state forest reserves, state natural area reserves, state parks, unencumbered lands and privately owned areas (Table 1).

The ho‘oilō (rainy, winter) season lasted for an abnormally long period, which hindered coqui control efforts. Because citric acid cannot be effectively applied during rain or on heavily saturated substrates, our control efforts emphasized site preparation (creating transects, surveying and mapping new populations, etc.) during the rainy months. Despite unfavorable conditions, DLNR/DOFAW was able to treat priority conservation areas.

Control Operations included:

	Acres Treated	Chem. Used (gal)	Chem. Used (lbs)
State Forest Reserves	23.28	36700	30762
State Natural Area Reserves	11.20	28075	23716
State Parks	24.67	14775	12578
State Unencumbered Lands	3.63	4000	3725
Other State Lands (Arboretum, Schools, etc.)	2.78	4825	4422
Other Agency (Federal, Kamehameha Schools, etc)	2.37	4010	4165
Total	67.93	92385	79367

Infested Areas:

A secondary task included mapping the occurrence of coqui frogs along accessible roads (Figure 1). Using gps tracklogs and Geographic Information Systemm (GIS) software, DLNR was able to estimate the amount of Hawai‘i island infestation. DLNR surveyed a total of 93,373 acres and an estimated 65.5% (or 60,880 acres) of the surveyed area was considered infested with coqui frogs.

Eradication:

Male coqui takes 5-6 months to mature into adulthood (Michael 1995), during which time, male coquies do not call. During their development into adulthood, males do not call. Because of this fact, a treated area is not considered eradicated until a year has passed without hearing a coqui. Treating the entire expanse of Hawai‘i Island’s population would require an estimated \$98 million in citric acid chemical alone. Therefore, island-wide eradication is not a feasible goal. Local eradications are possible. At Kulani Correctional Facility (5,000 ft elevation), frogs were

heard and then treated. As of September 11, 2009, there has not been any coqui heard in the area.

Preventative Measures:

It is of the utmost importance to control coqui as soon as they are heard to prevent them from establishing and becoming a reproducing population. It is even more important to prevent bringing coqui frogs into new areas. Teaching people the different methods of controlling and preventing coqui from entering new areas should be a high priority. Every person looking for help with their coqui population, I inform them of how they can safely control coqui and how to prevent frogs from reestablishing.

Outreach/Support:

DLNR/DOFAW and BIISC continues to take coqui hotline calls (Figure) and offer information and suggestions on how to control coqui frogs.

- Education:
 - Taught students from Innovations Charter School and Na Pua No‘eau the ecology of coqui and how to use this knowledge to better manage the spread of the invasive coqui frogs.
- Planning:
 - Worked with the Waikoloa Colony Villas manager to create a strategy to control coqui frogs on their property.
- Cooperation:
 - Worked with Hawai‘i Volcanoes National Park to treat a large population of coqui on federal land, Volcanoes Transfer Station and Ola‘a Forest Reserve.
 - Worked with Hawaii County to control coqui populations in Volcano Transfer station and Waiohinu Transfer Station.

- The Big Island coqui crew is based with the BIISC and coordinates control outreach and reporting efforts.

Additional details are provided about the Big Island, Oahu, Kauai and Maui control efforts in this report under each of the Invasive Species Committees sections above. Additional coqui control work by HDOA has also occurred but is not reported here; often control efforts are carried out cooperatively between invasive species committees, HDOA, nursery owners and community groups.

IDENTIFICATION OF ALL INVASIVE SPECIES IN THE STATE

Bishop Museum staff regularly published estimates of alien species of plants, animals, and invertebrates growing wild in Hawaii. However, they did not measure the relative harmfulness (i.e., invasiveness of each species), which means that their information has limited application for management purposes. The Hawaii Ecosystems at Risk website <http://www.hear.org> identifies most invasive species present in Hawaii. However, more needs to be done to ensure that good information is kept about all alien taxa present in the state, and distinguishing those for which there is some evidence of invasiveness from those which are apparently harmless, all the while following standardized methods to support state needs for practical invasive species management applications.

In FY 09 HISC approved \$160,000 to go to the Bishop Museum for the first year of a multi-year project to document all alien taxa in the state and the factors that contribute to invasiveness. More information about the database and its progress is provided in the Research & Technology section “HISC Alien Species Database Project” above. See also HISC Budgetary Matters in this report.

MONEY SPENT ON INVASIVE SPECIES MANAGEMENT IN HAWAII

As shown in the 2007 report, 2006 spending on invasive species management in Hawaii was significant at about \$40.8 million for government-projects and up to \$153 million total spending on invasive species and pests; actual costs to our economy could be higher as few estimates of that take into account lost productivity and lost opportunity (e.g., access to markets for Hawaiian products). See below in this report Funding Sources for Invasive Species Management.

ORGANIZATIONAL AND RESOURCE SHORTFALLS FOR INVASIVE SPECIES MANAGEMENT IN HAWAII

Resource needs to fill gaps in invasive species management capacity

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. Last year's 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.

Resource shortfalls for invasive species management in Hawaii	Millions of dollars	
	Annual	Set up costs
Modern Biosecurity System	\$4.0	\$54.0
Biocontrol	\$3.1	\$10.0
Restoration and Site Management to Protect Watersheds and Biodiversity	\$10.5	\$10.4
Rodent and Predator Control To Protect Native Biodiversity	\$4.0	\$20.5
Brown 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

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

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

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

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. Meanwhile, brown treesnake impacts could double. Investing in a modern biosecurity system would stop or postpone these costs for years. Money saved in costs avoided easily justifies a significant investment in such a program.

HISC has already contributed to this need by providing HDOA with funds for carrying out risk assessments at ports, where extra thorough inspections allowed HDOA to assess the risk posed by various pathways and commodities imported into 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. Maui Airport recently had such a facility put in place. Conditions are much improved and inspections more effective. Some ports completely lack inspection buildings, and other ports are open-air and ill-lighted. Research about treatment methods and risk management are needed. Sophisticated manifest tracking databases are needed to identify high-risk cargo prior to inspection, and track effectiveness.

Estimated cost for inspection and treatment facilities in place on all islands over 6 years: **\$54 million**

Operating: **\$3-4 million annually**

Research: **\$1-3 million annually**

Rodent and predator control to protect native biodiversity

Offshore islets

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

pests on offshore refuges is a cost investment with clear gains in the species that respond.

Rats (*Rattus exulans*) were present on Mokapu, an islet off of 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 whether or not 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.

Predator-proof fences in high value biodiversity sites

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

Predator proof fences are costly to build, but allow managers to undertake complete removal of predators from within the fenced area. These have been tested in New Zealand and elsewhere with good results. This is particularly useful for protecting birds from predator impacts. As native bird populations grow, such fenced areas could become eco-tourism sites in addition to providing safe sites for native biodiversity. One such fence is planned for Kaena Point on 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.

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

Kahoolawe invasive species removal and restoration: **\$10.5 million**

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

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

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

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

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

Biocontrol

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

New facility: **\$10 million**

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

WNV

HISC has funded DOH to undertake early detection work for WNV for the last 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. This year’s efforts are reported elsewhere in this report, in relation to prevention efforts. Such work should ideally be funded separately so that HISC funds can be

used to support innovation and fill key gaps in the effort to protect Hawaii from invasive species. However, a concerted effort to eradicate the disease will be needed wherever the disease might be detected. Due to the fact that we are an island archipelago, the disease could possibly be eradicated using aerial mosquito control operations such as those used to keep mosquito populations down near urban areas of southern mainland states where the disease is now prevalent. Two aspects need to be funded are: annual early detection efforts and an emergency fund in case the disease is detected. A number of other pests and diseases not yet in 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 (see above for information about their current programs). Due to limited resources their work is leveraged and HISC funds typically provide between 20% and 90% of their funding. Work is carried out using soft money sourced from a variety of state, federal and county agencies. ISCs provide the only early detection capability for new invasive plants—there are no agencies that are tasked with this work. In addition, many of ISCs provide the only trained crew that works consistently on major invasive pests, such as miconia.

The work mainly involves hard work in the field searching for and controlling between 10 and 25 main target species that have been prioritized and assessed for feasibility of success. Early detection crews search for new targets at the earliest stages of invasion to maximize the probability of eradication before species are well established. Baseyards are often shared with other natural resource managers and require upkeep or, in some cases, facilities are on loan from agencies. Field crews may have to travel for much of the day or camp out in sites remote from the main baseyard, often accessing sites by helicopter. On Maui and the Big Island some crews are needed to work in specific geographical areas. GIS experts track field work progress; training safety and vehicle operations are growing costs. Helicopter contracts are an expensive and necessary part of the work. As one species is eradicated or contained this may allow other lower priority species to become targets. Currently identified funding needs are based on the assumption that current levels of funding continue, a situation that could be changing in these tough economic times of budget restrictions.

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

Brown treesnake

As mentioned above, 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- S.N.I.P.P. (Statewide Noxious/Invasive Plant Program)

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

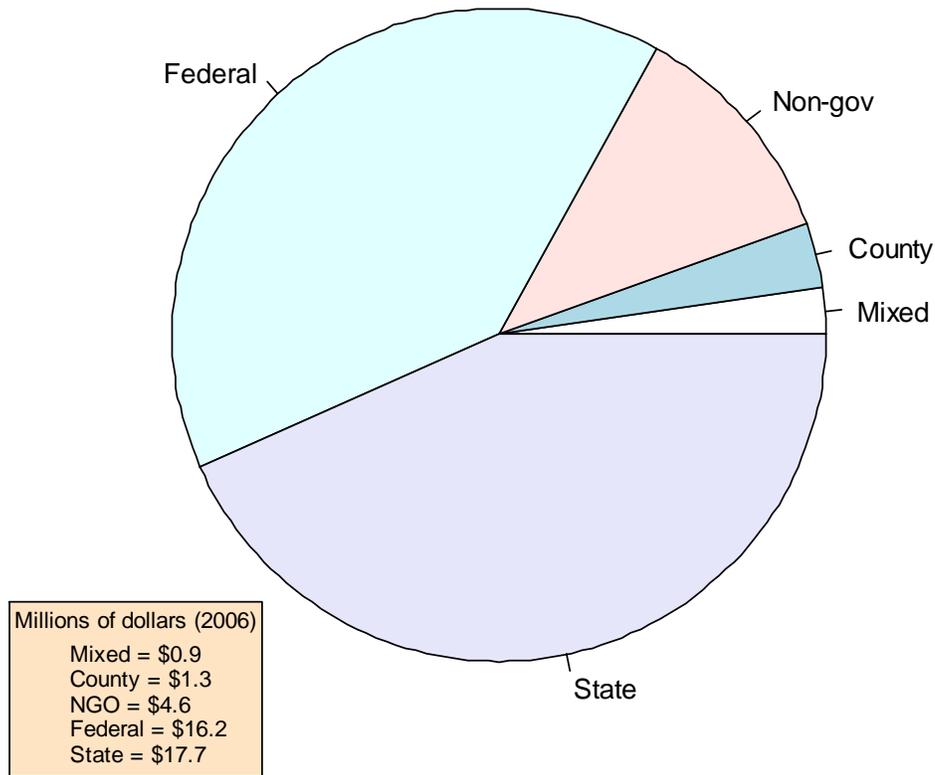
Emergency response fund

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.

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 last year. Results of last year's survey are reported in detail in last year's 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 is generally state and federal sources. Little change in the relative sources of funding is likely since 2006.



ADVICE TO THE GOVERNOR/LEGISLATURE ABOUT INVASIVE SPECIES

In January 2006, HISC approved a resolution in support of the invasive species recommendations of the Governor’s Economic Momentum Commission Report. HISC confirmed that the recommendations were in line with several of its goals and tasks as outlined in the HISC strategy and legal mandates. More is reported below under “Review of Legislation and Regulations in 2009”.

COUNTY INVOLVEMENT

HISC supported on the ground work and outreach by ISCs in all counties and has been working closely with counties to control coqui frogs and miconia to protect watersheds. There has been

increasing interest from counties to be involved in the management of invasive species. Although, over the years there has been cooperation in efforts from the Honolulu Board of Water Supply, increased involvement and support by the state's most populated county, Honolulu, would be appreciated.

REVIEW OF CONFLICTING AGENCY MANDATES

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

REVIEW OF LEGISLATION AND REGULATIONS IN 2009

House Bill (HB), Senate Resolution (SR), Senate Concurrent Resolution (SCR), Session Laws of Hawaii (SLH).

Each member agency or HISC working group has carried out reviews of laws and regulations on an ad-hoc basis. Although within the duties of the HISC, none of these bills was suggested by the HISC directly. Some bills, however, were testified upon by HISC members.

The 2009 legislative session yielded several bills and resolutions that were directly or indirectly related to Invasive Species in the state. The majority of them did not pass. The one bill that did pass, however, directly impacts the funding of the HISC.

Bills and Resolutions that passed

HB 1741 (Act 59, SLH 2009), temporarily reduced the rate of the conveyance tax being distributed to the Natural Area Reserve Fund (NARF) and the Rental Housing Trust Fund. It also increases the rate of the conveyance tax on properties valued at \$2 million or more and second house purchases.

In FY09 the HISC was funded by with both General (\$1 million) and Special funds (\$3 million from the NARF). As FY10 approached, however, it was clear that HISC would not be general funded and therefore completely reliant on the NARF for funding. Given the declines in conveyance tax revenue, projections for FY10 HISC funding from the NARF appeared to settle around \$2 million. With the early drafts of HB 1741 reducing the NARF portion of conveyance tax from 25% to 15% over FY10 and FY11, however, the funding for HISC could have come out significantly less.

Later drafts of the bill only reduced the NARF portion to 20% [which could still cause significant funding reductions] but an increase in the overall conveyance tax rate for more expensive properties may keep the NARF stable. Actual funding outcomes will bear themselves out as the year progresses. If fund income levels fall below the projected, the HISC will be reduced proportionally. This being said, any further reductions to the NARF could significantly impact HISC funding in the future.

SR 43 and SCR 72 both requested USDA and the Department of Homeland Security (DHS) cooperate with HDOA to collaborate and share information to prevent invasive species from

entering Hawaii. According to the HDOA, efforts to get information sharing and joint facilities with the federal agencies were already in the works even before the resolutions were made. Even so, having the legislature make a formal resolution and request to the federal agencies helps to impress upon the agencies the importance of the collaborative efforts.

Bills of note that did not pass

HB 1433 has been carried over to the 2010 session. The intent of this bill was to clarify and enhance the effectiveness of the Pest Inspection, Quarantine and Eradication (PIQE) Fee which had, in the 2008 session, been amended to apply to both air and marine cargo at a rate of 50 cents per 1,000 pounds (Act 3, SLH 2008). Some cargo carriers (notably air carriers) have thus far refused to collect or remit the PIQE fees despite the law going into effect August 1, 2008. If HB 1433 were to pass in the 2010 session, it would help raise fee collection rates by establishing penalties upon the parties that refuse to collect or remit the PIQE fee in a timely manner. Since there currently is no penalty for non-payment, these added penalties would help to encourage compliance with the law. The funds raised are currently being used to fund HDOA inspectors as well as important invasive species actions which included a rapid response action to the discovery of varroa (bee) mites in Hilo. The PIQE fund is an important part of the state's overall biosecurity plan. Having enforceable penalties against shippers and cargo carriers who fail to pay the PIQE fee is integral to continuing the Prevention efforts of the HDOA.

The other part of this bill would add exceptions from the fee for "liquid bulk freight" and "cement freight". As currently written, there may still be some level of concern as to these items being fully exempt. After all, it is not just the freight itself that could have a risk of carrying invasive species but the containers and the vessels themselves that could be vectors for invasive species. The definitions could be tightened up in order to not exempt such bulk freight being loaded onto ships in trailers or containers (for example milk). The intent of this part of the bill is acceptable but could use some refinement in the definitions.

HB 1684 has also been carried over to the 2010 Session. This bill aims to prevent and reduce the intentional introduction and spread of invasive species by establishing and revising penalties appropriate to the harm caused by the intentional introduction and spread of invasive species. HISC supports penalties for those who intentionally violate permitting and prohibition rules intended to prevent introduction of invasive species. The establishment of tougher penalties along with public outreach about the penalties could help to deter future intentional introductions. Should penalties be adjusted, an administrative process to assess penalties (similar to traffic tickets) would be encouraged to streamline the enforcement.

HISC BUDGETARY MATTERS

Approved 2009-2010 FY Budget for HISC

The invasive species budget initiative calls for the expenditure of \$2 million in State special funds for State 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 request 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 current year's fiscal budget is being 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.

With the passage of the (PIQE Fee, HDOA has begun collecting funds that currently are being used to fund 30 HDOA staff. With the continuing layoffs, it is understood that \$1.3 million will be released from the PIQE fund in order to prevent loss of HDOA inspectors.

This budget was developed under the direction of DBEDTchaired 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. A detailed budget request that details the project funding is attached as Addendum 1.

The overall goals of HISC budget are to:

- Advise the governor and legislature on budgetary and 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 & Technology was reduced to \$0 in order maintain staff in the other components. Future restoration of Research & Technology funding was recommended even under continuing budget restrictions.

This budget request has been 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 will administer specific program components and HISC working groups will assure funding specifications, address 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.

Funding Contingencies and Recommendations

Although the Natural Area Reserve (NAR) Fund has allocated to fund HISC for \$2 million, the actual amount available to the HISC over FY10 is subject to reduction should actual revenues fall below projections. Reductions in the fund will be passed on to the NAR funded projects in an equal proportion. Transfers of the funds to the HISC are on a quarterly basis and therefore projects funded by the HISC will be funded likewise by default.

Given the many uncertainties associated with the financial situation, the labor negotiations, as well as the severity of the anticipated impacts to HISC-funded projects, the following contingency plans are proposed:

- 1) Should labor negotiations result in substantial layoffs of HDOA staff: HDOA receives full amount allocated during HISC budget process
- 2) State and union negotiate furloughs vs. layoffs: HDOA has identified level of funding needed in advance of this outcome and funding is reduced accordingly
- 3) HDOA secures adequate funding to maintain FY09 staffing levels from non-HISC source (federal, cargo fee, private): amount received from HISC is reduced accordingly and rebudgeted after scheduling a resources working group sponsored review
- 4) A regularly scheduled report be presented to the HISC on HDOA use of HISC funds, efficiencies gained within HDOA operations (including cooperative efforts fostered between industry and HDOA), funding from the PIQE fund including and shipper compliance, and efforts to secure non-HISC funding.
- 5) Amount of NAR funds available decreases throughout the year resulting in decreased funds available for all programs: all programs receive a proportional reduction in funding with the possibility of the project being eliminated if it becomes apparent that project would be reduced beyond functional level.
- 6) Authorize working groups to allocate funding changes within the group as opposed to requiring full council approval to make minor changes (<25% redistribution among proposed (not new) projects) to allow projects to take advantage of any budgetary flexibility that arises among the projects.

Budget requests and recommended funding for financial year 2010

Budget Item	S-10-314-522
<u>PREVENTION</u>	
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
<u>RESPONSE AND CONTROL</u>	
BIISC	\$100,000
MISC & MoMISC	\$200,000
OISC	\$190,000
KISC	\$90,000
HDOA Biocontrol	\$0
AIS	\$240,000
Total Response & Control	\$820,000
<u>RESEARCH AND TECHNOLOGY</u>	
Total R&T	\$0
<u>OUTREACH</u>	
Staff	\$115,000
Materials & Travel	\$15,000
Total Outreach	\$130,000
<u>HISC SUPPORT</u>	
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

<i>Fiscal Years</i>	<i>2006</i>		<i>2007</i>		<i>2008</i>		<i>2009</i>		<i>2010</i>	
Working Groups	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 (DLNR)	\$186,000		\$0		\$0		\$0		\$0	
Pacific Island Learning Network	\$120,400		\$60,000		\$331,400		\$181,900		\$100,000	
	\$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	100%	\$2,000,000	50%

APPENDIX 1 CHAPTER 194 HRS INVASIVE SPECIES COUNCIL

This year, Section 194-2 (a) (4), HRS, was modified (see underlined text) by HB 2977 that requires appropriate state agencies to 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 to report on this progress annually.

Section

194-1 Definitions

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

“Council” means the [invasive species council].

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

[§194-2 Establishment of council; duties.] (a) There is established the invasive species council for the special purpose of providing policy level direction, coordination, and planning among state departments, federal agencies, and international and local initiatives for the control

and eradication of harmful invasive species infestations throughout the state and for preventing the introduction of other invasive species that may be potentially harmful. The Council shall:

- (1) Maintain a broad overview of the invasive species problem in the state;
- (2) Advise, consult, and coordinate invasive species-related efforts with and between the departments of agriculture, land and natural resources, health, and transportation, as well as state, federal, international, and privately organized programs and policies;
- (3) Identify and prioritize each lead agency's organizational and resource shortfalls with respect to invasive species;
- (4) After consulting with appropriate state agencies, create and implement a plan that includes the prevention, early detection, rapid response, control, enforcement, and education of the public with respect to invasive species, as well as fashion a mission statement articulating the state's position against invasive species; provided that the appropriate state agencies shall collaborate with the counties and communities to develop and implement a systematic approach to reduce and control coqui frog infestations on public lands that are near or adjacent to communities, and shall provide annual reports on the progress made in achieving this objective;
- (5) Coordinate and promote the state's position with respect to federal issues, including:
 - (A) Quarantine preemption;
 - (B) International trade agreements that ignore the problem of invasive species in Hawaii;
 - (C) First class mail inspection prohibition;
 - (D) Whether quarantine of domestic pests arriving from the mainland should be provided by the federal government;
 - (E) Coordinating efforts with federal agencies to maximize resources and reduce or eliminate system gaps and leaks, including deputizing the United States Department of Agriculture's plant protection and quarantine inspectors to enforce Hawaii's laws;
 - (F) Promoting the amendment of federal laws as necessary, including the Lacey Act Amendments of 1981, Title 16 United States Code sections 3371-3378; Public Law 97-79, and laws related to inspection of domestic airline passengers, baggage, and cargo; and
 - (G) Coordinating efforts and issues with the federal Invasive Species Council and its National Invasive Species Management Plan;
- (6) Identify and record all invasive species present in the state;

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

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

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

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

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

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

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

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

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

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

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

(b) The council shall be placed within the Department of Land and Natural Resources for administrative purposes only and shall be composed of:

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

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

(A) Business, economic development, and tourism;

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

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

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

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

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

(C) Transportation; and

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

(A) Agriculture; and

(B) Land and Natural Resources.

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

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

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

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

(1) A simple majority of voting members of the council shall constitute a quorum to do business; and

(2) Any action taken by the council shall be by a simple majority of the voting members.

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

[§194-4 Relation of chapter to other laws.] Notwithstanding any other law to the contrary, and in addition to any other authority provided by law that is not inconsistent with the purposes of this [chapter], a department is authorized to examine, control, and eradicate all instances of invasive species identified by the Council for control or eradication and found on any public or private premises or in any aircraft or vessel landed or docked in waters of the State. [L 2003, c 85, §5; am L 2004, c 10, §16; am L 2006, c 109, §2]

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

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

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

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

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

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

[§194-6 Entry; public property.] (a) Whenever any invasive species is found on state or county property or on a public highway, street, lane, alley, or other public place controlled by the

state or county, notice shall be given by the department or its agent, as the case may be, to the person officially in charge thereof, and the person shall be reasonably notified and ordered by the department to control or eradicate the invasive species.

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

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