

Title: Kaua'i Island Invasive Species Detection & Control 2015
Organization: Kaua'i Invasive Species Committee
Award: \$282,808



Introduction: The continued introduction and spread of unwanted pest and invasive organisms harms our economy, water supply, native bio-diversity, health, and the lifestyle and culture unique to this island. The Kaua'i Invasive Species Committee (KISC) is a voluntary partnership of government, private, non-profit organizations, and individuals working together to: prevent the introduction of potentially damaging pest species to the island, eliminate recently arrived (incipient) pests before they spread beyond control, manage established pests in order to reduce their negative impacts, and educate and involve the public as to the magnitude of the invasive species problem and the need for control programs such as KISC. KISC works in partnership with existing programs and aims to assist in the coordination of efforts island-wide. KISC's priorities are those species that are recognized as having the greatest potential to harm human welfare and native biodiversity, and where the use of limited resources is most likely to be successful.

KISC estimates that its FY15 total base funding need from HISC for prevention and control was \$415,000. The budget was 68% of required funding which was regained through new sources including an increase in USFS funding, early arrival of a Kauai county grant, and a Tetra Tech Subgrant. In addition, a NFWF grant and USFWS trustee fund will come online in 2016.

Achievement Highlights in 2015

Early detection: Number of species detected and evaluated for feasibility of eradication:

Early detection of incipient invasive species included an expanded roadside survey effort by the new early detection botanist, private property surveys, as well as surveys at nurseries, ports, green-waste areas and resorts.

- A total of 2,536 acres were surveyed for early plant detections.
- A total of 17,607 acres were surveyed for mongoose presence and test running the mongoose assessment protocols and tracking tunnel locations.
- Little fire ant surveys were conducted island-wide at five new locations with no new introductions detected.
- Combing existing databases for incipient invasives



New infestation of False Kava identified and controlled

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

Control and eradication efforts centered on 8 priority plant species, 17 other species, two vertebrate species, coqui frog and mongoose and one invertebrate species - little fire ant.

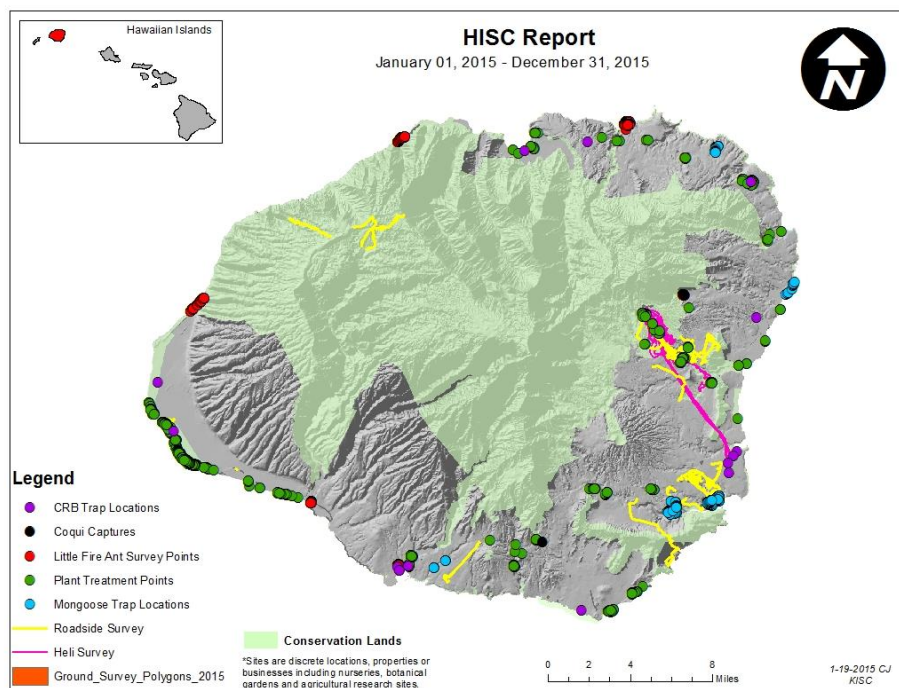
- Survey and control of Miconia was focused on three primary areas of the Wailua District; Wailua River State Park (WRSP), Wailua Homesteads, and the Game Management Area (GMA) in the Halele'a Forest Reserve. Air and ground crews surveyed 1,883 acres, and controlled 212 immature plants and 1 mature. Eradication strategies dictate the importance of removing plants before reaching maturity; current data suggests that these strategies are working to contain the

infestation though getting the number of controlled plants to decrease at this point has been difficult (see eMapi poster page 5.)

- Other priority plant targets included Arundo, ivy gourd, false kava, long thorn kiawe, and other miscellaneous species. Over 3,500 acres were surveyed, which is an increase due to expanded seedling control duties at the Pacific Missile Range LTK project and our intrepid botanist constantly covering new terrain. In addition, 13,541 individual plants were treated.
- KISC assisted HDOA and the Hawaii Ant Lab with continued eradication efforts at Kauai's established little fire ant infestation site in Kalihiwai. 121 acres were treated utilizing 1,222 person hours. Detection rates for most recent survey were 2.38% and located primarily on the infestation high cliff face.
- In collaboration with DLNR Division of Forestry and Wildlife, KISC utilized over 875 person-hours conducting mongoose detection and response. No mongooses were captured during this fiscal year.
- KISC continues to assist HDOA with coqui response and survey on Kauai. 45 acres were surveyed at high-risk areas as well as responding to calling frogs. Five separate introductions of coqui were detected and seven captured or sprayed during this period. Coqui continue to arrive via interisland shipping.

Rapid Response. Number of potential new island introductions responded to and dispatched: KISC's ability to quickly respond to reports of new invasive introductions helps to prevent establishment and unchecked invasion.

- In collaboration with HDOA, KISC was able to survey for a potential new infestation of LFA from the big island
- KISC also assisted HDOA with Coconut Rhinoceros Beetle trap monitoring and response to a Rapid Ohia Death report

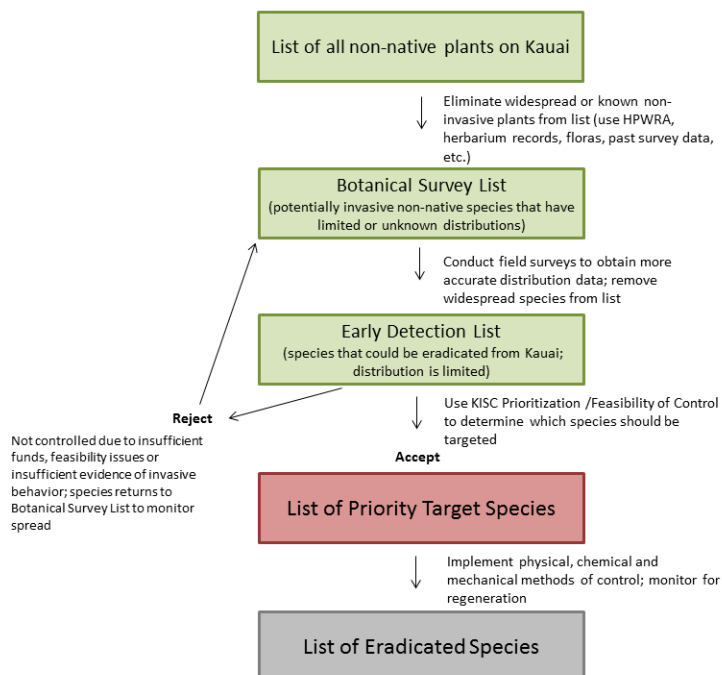


Other Activities in 2015

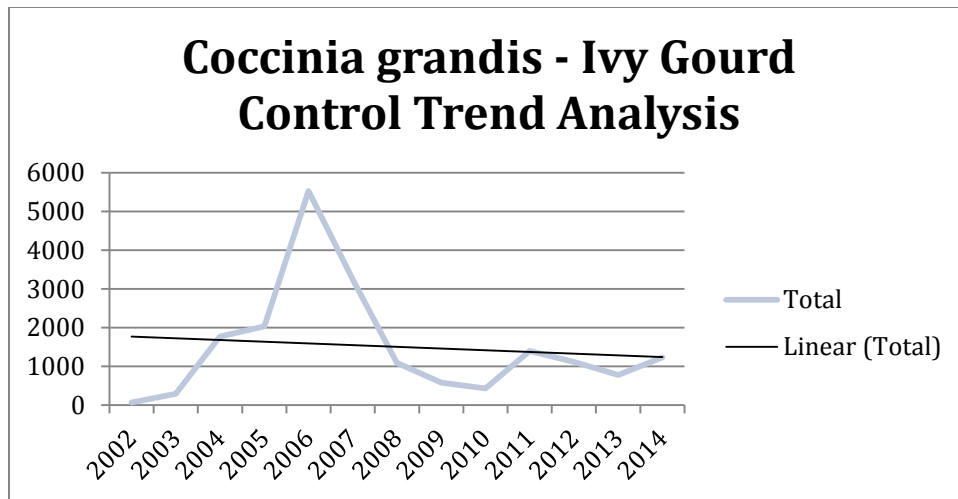
Capacity development: Overall staff capacity was enhanced in 2015 by adding one new field crewmember, an outreach position and an early detection botanist. The crew also participated in a Forest Pest Classification, Red Cross CPR and First Aid Certification, Aviation Safety.

Development of KISC's Strategic Action Plan continues, but cannot be completed until all historical data is entered into the KISC database and GIS geodatabases. The plan serves as a guide to action priorities, but as new species are continuously identified and evaluated through early detection surveys, citizen reports and other natural resource partners, priorities shift.

There is a new KISC process for identifying priority targets as described in the following flow chart. The first step was achieved by combing all known Kauai botanical databases including, DOFAW, The Nature Conservancy, Bishop Museum, National Tropical Botanical Garden and the literature to produce a comprehensive list of all known records of non-native plants. Using the WRA a botanical list was created to focus the efforts of the Early Detection Botanist on the species that pose the greatest risk to Kauai. Identified species are scheduled for a delimiting survey and rated on feasibility of eradication and/or control. Species deemed not feasible for eradication or control are returned to the list until such time new methodologies are discovered or resources are abundant enough to undertake the eradication.



As part of the strategic action plan revision KISC is currently reviewing fifteen years of control data and applying regression analysis to determine the current status of all current and past target species. The result will be a new plan consisting of five strategic plans focusing on; terrestrial, aquatic, vertebrate, invertebrate pests and a mongoose assessment/biosecurity plan. The terrestrial planning meeting occurred on June 30th, 2015.



Example: Total number of plants controlled on a species by species basis

KISC continues a partnership with the University of Hawai'i at Mānoa, College of Tropical Agriculture as operations are based out of their Research Station in upper Wailua. Since KISC is a project of the University of Hawai'i's Botany Department and the Pacific Cooperative Studies Unit, this relationship strengthens this association as well as eases access to University expertise in the form of entomologists, plant pathologists, and other plant and agriculture experts. This includes staff from CTHAR who oversees the aerial miconia control via High Ballistic Pesticide applications. This partnership has been beneficial in the form of cost-savings as well as access to testing control methodologies and partnership work. This has been further facilitated by an increase of scientists on the KISC staff.

The addition of more science trained staff has allowed further analysis of control trends beyond basic regression analysis. This involves analyzing spatial distribution, potentially unknown vectors, categorizing populations for potential biocontrol experiments. Utilizing the existing KISC database as a resource for technical publications can help inform the greater invasive species biology community on what works and what doesn't. Analyzing operating procedures including treatment methodologies, monitoring time schedules and overall efficiency improvements will increase progress toward island-wide eradications.

The following poster was presented at the EMAPi conference in September 2015. It tells the entire miconia story for the island of Kauai from the first infestation to the current condition. As populations dwindle it is apparent effort will need to be increased in order to maintain a downward sloping trend line.



Towards eradication of *Miconia calvenscens* from the Hawaiian Island of Kauai: a history of detection and control efforts from the past 13 years.

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INTRODUCTION

As of 2011, more than 90,000 ha of forested ecosystems on Pacific islands have been invaded by *Miconia calvenscens* DC including six French Polynesian islands, four Hawaiian Islands as well as mainland New Caledonia (Meyer et al. 2011). Island Invasions: eradication and management. BORN, Gerd, Swetnam, pp.11-16). This plant is one of the highest control priorities in Hawaii due to its capacity to suppress native vegetation, influence surface hydrology and cause soil erosion. On the island of Kauai, control efforts were initiated in 1995 after *Miconia* was introduced in about 1985. Currently, operations are still underway by Kauai Invasive Species Committee (KISC) to eradicate *Miconia* on Kauai. This infestation is contained within approximately 1400 ha – the smallest infestation of any of the four *Miconia* invaded Hawaiian Islands. However, detectability and accessibility of the infestation is hindered by dense vegetation and steep terrain. The data presented here represents the reality of *Miconia* control on Kauai from the last 13 years, revealing valuable lessons that can be applied towards future eradication efforts across the Pacific.



Photo 1: Immature *Miconia* growing in understory.

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METHODS

Data collection chronicling the number of *Miconia* detected by ground or aerial survey as well as work hours expended started in 2001. Mature and immature *Miconia* detected by ground surveys were removed mechanically or treated using 100% Garlon® 4 Ultra (10% Triclopyr). In 2003, KISC began conducting aerial surveys by helicopter to increase their ability to detect unknown *Miconia* locations. Additionally, aerial treatment via Herbicide Ballistic Technology (HBT) was initiated in 2011 (Jenny et al. 2013, Inv. Plant Sci. and Man. 6(2):292-303). The relationship between number of plants treated and work hours required was assessed over time to infer whether *Miconia* density is decreasing. Furthermore, this information was used to illuminate the apparent impacts of management decisions including use of helicopter time and varying amounts of ground survey time invested.



Photo 2: Mature *Miconia* detected from helicopter.



Photo 3: *Miconia* ground survey.

RESULTS

Table 1. Summary of plant removal and work hours for ground and aerial surveys.

	Plants Treated	Survey Area (ha)	Work Hours	Plants Treated/Work Hour	Survey Area/Work Hour
Ground	7541	1619	7687	0.98	0.21
Aerial	80	1955	w/ HBT =78 Total =214 w/HBT =7763 Total =7901	1.05	9.15
Total	7621	3574		0.98	0.45

Approximated length of survey path (20% over) and line of sight (topographical maximum distance surveyor could detect Miconia). Use of light is assumed for the ground survey and 100% for aerial survey.

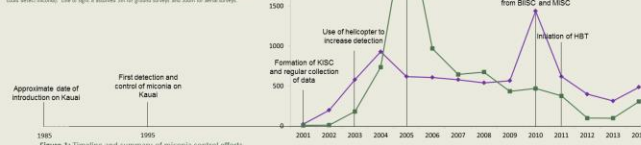


Figure 1: Timeline and summary of *Miconia* control efforts.

- Aerial surveys cover over 40X more area /work hour than ground surveys (Table 1).
- Ground and aerial treatment remove roughly the same amount of plants/work hour (Table 1).
- Plants treated/work hour was greatest from 2005-2008 (>1 plant/work hour), whereas early (2001-2004) and more recent (2009-2014) control efforts treated <1 plant/work hour (Figure 1).
- Plants treated from 2009 – 2014 is proportional to the amount of work hours expended (Figure 1).
- Ground survey tracks are mostly restricted to areas around known *Miconia* locations (reflecting difficult terrain) while aerial survey tracks also cover adjacent areas (Figure 2).
- Although most seedlings are detected within 40m of the mature plant, some are detected at least 350m away from the putative mother plant (Figure 3). However, it is difficult to discern which seedlings arise from which mature plant.

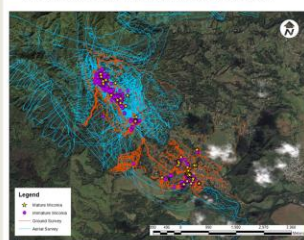


Figure 2: Map showing difficult terrain, *Miconia* removal points and survey density in the *Miconia* infested area.



Figure 3: Map showing prolific germination and spatial distribution of seedlings (purple dots) likely arising from a single fruiting plant (yellow star) targeted by HBT.

CONCLUSIONS

- Despite control initiation in 1995, *Miconia* density probably didn't start to decline until 2005, as shown by an increase in *Miconia* detection/removal and proportional increases in work hours spent until 2005 (Figure 1). This is likely due to better ability to pinpoint densely infested areas and mature plants by helicopter starting in late 2003. This emphasizes the importance of aerial surveys in delimiting populations in difficult terrain. *Miconia* density appears to decline from 2005-2010 because less *Miconia* are detected despite relatively equal or more work hours spent year-to-year.
- From 2011-2014, plant treatment is consistently proportional to number of work hours invested. This may indicate that *Miconia* density is no longer decreasing (Figure 1), as an ideal eradication scenario should reveal the number of *Miconia* treated per work hour steadily decreasing over time. However, trends presented here could also indicate persistent year-to-year seed bank recruitment or variation in site conditions and timing of visitation.
- Although most seedlings germinate near the mature plant, seedlings detected up to 350m away may have been dispersed by birds. Furthermore, seedlings are often found along adjacent streams, which may implicate pigs as dispersal agents as drainages are often used as travel corridors. Due to prolific germination and multiple dispersal vectors, timely use of aerial surveys and HBT is critical to avoid maturation of aerially visible plants.
- Despite the capability for helicopter surveys to cover more area than ground surveys, plants detected per work hour is similar for both survey types. This is likely due to dense canopy enabling only ground surveyors to detect immature or sub-canopy visible *Miconia*, leaving the majority of the population invisible via aerial surveys (Photo 3). This emphasizes the value of combined ground and aerial surveys for eradication of *Miconia* on Kauai.

Partner collaboration: KISC continued to work closely during 2015 with the Pacific Missile Range Facility, Hawaii Army National Guard, Tetra Tech Inc., UH-CTAHR, DLNR-DOFAW, The Nature Conservancy, Hawai'i Department of Agriculture, US Department of Agriculture, Hawaii Department of Transportation, The Garden Island racing Association, Kauai Community College, the county of Kauai, The Koke'e Conservation Resource Conservation Program, the National Tropical Botanical Garden and US Fish and Wildlife Service offices on Kauai and Oahu.

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