



# OISC

**O'AHU INVASIVE SPECIES COMMITTEE**

## 2002/2003 Strategic Action Plan



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## Project Abstract

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The O'ahu Invasive Species Committee (OISC) is a voluntary partnership of private, governmental and non-profit organizations and individuals united to prevent new invasive species infestations on the island of O'ahu, to eradicate incipient invasive species, and to stop established invasive species from spreading. The group is concerned with all non-native invasive species threatening agriculture, watersheds, native ecosystems, tourism, industry, human health, or the quality of life on O'ahu.

OISC was formed in August 2000. It evolved from the Fountain Grass Working Group, a collection of individuals from several agencies and organizations dedicated to on-the-ground control of fountain grass (*Pennisetum setaceum*). The formation of OISC was initiated to expand the range of invasive species prevention and control activities on O'ahu,

OISC focuses its activity in 4 areas.

1. On-the-ground control, containment or eradication of invasive alien species
2. Recognition of and preparation for rapid response to control new incipient alien species not yet present on O'ahu
3. Education of community members, legislators, and businesses about the threat of invasive species and what can be done to ameliorate this threat
4. Support of statewide efforts by CGAPS and other ISCs to affect policies related to invasive species (e.g. plant importation screening, revision of state Noxious Weed List)

The O'ahu Invasive Species Committee implements its strategy through the efforts of working groups and through discussion at quarterly general meetings of the entire OISC membership. OISC and its partners have made considerable progress over the past year in surveying and controlling O'ahu's most serious invaders: miconia (*Miconia calvescens*), fountain grass (*Pennisetum setaceum*), thorny kiawe (*Prosopis juliflora*), Himalayan blackberry (*Rubus discolor*), Caribbean frogs (*Eleutherodactylus* spp.), and manuka (*Leptospermum* spp.). Since the inception of OISC in August 2000, staff members, partner organizations, and volunteers have surveyed and controlled over 1,015 acres of habitat-modifying weeds and eradicated over 3,070 miconia plants on O'ahu. In addition, OISC has created a GIS-linked database for each target species on specific locations, distribution and survey areas.

Each year, the list of OISC targets is reviewed and reprioritized to reflect changing conditions. This year, following a Reprioritization of Species meeting held on August 7, 2002, several new species were added to the rapid response list. New species, including fire/faya tree (*Morella faya*, formerly *Myrica faya*), bush beardgrass (*Schizachyrium condensatum*), hiptage (*Hiptage benghalensis*), and *Tibouchina urvilleana*, were added to

the list of invasives targeted for control or eradication. The complete list of priority species is detailed in the Objectives and Methods section of this Strategic Plan. With the addition of several new species of concern, and with additional financial support from private, local, state and federal agencies, OISC will be expanding its control and eradication goals for this year, in our continuing effort to protect O'ahu's biodiversity, watersheds, agriculture, industries, and quality of life for our communities.

Over the last year, OISC's education and outreach working group has produced educational materials and written letters of support for invasive species legislation to increase public awareness and provide an additional line of defense for control of invasive species on O'ahu. With permanent OISC staff now in place and with the planned addition of an O'ahu-based statewide ISC Education and Outreach Coordinator, OISC is poised to increase its activities in these areas.

This document outlines the primary goals of OISC for the third year of operation (fiscal year 2002/2003). These goals are aggressive. Projected budgets to achieve them are provided at the end of the document.

## Project Description

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### Project Need

#### *Alien Species Background*

Alien species (also termed “exotic,” “non-native,” or “non-indigenous” species) are species that have been moved deliberately or inadvertently beyond their natural range as a result of human activities. Invasive alien species are those that spread from the point of introduction and become abundant, displacing native organisms and altering the environment. Worldwide, invasive alien species pose major threats to native ecosystems and biodiversity, cause huge losses to agriculture and commerce, and significantly affect human health and quality of life.

#### *Hawaii’s Alien Species*

Alien species are increasingly recognized as a threat to biological diversity and human welfare worldwide. Oceanic islands are particularly vulnerable to invasive species. Island organisms evolve in isolation from many forces that shape continental ecosystems, such as herbivorous mammals, eusocial insects, diseases, and frequent fires. Hawai‘i is especially vulnerable to invasion by alien species because of its role as a transportation hub and tourist destination.

More native species have been extirpated in Hawaii than anywhere else in the United States. Despite the high incidence of extinction and endangerment in the Hawaiian Islands, Hawai‘i retains more non-endangered endemic species of vascular plants, birds, and insects than any other state except California (Loope, 1998). Due to its extreme isolation, many species of unique plants and animals have evolved in the Hawaiian Islands. Ninety-five percent of all native insects, 91% of all native flowering plants, and 100% of the remaining native forest birds are endemic (unique) to Hawai‘i. It is our goal to protect these remaining species from harm and preserve them for future generations.

Hawai‘i also has the highest number of endangered and threatened species in the nation. There are 349 endangered species and 14 threatened species in the State of Hawai‘i, 282 of which are plants. O‘ahu alone has 101 federally listed and candidate endangered plant species, 56 of which are endemic to this island only. These species are primarily found in on large tracts of intact native ecosystems that still exist at high elevations in the Ko‘olau and the Wai‘anae mountain ranges. Although habitat destruction has been an important cause of extinction and endangerment, the introduction of alien species has exacerbated biodiversity loss in Hawai‘i over the past two centuries. The O‘ahu Invasive Species Committee, in conjunction with its partnership, is committed to preventing O‘ahu’s most serious threats from encroaching on these and other sensitive areas.

In addition to the threat to native plants and animals, invasive species pose huge threats to Hawai'i's tourism-based economy, agriculture, health, and general quality of life. The introduction of snakes, biting sand flies, or red imported fire ants will make Hawai'i a less favorable tourist destination and will adversely affect the quality of life for Hawai'i's residents. The recent introduction of Caribbean frogs has already resulted in the loss of peaceful night for those in infested areas, including hotel guests, and may result in quarantine of Hawai'i agricultural exports. Within the last fiscal year, the State Dept. of Agriculture has issued 4 pest advisories for insects new to the state that threaten agriculture. An additional 3 pest advisories were issued for plant diseases. The state's recognition of the threat posed by invasive plants is reflected in the 79 species listed on their Noxious Weed List.

Hawai'i's island-level Invasive Species Committees (ISCs) became active in the 1990s with the goal of responding to threats from alien pest infestations and controlling established pest populations. The Maui Invasive Species Committee (MISC), the Moloka'i subcommittee of MISC (MoMISC), the Big Island Invasive Species Committee (BIISC), the Kaua'i Invasive Species Committee (KISC), and the O'ahu Invasive Species Committee (OISC) are involved in the battle against invasive species. Each ISC is a voluntary partnership of county, state, and federal agencies, private businesses, nonprofit organizations, and individuals united in cooperative efforts to control the alien pest species that pose the greatest threats to each island's ecosystems, watersheds, economy, public health, and quality of life.

### ***Protecting O'ahu's valuable natural resources***

Combating present and potential invasive species requires a multi-pronged, multi-agency approach. The O'ahu Invasive Species Committee is comprised of individuals from many federal, state, and county agencies as well as private organizations and concerned individuals. OISC focuses its activity in 4 areas.

1. On-the-ground control, containment or eradication of invasive alien species
2. Recognition of and preparation for rapid response to control new incipient alien species not yet present on O'ahu
3. Education of community members, legislators, and businesses about the threat of invasive species and what can be done to ameliorate this threat
4. Support of statewide efforts by CGAPS and other ISCs to affect policies related to invasive species (e.g. plant importation screening, revision of state Noxious Weed List)

OISC currently helps to protect a wide range of environments by targeting selected invasive species. We help to protect wet forest ecosystems and native species by controlling miconia, manuka, and Himalayan blackberry. Drier areas and beach ecosystems are improved through the removal of fountain grass and thorny kiawe. Neighborhood environments benefit from the removal of coqui frogs. OISC has made significant progress in meeting major goals: 1) controlling O'ahu's worst weed, miconia;

2) surveying and eradicating fountain grass populations, a major fire and native dry forest threat; and 3) controlling known populations of Himalayan blackberry, thorny kiawe and manuka, all of which alter O‘ahu’s native ecosystems. To date, OISC and its partners have treated 1015 acres of infested habitat, surveyed and mapped crucial treatment areas for all target species, and conducted significant control work on all known infestations of our priority pest plants on O‘ahu.

With the financial support of sponsors, including the US Fish and Wildlife Service, the US Forest Service, the State of Hawai‘i Department of Land and Natural Resources, and the Hawai‘i Community Foundation, the Committee has established a fully equipped and operational office, baseyard, and full-time staff of three. With support from the Department of Land and Natural Resources Division of Forestry and Wildlife, the new OISC headquarters and base-yard is centrally located on O‘ahu, enabling field work to be accomplished effectively at all island sites.

Over the last year, OISC has produced educational materials and written letters of support for invasive species legislation. With permanent OISC staff now in place and with the planned addition of an O‘ahu-based statewide ISC Education and Outreach Coordinator, OISC is poised to increase its activities in these areas.

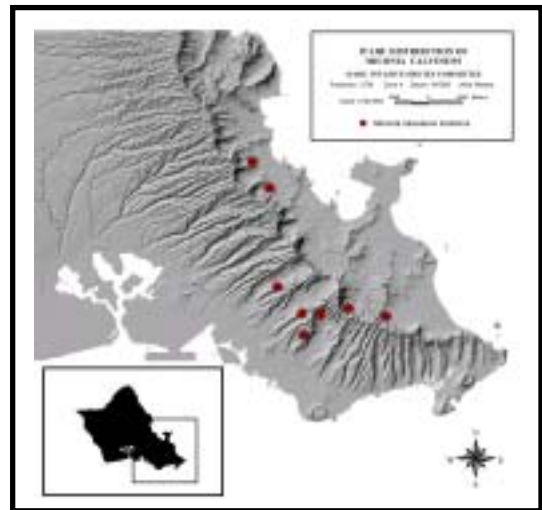
## Objectives and Methods

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**Control objective:** To achieve on-the-ground control or eradication of target invasive species on O‘ahu. Gather information and develop strategy on additional target species. FY03 target invasive species are listed below in order of ranking at the August 7, 2002 OISC Species Prioritization Workshop.

### 1. Miconia

*Miconia calvescens*



#### **Background:**

Because of the severity of the threat it poses to Hawai‘i’s natural areas and watersheds, *Miconia calvescens* is OISC’s number one priority for control. *Miconia* is on the Hawai‘i Dept. of Agriculture’s Noxious Weed List. The Division of Forestry and Wildlife of the Hawai‘i Dept. of Land and Natural Resources has designated *miconia* as one of Hawaii’s Most Invasive Horticultural Plants. *Miconia* is a member of the Melastomataceae family and is closely related to other invasive plants such as *Clidemia* and *Tibouchina*. It is native to Tropical America. In Tahiti, *miconia* dominates nearly 70% of the forests and causes significant erosion problems. *Miconia* was originally introduced to Hawai‘i in the 1960’s as an ornamental plant and was transported by botanical gardens and commercial nurseries throughout the state. From those planted individuals, birds have dispersed the small, fleshy berries of *miconia* into nearby forested areas. In Hawai‘i the worst infestation occurs on the Big Island, with approximately 25,000 acres infested. On Maui the infestation extends over approximately 12,000 acres. Approximately 1000 acres on each of these islands consist of dense, monotypic *miconia* stands. On O‘ahu, *miconia* is known to occur in Kalihi, Manoa, Tantalus-Makiki, Nu‘uanu, Maunawili, Waimanalo and Kahalu‘u. Control has been conducted by the Sierra Club and the Hawai‘i Department of Agriculture in Kalihi and Manoa Valleys for over five years, and is ongoing in conjunction with paid OISC staff members.

## **Objectives:**

### 1. Control

- a) Survey: Conduct ground surveys in areas identified from the priority task list generated from the November 9, 2001 Miconia Strategy Meeting, and from the GIS miconia database reference. Identify the outer boundary of populations in miconia-infested areas. Identify and survey all high-probability habitats around infestations. Aerially survey a 1km radius around all known miconia sites. b) Map: Use Global Positioning System (GPS) technology in addition to other field methods (topographical map, compass, altimeter, and flagging) to keep accurate and up-to-date records of all miconia control work in the GIS database.
- b) Treat: Pull all seedlings, cut stump/herbicide all larger plants, and destroy all fruits from mature plants.
- c) Resurvey and Retreat: Revisit within one year all areas where mature miconia trees are known to have existed previously; pull seedlings in order to exhaust seedbank.

### 2. Research

- a) Collect leaf samples for DNA analysis at Bishop Museum. Determine genetic variability of populations on O'ahu. Use information to determine source population of satellite plants.
- b) Identify all plant nurseries that may have grown miconia prior to its designation as a noxious weed to survey for other undetected sources of miconia.

### 3. Outreach

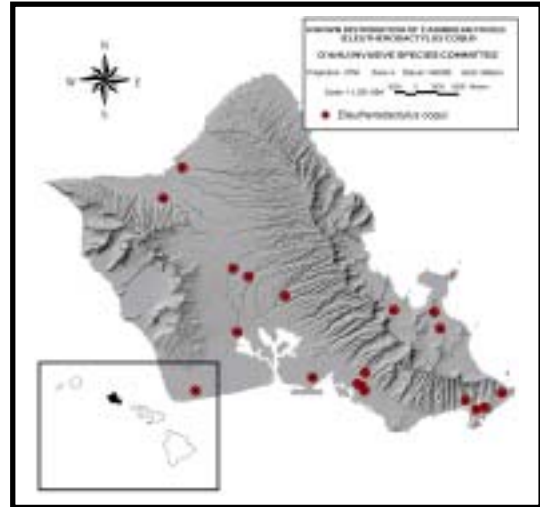
- a) Canvass all residential areas near miconia populations in Nu'uuanu, Manoa, Kahalu'u, Waimanalo and Kalihi areas to inform residents of its proximity to their property to improve detection and increase awareness.
- b) Promote Na Ala Hele "clean-boot-initiative" at volunteer outings and field work activities. Ensure that staff and volunteers are helping to prevent the spread of seeds by scrubbing boots and field gear on a regular basis.
- c) Work with Na Ala Hele in generating trailhead miconia signs to be placed on Manoa, Nu'uuanu, and Maunawilli trails.

## **Control methods:**

Apply herbicide (Garlon 3A or 4, 20% concentration in water or crop oil, respectively) to cut stumps immediately after cutting. Pull seedlings and hang in trees for roots to dry. For mature trees, remove all panicles with fruit; bag and either autoclave or incinerate fruit/seeds of plant material.

## 2. Caribbean Frogs

*Eleutherodactylus coqui*  
and *E. planirostris*



### **Background:**

Two species of small brown Caribbean frogs of the large Neotropical genus *Eleutherodactylus* have been introduced to Hawai'i within the past 10 years. Both species are widespread in the state but their current distribution remains restricted on O'ahu. *E. coqui* is commonly called "coqui," while *E. planirostris* is referred to as the "greenhouse frog." Both frogs probably arrived in Hawai'i via infested nursery materials, and continue to be spread throughout the state in this way. This method of dispersal for these and related species is well-documented throughout the Caribbean region as well. However, here in Hawai'i, with no predators or disease to keep their numbers in check, these frogs reach much higher population densities than they are able to on Caribbean islands. Severe problems could arise from their presence in Hawai'i.

- These frogs will exert a tremendous predation pressure on a wide array of native nocturnal invertebrates, including insects, spiders, and snails, many of which are already stressed to the edge of extinction;
- By removing a large percentage of the insect prey base, these frogs will have a large indirect effect on the O'ahu elepaio, a federally listed endangered insectivorous, native bird.
- The incessant, loud (>90 decibel) calling of these frogs will seriously disrupt people's ability to sleep at night;
- This noise is likely to reduce property values as people try to vacate areas infested with frogs;
- These frogs may interfere with nurseries' ability to export their products if frog infestation is high;
- These frogs may serve as a food source for rats and mongooses, allowing these predators to reach even higher densities than occur now and thereby increasing the predation pressure these alien mammals exert on O'ahu's native birds, tree snails and plants;
- These frogs may serve as a potential food source for any snake species that may become established on O'ahu in the future, thereby making it easier for snakes to maintain high population densities, as has occurred with the brown tree snake on Guam.

**Objectives:**

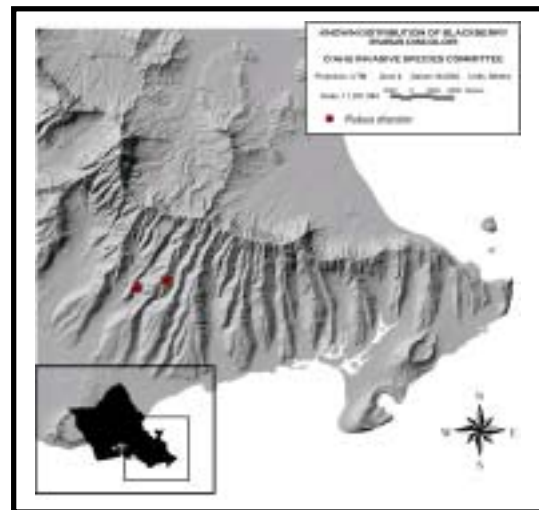
1. Create and maintain a GIS map of frog locations from the Hawaii Department of Agriculture reports as well as Bishop Museum specimens.
2. Host a frog control strategy meeting for HDOA, USFWS, USDA \_ WS, DLNR and Army staff to develop a plan for controlling frogs on Oahu.
3. Designate and support an invasive species technician (DLNR or OISC) to become the point of contact for frog control information.
4. Use the USFWS grant money to hire a staff person to assist with ongoing control efforts.
5. Produce a radio information spot to complement the previous efforts by HDOA and DLNR that will help the public identify these species.
6. Become certified to apply restricted use pesticides or identify certified applicators that could be hired to complete control work in sites where caffeine can be used.
7. Develop an informational flyer for nurseries and garden shops to educate the public on identifying and catching frogs.
8. Assist HDOA with presenting information on frogs to garden clubs, nursery associations and other groups that may encounter the frogs.

**Control Methods:**

Hand capture by isolating calling males. Develop a list of sites where caffeine use is possible by working with HDOA pesticides branch. Assist HDOA and CTAHR with experimental control methods. Work with MISC and BIISC to identify the most effective application and control strategies.

**3. Himalayan blackberry**

*Rubus discolor*



**Background:**

*Rubus discolor* poses a threat to natural areas in Hawai'i by forming dense impenetrable thickets that exclude other native plant species, and make access difficult for hunters, hikers, and other visitors to forests. Although *Rubus discolor* is not on the Hawai'i Department of Agriculture's Noxious Weed List, several other *Rubus* species are on the

list. The Division of Forestry and Wildlife of the Hawai‘i Dept. of Land and Natural Resources has designated all species of *Rubus* as some of Hawai‘i’s Most Invasive Horticultural Plants. Himalayan blackberry, native to Eurasia, is a perennial bramble with sturdy, 5-angled, thorny stems. It overtops native vegetation and forms impenetrable thickets in riparian areas, marshes, and oak woodlands on the West Coast from California to British Columbia. The California exotic Plant Pest Council considers this species a “most invasive wildland pest plant.” *Rubus discolor* is a high priority for control because it poses a potentially serious threat to natural ecosystems and outdoor recreation, and because it currently has a limited distribution on O‘ahu. Other *Rubus* species, such as *Rubus argutus* (prickly Florida blackberry) and *Rubus ellipticus* (Himalayan raspberry) have proved to be highly invasive and disruptive to native ecosystems in Hawaii. Prickly Florida blackberry has already destroyed habitat for many important species in the wetter regions of the Wai‘anae mountains and has hindered management of such areas due to its thorny thickets. Currently, *Rubus discolor* is the only species of blackberry in the Ko‘olau Mountains and is known from only two areas on O‘ahu: Mau‘umae trail and Palolo Valley in the SE corner of the island. Other *Rubus* species are bird dispersed and several fruit-eating birds are common in the areas where Himalayan blackberry grows on O‘ahu. It is likely that the fruit is ingested and dispersed by such birds.

**Objectives:**

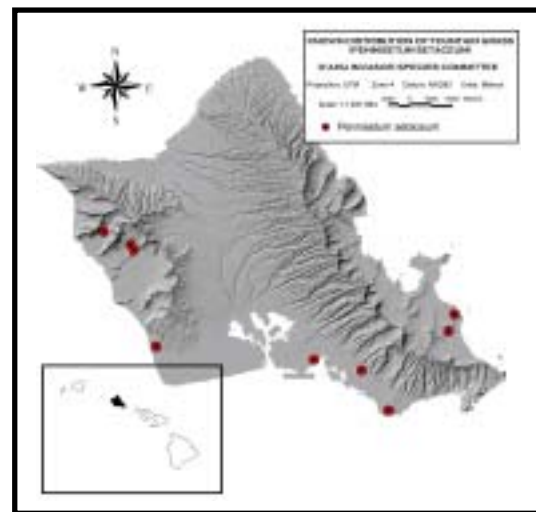
1. Map and retreat all known populations (Lanipo trail, Palolo valley).
2. Promote volunteer service trips to revisit/retreat population.

**Control method:**

Garlon 4 (20% concentration in crop oil). Snip and drip application using applicator bottles.

**4. Fountain Grass**

*Pennisetum setaceum*



**Background:**

Fountain grass poses a major threat to many of Hawai'i's natural and developed areas and has been designated a noxious weed by the Hawai'i Department of Agriculture. The Division of Forestry and Wildlife of the Hawai'i Dept. of Land and Natural Resources has designated fountain grass as one of Hawai'i's Most Invasive Horticultural Plants. Fountain grass, native to Africa, is a clumping grass up to a meter tall with long purple to rose-colored inflorescences. Originally introduced as an ornamental, fountain grass has become an aggressive invader that out-competes and displaces most native Hawaiian plant species. It is not a good pasture grass and it degrades the quality of pasture lands, particularly in drier areas. Fountain grass is also fire-adapted and can sustain fires that spread quickly into adjacent areas. The worst infestation occurs on the Island of Hawai'i where fountain grass covers at least 200,000 acres. Resource managers on the Big Island annually spend \$519,614-\$529,614 controlling fountain grass. Less than 200 acres of fountain grass occur on the island of O'ahu. Most of the 14 populations on the island have been treated at least once. Major infestations occur on Diamond Head and Punchbowl Craters and in Lanikai.

**Objectives:**

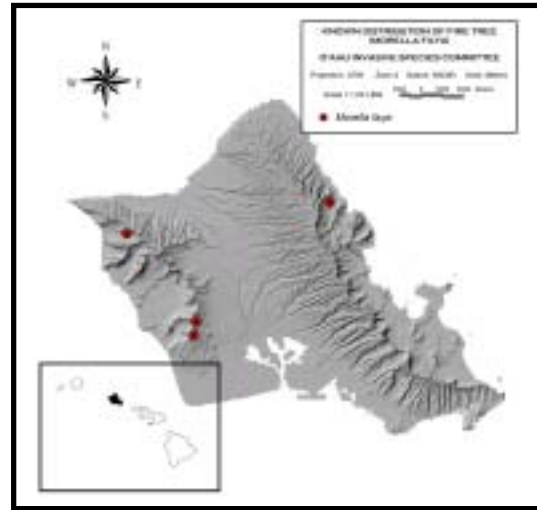
1. Control
  - a) Eradicate fountain grass from the Wai'anae mountains. Identify and control all smaller populations in Wai'anae Kai, Makaha Kauaopu'u, and any other known areas. Establish contacts with landowners adjacent to known population sites. Continue surveying areas adjacent to known populations.
  - b) Survey and treat all lesser populations of fountain grass on the island (Airport, Manoa, Pali Highway tunnel and Pauoa on-ramp, Punchbowl, Sierra Drive, Waimanalo, He'eia State Park).
  - c) Re-treat all high traffic areas on Diamond Head and Lanikai areas on a bi-annual basis. Coordinate efforts with National Guard for follow-up/control of Bellows population.
2. Research
  - a) Develop a strategy with State Parks and National Guard for control of Diamond Head infestation along the outer wall of the crater.
  - b) Develop a strategy for control efforts with Kamehameha Schools and Na Ala Hele for the Lanikai infestation.

**Control methods:**

Velpar (20% concentration in water); Round-up (2% concentration in water); considering Pronone (granular) for experimental plot. Use backpack sprayers to spray base of each clump. Cut flowering heads of all smaller populations for autoclaving. Hand removal of seedlings for follow-up treatments in smaller populations.

## 5. Fire/Faya tree

*Morella faya*  
(formerly *Myrica faya*)



### **Background:**

This tree is capable of forming dense, single-species stands, devoid of all other plant life. Fire tree is designated a noxious weed by the Hawai'i Department of Agriculture. It is bird dispersed and able to colonize a wide range of habitat due to its ability to alter soil chemistry. Firetree is a major habitat modifier because it significantly increases soil nitrogen levels. Not only does it successfully outcompete native plant species, but also it makes habitats more suitable for other invasive species because of increased soil fertility. Firetree is present on at least five of the main Hawaiian islands, but the species is especially widespread on the Big Island where hundreds of acres are already infested. *Morella faya* is known to be present on approximately 100 acres on O'ahu. It is mainly confined within The Nature Conservancy's Honouli'uli preserve and adjacent lands in the Wai'anae mountains. One lone tree was found in the northern Ko'olau Mountains and subsequently controlled.

### **Objectives:**

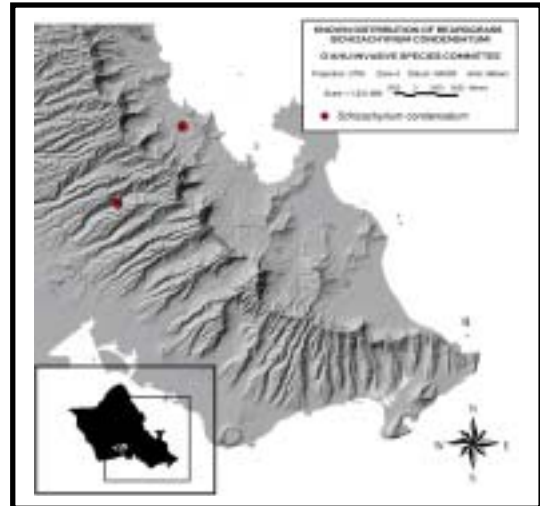
#### Control

- a) Survey: Determine population boundary of the core population. Survey the two sites in the Ko'olaus for any remaining individuals.
- b) Map: Use Global Positioning System (GPS) technology in addition to other field methods (topographical map, compass, altimeter, and flagging) to keep accurate and up-to-date records of *Morella faya* locations and treatment areas.
- c) Treat: Work with the Nature Conservancy of Hawai'i's staff to treat all trees around the periphery.
- d) Resurvey and Retreat:

### **Control methods:**

Basal frill cut and herbicide with Garlon 4 (50% concentration in crop oil). Hand pull seedlings.

## 6. Bush Beardgrass *Schizachyrium condensatum*



### **Background:**

Beardgrass is a successful fire-promoter and post-fire colonizer. It is native to tropical and sub-tropical America. Major infestations occur on the Big Island, especially in the Volcano area. On O'ahu it has been recently discovered in relatively low densities at several road-cuts on the town-side of the H-3 freeway, and in Temple Valley, Kahalu'u.

### **Objectives:**

Eradicate all populations.

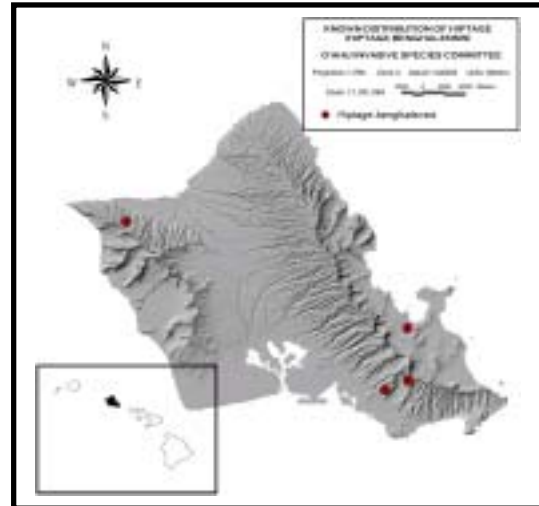
- a) Survey: Determine population boundary of the population.
- b) Map: Use Global Positioning System (GPS) technology in addition to other field methods (topographical map, compass, altimeter, and flagging) to keep accurate and up-to-date records of *Schizachyrium condensatum* locations and treatment areas.
- c) Treat: Target both populations with current control methods.
- d) Resurvey and Retreat: Revisit all controlled populations within 1 year.

### **Control method:**

Manually remove plants (chemicals are not allowed to be sprayed along the H-3 freeway). For other populations, manually remove inflorescences and treat with Round-up 2%.

## 7. Hiptage

*Hiptage benghalensis*



### **Background:**

This climbing liana smothers and kills vegetation on which it grows and forms dense thickets that block trails used by hikers and hunters. The Division of Forestry and Wildlife of the Hawaii Dept. of Land and Natural Resources has designated hiptage as one of Hawaii's Most Invasive Horticultural Plants. Its winged fruits (samaras) are wind dispersed. Already a major problem on Kaua'i, this plant has begun to invade areas on O'ahu as well. Hiptage threatens dry and moist areas from sea level to the 3500 ft. elevation. Hiptage, a member of the Malpighiaceae family, is native to India and Malaysia and was introduced to Hawaii as an ornamental plant. Its current known distribution on O'ahu includes Manoa Valley, Nu'uauu Valley, UH campus, and the Pali Hwy overlook.

### **Objectives:**

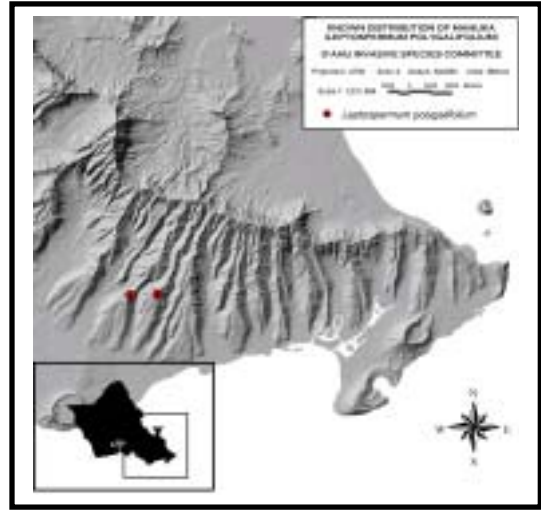
1. Identify, GIS map and quantify all currently known populations on O'ahu.
2. Control smaller satellite populations in areas where populations are encroaching on critical habitat areas.

### **Control method:**

Apply herbicide (Garlon 3A or 4, 20% concentration in water or crop oil, respectively) to cut stumps immediately after cutting.

## 8. Manuka

*Leptospermum polygalifolium*  
and *L. scoparium*



### **Background:**

*Leptospermum polygalifolium* and *L. scoparium*, both commonly known as New Zealand tea tree or manuka, are serious threats to forest ecosystems in Hawai'i because of their ability to displace natives and reduce habitat of both native flora and fauna. The Division of Forestry and Wildlife of the Hawai'i Dept. of Land and Natural Resources has designated manuka as one of Hawai'i's Most Invasive Horticultural Plants. These species are highly adaptable and in their native Australasian range can survive from salty coastal areas to high elevation windswept forests and from dry rocky ledges to swamps. Tiny manuka seeds can be dispersed via wind (Staples, Herbst, and Imada 2000), hikers, and feral animals. Several populations of *L. scoparium* have been recognized along ridgelines in the Ko'olau mountain range on O'ahu. Control efforts for these populations have been ongoing by Army Environmental and dedicated volunteers since 1997. There are only two known populations of *L. polygalifolium* on O'ahu, both in the Ko'olau mountains. These populations are small in size and have been controlled by OISC staff members.

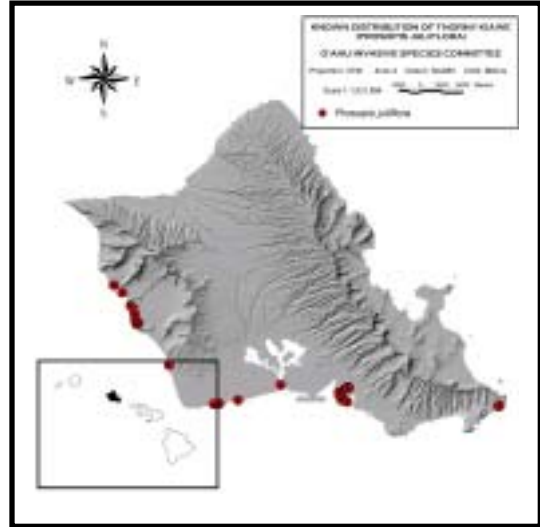
### **Objectives:**

1. Survey and retreat any regrowth of *L. polygalifolium* species.
2. Assist other agencies/organizations with control of satellite *L. scoparium* populations that are encroaching on critical habitat areas in the Ko'olau mountains.
3. Organize a strategy meeting involving other organizations and interested parties in identifying and mapping all known populations of manuka and implement control measures with assistance from other agencies.

### **Control methods:**

Cut stump and application of herbicide with Garlon 4 (20% concentration in crop oil) for *L. polygalifolium*; cut stump (no herbicide application required) for *L. scoparium*. Pull seedlings.

## 9. Thorny Kiawe *Prosopis juliflora*



### **Background**

Thorny kiawe poses a major threat to Hawai'i's natural and developed areas and is designated as a noxious weed by the Hawai'i Department of Agriculture. Originally introduced as possible livestock forage, and/or unintentionally along with common kiawe plantings in the late 1800s, naturalized populations were first recorded on O'ahu at Sand Island in 1978. Unlike the common kiawe (*Prosopis pallida*), which may have thorns up to ¼ inch long, thorny kiawe has thorns up to 2 ½ inches in length which can puncture automobile tires. Thorny kiawe forms dense, impenetrable thickets that can overtake developed landscapes and out-compete native Hawaiian plant species. Thorny kiawe is also known to cross pollinate with *P. pallida*, developing new hybrids having thorns up to 1 inch or more in length. Preliminary surveys confirm that thorny kiawe grows along coastal, leeward areas on Oahu and Kauai, but it has also been reported to be on Niihau, Molokai, Lanai and the Island of Hawai'i. Thorny kiawe is well adapted to dry, arid, coastal habitats. The worst infestation occurs on the island of Kauai where stands of thorny kiawe occur at Mahaelepu and stretch for 6 miles of beach front, from the Pacific Missile Firing Range at Barking Sands to Kapalawai. Trace populations of thorny kiawe are found on Oahu's leeward coast, from Waianae to Hawaii Kai. On Oahu, infestations occur from Kalaeloa to the mouth of Pearl Harbor and at Sand Island. The Hawaii Department of Agriculture is forming partnerships with the City & County of Honolulu, State and Federal Naval agencies to control thorny kiawe found on their properties.

### **Objectives**

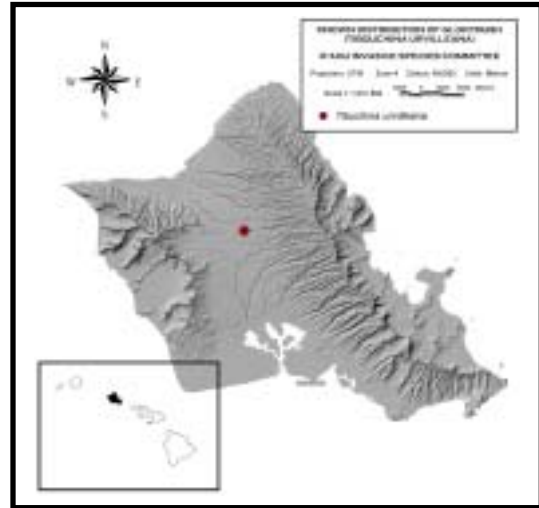
1. Reduce the spread of thorny kiawe by removing it from high-use recreational areas at public parks, camping areas, stream inlets, and residential properties.
2. Continue surveys to determine extent of thorny kiawe infestations.
3. Provide support for the Department of Agriculture's staff during control efforts.

### **Methods**

Cut stump and application of herbicide with Garlon 4 (20% concentration in crop oil).  
Pull seedlings.

## 10. Glory Bush

*Tibouchina urvilleana*



### **Background:**

Glorybush is another invasive plant in the Melastomataceae family. Native to Brazil, it was introduced to Hawaii as a horticultural plant for its showy purple-pink flowers. Like other problem melastomes such as clidemia and miconia, glorybush can form thickets that exclude other plant species. All *Tibouchina* species are designated as noxious weeds by the Hawai'i State Department of Agriculture. The Division of Forestry and Wildlife of the Hawaii Dept. of Land and Natural Resources has designated both *T. urvilleana* and *T. herbacea* as two of Hawaii's Most Invasive Horticultural Plants. Glorybush forms dense stands in open areas and spreads easily by mechanical dispersal of seeds from capsules. It prefers wet habitats and is known from only one location on O'ahu, at Whitmore Village in Wahiawa. The Bishop Museum collections contains one record of *T. urvilleana* from 1946 near upside-down falls in Nu'uauu valley.

### **Objectives:**

1. Assist Army Environmental with eradication of the Wahiawa population.
2. Survey Nu'uauu area for Bishop Museum collections record of *T. urvilleana*.
3. Survey other Bishop Museum collection records for spread into adjacent lands.

### **Control method:**

Foliar application using 2% Garlon 4.

## 11. Opportunistic Invasive Plant Control - Species of Concern

Several other invasive plant species were identified as “species of concern” at the August 7, 2002 OISC Reprioritization Meeting. These species are known to be problem invasives elsewhere in Hawaii or the Pacific region. Some are known to have limited distributions on Oahu and would therefore be suitable for OISC control activity. Others require additional information about the extent of their distribution on Oahu, but could be controlled in those areas where they currently occur. The following invasive plant species will be treated when encountered during the course of other control work. OISC will also assist land managers from other agencies and institutions to control these species on their lands. Concurrently, OISC will record distributional information about these species when these species are encountered during the course of field work and surveys.

<i>Cinchona pubescens</i>	
<i>Dillenia suffruticosa</i>	On DOFAW List of Worst Horticultural Plants
<i>Melastoma septemnerium</i>	All melastomes on HDOA Noxious Plant List
<i>Rhodomyrtus tomentosa</i>	On HDOA Noxious Plant List On DOFAW List of Worst Horticultural Plants
<i>Setaria sphacelata</i>	
<i>Tetrazygia bicolor</i>	On DOFAW List of Worst Horticultural Plants
<i>Tibouchina herbacea</i>	On DOFAW List of Worst Horticultural Plants

## 12. Rapid Response Capabilities

Even the most sincere prevention efforts cannot stop all introductions. Because of this, early detection of incipient invasions and quick coordinated responses are needed to eradicate or contain invasive species before they become so widespread that control becomes technically and/or financially impossible. Populations that are not addressed early may require ongoing and costly control efforts (National Invasive Species Management Plan, 2002). OISC can mobilize staff and volunteers to help control or eliminate incipient invasive species on Oahu before they become intractable. Presently, multiple agencies have developed emergency response plans to control several serious threats to the Hawaiian Islands. Emergency response plans are already in place for the brown tree snake and the red imported fire ant species. If any of the following invasive species are detected on Oahu, OISC is ready to assist with immediate control efforts.

Red Imported Fire Ant - <i>Solonopsis invicta</i>	Butterfly bush - <i>Buddleia madagascariensis</i>
Brown tree snake - <i>Boiga irregularis</i>	Banana poka - <i>Passiflora mollissima</i>
Gorse - <i>Ulex europaeus</i>	St. John's Wart - <i>Hypericum canariensis</i>
Pampas grass - <i>Cortaderia jubata &amp; selloana</i>	Fireweed - <i>Senecio madagascariensis</i>

**Objectives:**

1. Attend training and workshops, which include preparation for rapid response when these species are detected. .
2. Purchase any necessary equipment required for immediate control of these species.
3. Assist other organizations responsible for the detection, control and eradication of these species.

**13. Detection of New Targets**

Previously, detection of target species and identification of new species was accomplished with the Detection Working group. These volunteers reported sightings of any targets or new species they encountered. This volunteer effort was relatively successful when the number of targets was limited. Now that the number of target species has increased a broader and more intensive method of detection must be developed. Over the past year BIISC and MISC have completed roadside surveys for target species using staff time. These surveys allowed a relatively wide area to be surveyed with minimal effort and provided an obvious opportunity for replication in future years. While this method may benefit OISC's efforts to identify the extent of the populations of some of the target species, many of Oahu's remaining natural areas are not accessible by road. To achieve increased detection in these areas trail surveys by Hawaii Trail and Mountain Club members, Sierra Club volunteers, hunters and OISC staff could be used. To facilitate this, a web reporting form in addition to OISC's phone line would be used to collect volunteer reports. These reporting options would be advertised on the species identification cards and other materials distributed to volunteers and posted at trail heads. Additional detection methods will be solicited from the membership and tested in the next year.

There are dozens of other potential target species on O'ahu that should be considered for control or eradication. However, little is known about the distribution, range, and population sizes of these species on O'ahu. In some cases, it is not clear if the species even poses a threat. Our goal is to gather more information on the following species and determine whether or not they are suitable control targets for OISC.

**Objectives:**

1. Gather information on the distribution, range, and population sizes of the species below. GPS populations where possible and create GIS-linked mapping database to determine extent.
2. Identify all control efforts that are currently in place.
3. Provide the Bishop Museum with material for collections and information on the distribution of each invasive species on O'ahu.

**Invasive Species of Concern:**

Gather information about species distribution and level of invasiveness on O‘ahu.

<i>Acacia parramattensis</i>	<i>Ilex cassine</i>
<i>Artabotrys hexapetalus</i>	<i>Jasminum fluminense</i>
<i>Arundo donax</i>	<i>Medinilla cummingii</i>
<i>Cardiospermum grandiflorum</i>	<i>Melaleuca ericifolia</i>
<i>Cissus rotundifolia</i>	<i>Melastoma sanguineum</i>
<i>Convolvulus erubescens</i>	<i>Passiflora quadrangularis</i>
<i>Cordia spp.</i>	<i>Phyllostachys aurea</i>
<i>Cortaderia jubata</i>	<i>Pimenta racemosa</i>
<i>Cortaderia selloana</i>	<i>Pittosporum pentandrum</i>
<i>Crotalaria spectabilis</i>	<i>Tecoma castanifolia</i>
<i>Cuscuta campestris</i>	<i>Setaria gracilata</i>
<i>Filicium decipiens</i>	<i>Urtica urens</i>
<i>Gossypium hirsutum</i>	<i>Vernonia elliptica</i>

**Methods:**

Work closely with staff from the Bishop Museum and faculty and students from the University of Hawaii-Manoa to determine the distribution and historical records of invasive species on O‘ahu. GPS newly found locations of invasive plant and animal species on O‘ahu. Collect voucher specimens for Bishop Museum herbarium.

**14. Public Relations, Education, and Outreach**

OISC has been involved in a number of outreach activities. In June of 2002, OISC staff taught one invasive species workshop as part of Lyon Arboretum’s summer educational programming OISC staff have scheduled two more workshops in July and August open to members of the community. In areas where miconia populations are known to exist, neighborhoods are canvassed and miconia informational fliers are distributed with the goal of alerting residents to the threat of this weed, and to enlist their help in its detection and control. Several articles by local journalists have appeared in Honolulu newspapers regarding the work of OISC. In addition, OISC has appeared on a slot on a morning local talk show focused on invasive horticultural plants.

**Objectives:**

1. Develop statewide outreach materials for all Invasive Species Committees to promote awareness of island ISC’s mission.
2. Submit press releases to media and attend public events in order to raise public awareness of OISC’s activities.
3. Develop an OISC brochure and poster.
4. Create and post miconia identification signs for display at major trailheads in miconia-infested areas.

5. Develop and/or conduct education and awareness programs to target specific audiences such as government, nursery professionals, gardening public, architects, botanical gardens, hikers, and environmental organizations.
6. Invite the media to invasive species control projects.
7. Continue to develop and update the OISC website: [www.hear.org/OISC](http://www.hear.org/OISC)

**Methods:**

Work with the ISC Statewide Outreach Coordinator to perform the following tasks:

- Communicate with community members, media representatives, legislators, and agency staff regarding ISC concerns and accomplishments;
- Develop public outreach and educational programs utilizing all forms of media to reach a broad audience;
- Assist in identifying and securing statewide funding from state, federal, county, and private sources;
- Assist in preparing reports on ISC accomplishments for the ISC/CGAPS membership and for funding sources.

## Evaluation

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The O'ahu Invasive Species Committee evaluates its progress annually and documents results in its annual plan. At the time of annual program evaluation, priority species are reevaluated and additions or deletion to the list of target species may occur. Development of the annual strategic plan is accomplished through support and input from OISC staff and membership at workshops and quarterly meetings.

The goals of OISC are set by the consensus of the membership at quarterly general meetings and annual strategic planning meetings. Specific goals are met through the work of the OISC staff and ad hoc (formerly permanent) sub-committees that are made up from volunteers from the general membership. These sub-committees have included education; budget; policy; control; and aquatics. The progress towards meeting out goals is reported in our yearly Strategic Plan update.

During the last year OISC has held species-specific workshops focused on *Miconia calvescens* and *Pennisetum setaceum*. These strategic planning workshops have helped define control objectives for these targets. In the next fiscal year, we plan to bring together partner organizations for developing and implementing a manuka (*Leptospermum*) control plan. To date, all decisions have been reached by consensus within the OISC membership.

The OISC Coordinator is responsible for documentation of all OISC activities, monetary expenditures, and accomplishments. The Coordinator is assisted by field technicians. Additional administrative support is provided by the current OISC Chairperson, Deputy Chairperson, and Chairperson Emeritus, as well as the leaders of working groups.

GIS maps of known locations of all target species are kept and updated when new information from surveys is received. Records are also kept on the number of acres surveyed, number of plants treated or removed, phenology and size of treated plants, and number of volunteer and staff hours involved in on-the-ground invasives control. Progress reports of OISC activities are presented at quarterly meetings that are open to all interested persons.

## **Results to Date July 1, 2001 – June 30, 2002**

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### **Invasive Species Control**

The O‘ahu Invasive Species Committee (OISC) was formed to prevent new invasive species infestations on the island of O‘ahu, to eradicate incipient invasive species, and to stop established invasive species from spreading. Our goals to date have been to identify, map, control, and eventually eradicate the six major pests identified by the general OISC membership in September 2000. OISC staff and volunteers have made considerable progress in achieving our goals in detection, control, policy formation, and education. This section highlights the accomplishments made during the last year. Table 1 shows a summary of our accomplishments in control work, and Table 2 displays our methods of control for each species.

#### **Miconia (*Miconia calvescens*)**

- 5 hours of helicopter reconnaissance, covering 1,192 acres, were conducted in order to locate new trees/infestations.
- 5 mature trees and 5 non-reproductive trees were found during aerial reconnaissance.
- OISC spent a total of 1490 person hours conducting ground miconia surveys, covering 447 acres of land and removing 33 mature trees and 3037 non-reproductive plants, for a total of 3068 miconia plants killed.
- All known infestation areas on O‘ahu were revisited (Manoa, Kalihi, Nu‘uanu, Kahalu‘u, Wahiawa and Maunawili) and preliminary miconia population boundaries were established.
- Utilizing global positioning systems (GPS), topographical maps, and historical records, OISC established a Global Information System (GIS) database of miconia populations and survey areas incorporating current and previous control/survey work.
- Electronic (Excel) and hard-copy databases of field work have been established.

#### **Fountain Grass (*Pennisetum setaceum*)**

- OISC spent a total of 318 person hours controlling fountain grass throughout O‘ahu.
- 9142 plants were treated on over 155 acres.
- Areas surrounding the Diamond Head State Park trails, and the main ridge trails of Kaiwa ridge bordering Lanikai were treated in order to clear fountain grass from the most highly trafficked areas.
- Containment strategies were initiated for Diamond Head and Lanikai populations.
- Full treatment was performed at known satellite populations of fountain grass at Punchbowl, Pali Hwy, Sierra Dr., Waimanalo, Kahuku Training Area.
- Follow up surveys to monitor possible persisting seed banks were carried out in the Waianae mountains.
- GPS was used to map locations and boundaries of known populations, creating a GIS database for fountain grass.

**Himalayan Blackberry (*Rubus discolor*)**

- OISC spent a total of 90 person hours controlling *Rubus*, surveying over 20 acres and treating over 500 plants.
- GPS was used to map locations and boundaries of known populations, creating a GIS database for blackberry.

**Manuka (*Leptospermum* spp.)**

- All plants in the two known populations of *L. polygalifolium* were treated.
- GPS was used to map locations and boundaries of known populations, creating a GIS database for manuka.

**Table 1.** Summary of 2001-2002 control work for OISC target species.

<b>Species</b>	<b># Plants / Animals Controlled (est.)</b>	<b># Acres Surveyed (est.)</b>	<b>Aerial Surveys (est.)</b>	<b>Person Hours</b>
Miconia <i>Miconia calvescens</i> *	3070 plants/33mature	447 acres	1,192 acres	1490
Fountain Grass <i>Pennisetum setaceum</i> *	9142 plants treated	155 acres	-	318
Blackberry <i>Rubus discolor</i>	500 plants	20 acres	-	90
Manuka <i>Leptospermum</i> spp.*	500 plants	45 acres	-	228
Caribbean Frog <i>Eleutherodactylus</i> spp.*	283 frogs**	N/A	-	N/A
Thorny Kiawe <i>Prosopis juliflora</i> *	649 plants**	1.61 acres	-	N/A
<i>Melochia umbellata</i> *	125 plants	5 acres	-	30

\* Survey work for these species includes assistance from Army Environmental, DOA and/or other volunteer partnerships.

\*\* Represents control efforts performed by the Department of Agriculture and other volunteers.

**Table 2.** Method of control for each target species.

<b>Species</b>	<b>Control Methods</b>
Miconia <i>Miconia calvescens</i>	hand pull / cut and herbicide (20% Garlon 4)
Fountain Grass <i>Pennisetum setaceum</i>	herbicide (20% Velpar or 2% Round-Up)
Blackberry <i>Rubus discolor</i>	cut and herbicide (20% Garlon 4)
Manuka <i>Leptospermum</i> spp.	<i>L. scoparium</i> : cut <i>L. polygalifolium</i> : cut and herbicide (20% Garlon 4)
Caribbean Frog <i>Eleutherodactylus</i> spp.	hand capture at night
Thorny Kiawe <i>Prosopis juliflora</i>	cut and herbicide (20% Garlon 4)
<i>Melochia umbellata</i>	cut and herbicide (20% Garlon 4)

### **Data Collection/GIS**

All current OISC staff members are trained and qualified to use global positioning system (GPS) units and assist with entering data into an Access database and Arcview GIS programs. Since January 2002, OISC has created a GIS/Access database for all known miconia, fountain grass, and *Rubus* populations on O‘ahu. In addition, a hardcopy weed management form has been generated and used to document weed control work.

### **Public Relations, Education and Outreach**

In order to emphasize continuity and cooperation among statewide invasive species efforts, OISC has developed a logo consistent with logos used by other island invasive species committees. OISC has developed a 1-page fact sheet about invasive species that is used to educate legislators and the general public. Informational signage about miconia was created during this past year and is slated to be installed at selected state Na Ala Hele trail heads in FY03. A set of 20 pocket-sized invasive species identification cards was created during the past year and will be produced as a set of laminated cards for use in the field by hikers and agency field technicians.

During the 2002 state legislative session (Jan-May 2002), OISC members wrote letters supporting invasive species funding and policy initiatives. Although many of legislative bills did not pass or were subsequently vetoed by the governor, the process made legislators more aware of invasive species issues. After vetoing the bill to create a Hawaii Invasive Species Council comprised of state Department directors, the governor did later create such a council by executive order. The 2002 legislative session appropriated \$614,000<sup>1</sup> of state funding for the ISCs.

<sup>1</sup> This figure represents \$150,000 Forest Health pass through funds; \$250,000 Supplemental Budget request; \$214,000 Natural Area Reserve Fund. This figure also does not include HDOA quarantine allocations.

## Project Support

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The O‘ahu Invasive Species Committee has operated with a full time staff of three since January 2002. OISC is planning to hire an additional 2 field technicians in FY03. Staff salaries and operational expenses have been funded through allocations from the US Fish and Wildlife Service and the State of Hawai‘i Department of Land and Natural Resources, as well as grants from the US Forest Service and the Hawai‘i Community Foundation. OISC coordinates federal and state funding proposals with the Coordinating Group on Alien Pest Species (CGAPS) and other island ISCs.

A huge portion of the decision making and control work that has been accomplished over the past year was made possible by volunteers. Tables 3 and 4 display time generously donated by volunteers within the past fiscal year.

**Table 3.** Summary of Volunteer Administrative Support Hours for 2001-2002.

Meetings	Volunteer Person Hours
All-OISC General	270
Control Group	105
Strategy	84
Fountain Grass	18

**Table 4.** Summary of OISC Staff and Volunteer Person Hours for 2001-2002 Control Work.

Species	OISC person hours	Volunteer person hours	Major volunteer support groups*
<i>Miconia calvescens</i>	1129	1504	Sierra Club, EEWf
<i>Pennisetum setaceum</i>	208	110	HIARNG, DLNR
<i>Rubus discolor</i>	62	15	
<i>Leptospermum</i> spp.	156	73	Army Environmental
<i>Eleutherodactylus</i> spp.	2	550	DOA, EEWf
<i>Prosopis juliflora</i>	n/a	147	DOA, EEWf
<i>Melochia umbellata</i>	18	12	Army Environmental

- \* EEWf: Emergency Environmental Workforce (State of Hawai‘i)  
 HIARNG: Hawaii Army National Guard  
 DLNR: Department of Land and Natural Resources (State of Hawai‘i)  
 Army Environmental : Directorate of Public Works, Environmental Division, Schofield Barracks  
 DOA: Department of Agriculture (State of Hawai‘i)

The tourist-based economy in Hawaii suffered as a result of the Sept. 11, 2001 terrorist attacks. Hospitality workers were laid off by many businesses. In an attempt to provide jobs for displaced workers, the state initiated a statewide Emergency Environmental Workforce (EEWF) modeled after the federal Civilian Conservation Corps (CCC) of the 1930's. Workforce members tackled jobs ranging from mosquito abatement in urban areas to weed control in rugged natural areas. The EEWF employed hundreds of people across the state from November 2001 through April 2002, when the funding was exhausted. OISC utilized 3 EEWF persons, one of which was subsequently hired as a full time OISC field technician.

## Projected Spending for FY2002/2003

modified 2/03

Account	USFWS	HCF (1)	HCF (2)	OIWR	Total Needs: CY 2003
RCUH account #	<b>658634</b>	<b>436247</b>	<b>436642</b>	<b>659171</b>	
source	federal	private	private	State/USFS	All accounts
Initial amount	\$82,089.00	\$62,262.00	\$50,000.00	\$131,000	
Account expiration date:	9/14/2006	2/28/2003	2/28/2004 (w/ NCE)	9/30/03(w/ NCE)	
<b>Staffing (budgeted)</b>	<b>\$54,000.00</b>	<b>\$30,642</b>	<b>\$35,000</b>	<b>\$98,701</b>	
Project Coordinator	3/03 - 12/03	1/03 - 2/28/03			\$46,000
GIS Database/Administrative Specialist*		TBA	~9/03 - 12/03	~ 3/03 through 9/03	\$30,000
Field Operations Leader*		TBA	~9/03 - 12/03	~ 3/03 through 9/03	\$35,000
ISC Support Specialist (4)		1/03 - 2/28//03	~9/03 - 12/03	~ 3/03 through 9/03	\$81,000
<b>TOTAL Staffing</b>					<b>\$192,000</b>
<b>Supplies &amp; Equipment</b>	<b>\$3,050.00</b>	<b>\$15,620</b>	<b>\$15,000*</b>	<b>\$22,364</b>	
Baseyard		\$6,000		\$10,000	\$16,000
Vehicle				\$12,000	\$12,000
Vehicle Gas and Maintenance*					\$6,000 DOFAW Support
Office supplies		\$4,000	\$4,000		\$8,000
GPS Units		\$1,000	\$4,000		\$10,000
Field Gear misc.	\$500	\$500			\$500
Remote camping gear			\$5,000		\$5,000
Hand Saws, Cutting tools*		\$250			\$250
Backpack Sprayers		\$870	\$870		\$1,500
Chemicals*	\$2,000	\$2,000			\$4,000
Personal Equipment (Boots, Packs)		\$1,000	\$1,000		\$2,500
<b>TOTAL supplies</b>	<b>\$2,500</b>	<b>\$15,620</b>	<b>\$14,870</b>	<b>\$22,000</b>	<b>\$59,750</b>
<b>Travel</b>	<b>\$0</b>	<b>\$16,000</b>	<b>\$0</b>	<b>\$3,000</b>	
Helicopter time (hours)		\$16,000			\$15,000min.
Travel Misc.					\$2,000
<b>TOTAL Travel</b>				<b>\$3,000</b>	<b>\$17,000</b>
<b>Print and Publications</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$6,935 (others pool)</b>	
Trailhead signs (Miconia)				5,000	\$5,000
Poster				\$500	\$500
Strategic Plan 02.03				\$500	\$500
Brochure				\$500	\$500
<b>TOTAL Print &amp; Publications</b>				<b>\$6,500</b>	<b>\$6,500</b>
<b>Other</b>	<b>\$2,050</b>	<b>\$0</b>	<b>\$0</b>		
Parrot survey					
Rentals	\$2,050				
Others pool					
<b>amount remaining as of 1/03</b>	<b>\$63,990.18</b>	<b>\$36,649.00</b>	<b>\$50,000.00</b>	<b>\$131,000</b>	<b>Total costs: \$275,250</b>
					Total amount: \$287,639

\* denotes staff positions not filled

USFWS (1) - U.S. Fish and Wildlife Service (account established in 2001)

OIWR - Oahu Invasive Weed Research: RCUH account; includes DLNR and US Forest Service monies from 2000/ 2001 used for staffing since OISC's inception

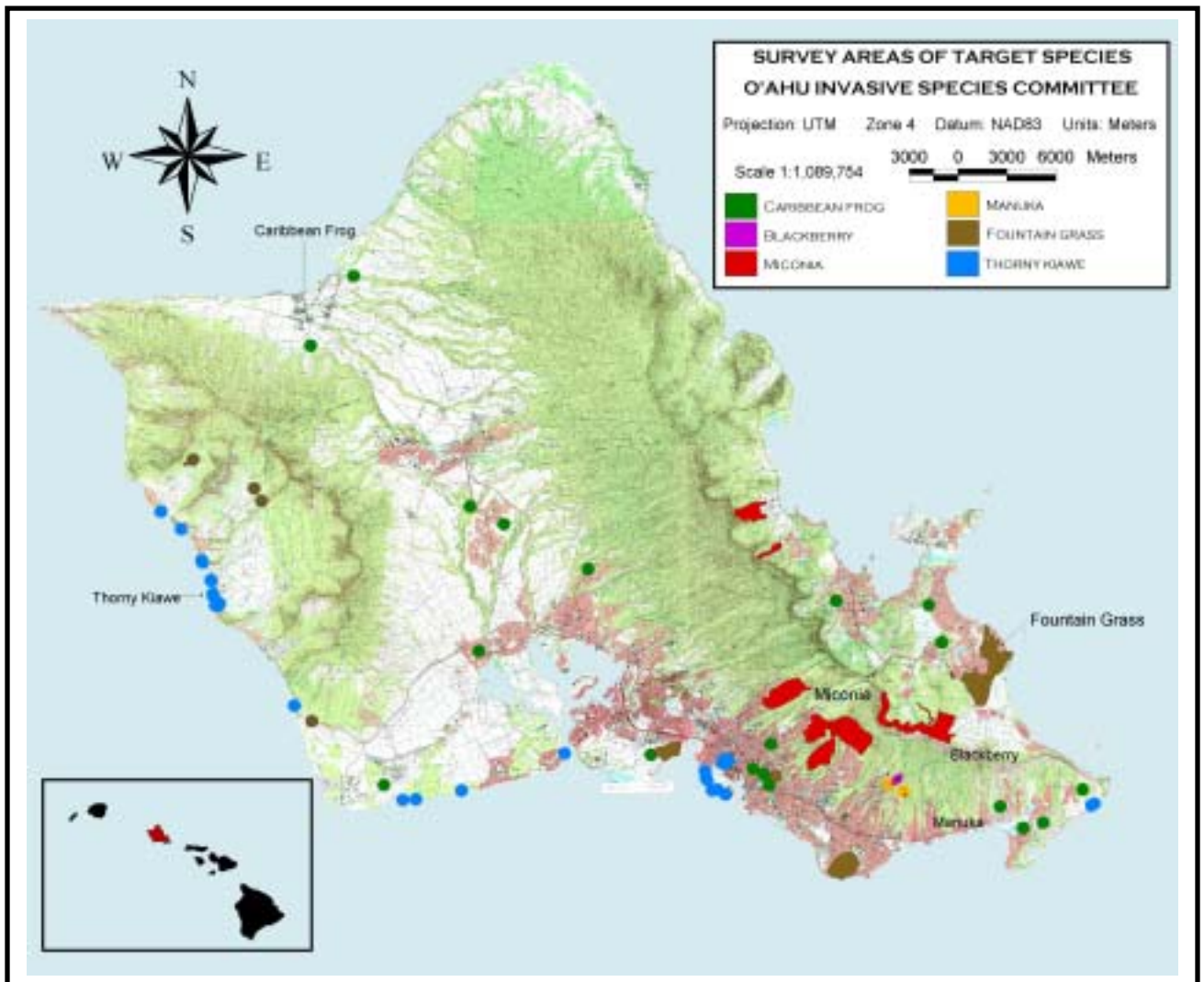
HCF (1) - Hawaii Community Foundation (Account est. 2001)

HCF (2) - Hawaii Community Foundation (Need to submit budget to RCUH prior to setting up account)

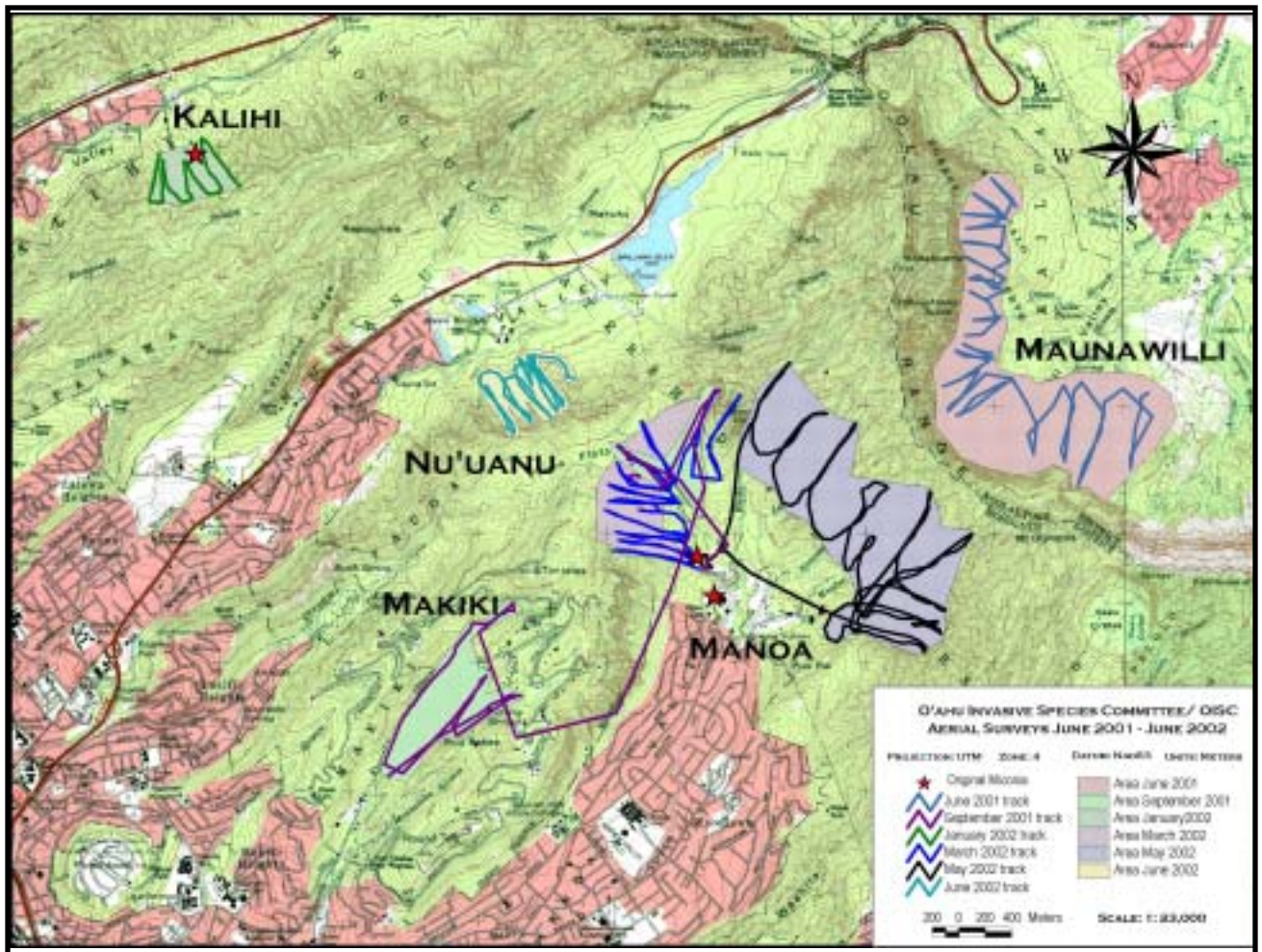
DLNR/DOFAW - Department of Land and Natural Resources/ Department of Forestry and Wildlife

## Figures and Maps

**Figure 1: Survey Areas of OISC Target Species**



**Figure 2:** Aerial Surveys of *Miconia calvenscens*: June 2001 – June 2002



Total Acres Surveyed: **1,192**

Total Hours of Flight Operations: **6**

Total # *Miconia calvenscens* plants found: **5 mature trees/ 5 non-reproductive plants**

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