ROADSIDE SURVEY AND EXPERT INTERVIEWS FOR SELECTED PLANT SPECIES ON MAUI, HAWAII

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ABSTRACT

Isolated for millions of years, the native species of Hawaii evolved in a world that lacked many aggressive predators and competitors. Unique species evolved to fill roles in different ecological niches and often dropped their traditional natural defenses. These unique endemic species are now under siege by aggressive invasive non-native species that quickly over-run native species, often combine with other circumstances, and lead to a loss of diversity and eventual extinctions. Agricultural crops and human health are also directly affected by invasive species. One strategy in the fight against alien species is early detection, which seeks to identify potential threats while they are still at a manageable level, before they cause significant damage.

To help address the growing concern of an overwhelming influx of non-native plant species into Hawaii, early detection strategies were explored over a three year period on the island of Maui. This project explored the process of invasion on Maui and obtained baseline data for approximately 100 incipient alien plant invaders which may pose threats to Haleakala National Park and other important reserves of Hawaiian biodiversity.

For each species, images were acquired and reports were created based on literature searches and results of surveys on Maui. Detailed island wide distribution maps for each species were created by driving all the roads on Maui at 5-10 mph while recording locations with a global positioning system (GPS) unit. Expert interview, literature searches, and existing data were also incorporated in the final maps. Unknown and new plant records were collected and accessioned to Bishop Museum (BISH).

During this project, we surveyed 1,246 miles (2,005 km) of road and recorded 16,031 plant locations for about 100 plant species. We also interviewed 12 expert field botanists from Maui who added 964 locations for 79 plant species, and found 11 new state records and 29 new island records which were published in the Bishop Museum Occasional Papers.

The results of this survey show that roadside surveys are a useful tool in early detection efforts. Driving the roads allows one to have repeatable transects over time, to cover a lot of area with minimum effort, to provide a landscape level view of distribution for each species, and to monitor "human" habitat which is often where most weeds are introduced and yet is often not surveyed by natural area managers. These survey methods could be adapted and used elsewhere by others seeking to use early detection as part of their overall weed management strategy.

INTRODUCTION

Early detection methods are currently being tested and refined in Hawaii to address weeds before they become widespread. It is hoped that by finding weeds earlier, costs will be reduced, feasibility of successful removal will be increased, and damage to economy, quality of life, and biological diversity will be minimized.

A roadside survey for approximately 100 incipient non-native plant species was done in 2000 by Forest Starr and Kim Starr, United States Geological Survey (USGS), under the guidance of Lloyd Loope (USGS). The purpose of this survey was to gather baseline distribution data for chosen target species and to collect any other plants that were unknown or new island records. The goal was to find invasive species which were still at an early stage of the invasion process that could be removed before they became more widespread. We also wanted to assess the effectiveness of roadside surveys on islands.

The following report summarizes our survey and includes distribution maps and an annotated checklist of target species found on Maui. Images, maps, and reports produced during this survey are available on the internet at the following web address: www.hear.org/starr.

METHODOLOGY

To begin our project, we drew from results of an earlier study in which we compiled a global weed list of plants known to be invasive elsewhere. We then compared that list to a list of plants known to be cultivated on Maui, which we created during a series of nursery surveys. Combining the two lists and highlighting the matches resulted in a list of plants known to be on Maui and known to be invasive elsewhere. Our list also included MISC control targets, noxious weeds, weedy species not yet known to be present on Maui, some widespread species, and many incipient invasive weeds. A few modifications by local expert botanists gave us our final list of about 100 target species.

Once the targets were chosen, we began to gather information for each species. We became familiar with them by reviewing existing literature and investigating known populations in the field. Search images were acquired in order to better recognize each species. Digital images were taken and put on a website for future reference. The information gathered was used to create reports discussing items such as history of invasiveness, distinguishing characteristics, and preferred habitat.

To create island wide distribution maps for each target, we drove all the roads of Maui at about 5-10 mph. With two of us in the car, both sides of the road were scanned. When we came across one of our target species, one of us recorded the location on the gps and the other took notes regarding species name, naturalized status, and location notes. We used a Garmin eTrex global positioning system (GPS) unit to record locations. When possible, digital images of target plants were taken.

Once the survey work was done, we downloaded the gps data and notes into an ArcView program to create island wide distribution maps for each target. We then created maps and asked those with botanical expertise on Maui to review them and add any locations that were missed. Additional locations were also added from literature searches and by incorporating existing gps data, and online herbarium collections.

In addition to searching for the target species, we were also on the look out for plants that we did not recognize or were new to Maui. To prepare, we printed a list of all species known to be naturalized on Maui which we used to check if something needed to be collected or not. When found, voucher specimens were collected and stored in plastic bags in the refrigerator until we could return back to the office to process them. When collecting specimens, we also recorded notes on location and other characteristics. All plants were scanned, pressed, dried, and accessioned to BISH along with accompanying data.

RESULTS

Overview

We drove 1,246 miles (2,005 km) and recorded 16,031 plant locations for 94 plant taxa. It took approximately 6 months for two field botanists to drive all the roads on Maui at about 5-10 miles per hour. Expert interviews, existing gps data, literature searches, and existing herbarium collections added 964 locations for 79 plant species. We located 88 (94%) out of 94 target species on Maui. The majority of species found, 41 (44%), were widespread (<50 locations). There were 25 (27%) species with medium sized distributions (>10-50 locations), 22 (23%) species with limited distributions (≤ 10 locations), and 6 (6%) species that were not observed during our survey (0 locations). We passed on 165 plant locations to the Maui Invasive Species Committee (MISC) for their 6 target species. We collected and published plants that we did not recognize or were new to Maui resulting in 11 new state records, 29 new island records, and 10 range extensions. These records are published in the Bishop Museum's Occasional Papers.

Target species with widespread distribution

Most of the target species mapped were widespread across the island and well established. Out of 88 target species found, 41 (44%) species had >50 locations recorded for each. Species with widespread distributions include the following: *Archontophoenix* spp.*, Bocconia frutescens, Buddleia davidii, Carmona retusa, Cinchona pubescens, Cinnamomum camphora, Citharexylum caudatum, Citharexylum spinosum, Clusia rosea, Coccinia grandis, Cortaderia* spp.*, Cotoneaster pannosus, Delairea odorata, Falcataria moluccana, Ficus benjamina, Ficus carica, Ficus* cf. *platypoda, Ficus elastica, Ficus lyrata, Ficus microcarpa, Ficus pumila, Leptospermum spp., Livistona chinensis, Lonicera japonica, Macaranga tanarius, Morella faya, Ochna* spp.*, Olea europaea* subsp. *cuspidata, Pimenta dioica, Pinus* spp.*, Podranea ricasoliana, Pyracantha* spp.*, Rubus niveus* f. a*, Rubus niveus* f. b*, Schefflera actinophylla, Senecio madagascariensis, Solandra maxima, Solanum torvum, Thunbergia fragrans, Tibouchina urvilleana,* and *Washingtonia* spp. These widespread species are further along in their invasion stage and may require a different strategy, such as a site-led strategy where they are removed only

when in direct threat to native species (such as within a National Park). It is not likely that these widespread species could be completely removed from the entire island, given current resources. Perhaps these species could be removed when found in or near high value sites.

Target species with medium sized distributions

This category represents species that are not fully widespread, but are not limited in distribution either. Out of 88 target species found, 25 (27%) species had >10-50 locations recorded for each. Species with medium sized distributions include the following: *Anredera cordifolia, Arundo donax, Buddleia madagascariensis, Caesalpinia decapetala, Cinnamomum burmanni, Cryptostegia* spp*., Ficus benghalensis, Ficus macrophylla, Ficus religiosa, Grevillea banksia, Hypericum canariense, Olea europaea* subsp. *europaea, Paederia foetida, Passiflora mollissima, Pennisetum setaceum, Philadelphus karvinskyanus, Phormium tenax, Pueraria montana* var. *lobata, Rubus glaucus, Salsola tragus, Senecio confusus, Sideroxylon persimile, Thunbergia alata, Thunbergia grandiflora,* and *Thunbergia laurifolia*. These species are beginning to leave the control priority stage and may be monitored further and evaluated for control based on their threat and proximity to natural areas, size of distribution, and available resources.

Target species with limited distributions

Some of the target species observed during our survey were found in limited distribution. Out of 88 target species found, 22 (23%) species had ≤10 locations recorded. Species with limited distributions include the following: *Aristolochia littoralis, Centranthus ruber, Clerodendrum inerme, Derris elliptica, Ficus deltoidea, Ficus pseudopalma, Hyparrhenia spp., Leptospermum morisonii, Ligustrum sinense, Macaranga mappa, Melastoma* spp*., Melochia umbellata, Morella cerifera*, *Parkinsonia aculeata*, *Passiflora laurifolia, Pittosporum viridiflorum*, *Rhodomyrtus tomentosa*, *Rubus discolor, Rubus ellipticus*, *Solanum robustum*, *Tetrastigma pubinerve*, and *Verbascum thapsus*. These species are still within the control priority stage of invasion and could possibly be removed from the island, given appropriate resources.

Target species not found

There were 6 out of 94 target species (6%) not observed during our roadside survey. Target species not found include: *Clerodendrum macrostegium*, *Hiptage benghalensis, Ficus nota, Oxyspora paniculata*, *Pittosporum undulatum,* and *Schizachyrium condensatum*. Other than *P. undulatum*, these species are still not yet known to be present on Maui, and prevention and early detection still seem to be viable strategies.

New records

We collected and published plants that we did not recognize or were new to Maui resulting in 11 new state records, 29 new island records, and 10 range extensions. These records are published in the Bishop Museum's Occasional Papers. A few of the target species had not been previously known to be naturalized on Maui, or in the state of Hawaii. During this survey, we collected and published them as so. A few examples are given here. One target species was documented as new naturalized record for the state of Hawaii: *Sideroxylon persimile*. A few target species were documented as new island

records for Maui: *Aristolochia littoralis, Carmona retusa, Citharexylum caudatum, Citharexylum spinosum, Buddleia davidii, Falcataria moluccana, Lonicera japonica, Philadelphus karvinskyanus, Pimenta dioica, Pyracantha koidzumii, Rubus glaucus, Thunbergia laurifolia,* and *Thunbergia grandiflora.* Several non-target species were documented as new naturalized records for the state of Hawaii: *Asparagus asparagoides*, *Brexia madagascariensis*, *Caltropis gigantea*, *Dichelacne crinita*, *Dyssodia tenuiloba*, and *Schefflera arboricola*. A few non-target species were documented as new island records for Maui: *Hedera helix*, *Noronhia emarginata*, and *Pentas lanceolata*.

Other species of interest

While searching for our target species, we came across a few species that were not on the target species list, but are known to be invasive species elsewhere. These species could be researched to find their distribution on Maui and what threat they pose to Maui. Some species that were found during this survey that were not target species include: *Acacia auriculiformis*, *Acacia mangium*, *Acacia podalyriifolia*, *Acacia retinodes*, *Maclura pomifera*, and *Tibouchina granulosa*.

Road survey methodology refinements

Some species that were not found during the survey have since been found on Maui. A good example is *Pittosporum undulatum*, which has been found in about a half dozen locations in Kula and Makawao, mostly cultivated large trees, and a few sparingly naturalized saplings nearby plantings. Having never seen this species in person, it is likely that there was not a good enough "search image". During a recent weed tour with a researcher from Lord Howe island, where *P. undulatum* is present, she immediately recognized the plant as we drove by, showing how important search image is in identifying targets. With current online references, it is easier today to get images of plants to look out for. However, nothing seems to beat seeing the plant for oneself in person.

A few other things that seem to increase detection ability include limiting the number of targets included in the search, driving both directions on roads, and driving as slow as possible.

There were many areas that were not accessible, even with 4wd, such as backyards, private properties, impassable four wheel drive roads, and remote inaccessible natural areas. Expert interviews, literature searches, and complimentary surveys employing foot, helicopter and remote sensing methodology could be used to refine maps made from roadside vehicle surveys.

CONCLUSION

Identifying and removing invasive species at an early stage provides a cost effective tool for managing weeds, and roadside surveys are an effective means to gather distribution information on incipient populations in areas where they are likely to get started. On Maui, we located 88 (94%) out of 94 target species. Out of 94 target species found, 22 (23%) species had $\leq$10 locations recorded. Some of these could be removed from the

island to prevent further spread. A few species, 6 (6%) were not found at all. These could be on a prevention and early detection list. Numerous species that were thought not to be on Maui were found once we acquired search images for them and began active searches. An overwhelming amount, 41 (44%) of the target species mapped were found to be widespread across the island and well established.

This roadside survey provides a baseline for distribution of selected non-native species on Maui. This process is an effective way to help provide information on what species are present and where they are located. While there was an overwhelming amount of widespread species found in what was thought to be a target list of incipient species, valuable information was gained and a few feasible targets for future control have been highlighted. This type of survey could be used on other islands or places that wish to assess distribution of selected species.

ANNOTATED CHECKLIST OF TARGET SPECIES

The following checklist provides information for target species surveyed for during our road survey on Maui in 2000 and subsequent expert interviews and literature searches. For each entry is a scientific name, common name, family name, and brief description. The description includes information on where the species was found during Maui roadside surveys and subsequent expert interviews, native range, notes on cultivation and invasiveness, current known distribution in the Hawaiian Islands, and other miscellaneous notes.

***Anredera cordifolia* -- Madeira vine -- (Basellaceae)**
Anredera cordifolia was found in over 20 sites of mostly naturalized populations from sea level up to 3,500 ft (1,067 m). The sites were typically in urban and residential areas, mostly in Haiku, Makawao, Ulupalakua, and Kaupo, but also in Wailuku, Waihee, Honokawai, and Kipahulu where *A. cordifolia* sprawls down gulches, on steep banks, along roads, up trees, and along old rock walls. *A. cordifolia* is native from Paraguay to southern Brazil and northern Argentina and is widely cultivated in tropical regions of the world (Wagner *et al*. 1999). *A. cordifolia* has become a major pest in places where it is cultivated, such as Hawaii, Australia, New Zealand, South Africa, and other Pacific Islands (HDOA 1992; Auckland Regional Council 1999, PIER 2002, Weeds Australia 2000). *A. cordifolia* is naturalized on all of the main Hawaiian islands, but is not documented from Niihau and Kahoolawe (Nagata 1995, Wagner *et al*. 1999). *A. cordifolia* is a Hawaii state noxious weed (HDOA 1992).

***Archontophoenix* spp. -- Alexander palm -- (Arecaceae)**
Archontophoenix alexandrae and possibly *A. cunninghamiana* were found to be widely planted, though most cultivated plants in drier climates did not appear to have naturalized yet. In a few moist to wet locations, including Haiku, Hana, and near the Keanae Arboretum, plants are beginning to spread into nearby surroundings, though infestation levels still remain fairly small. *A. alexandrae*, native to Queensland, Australia, is a tall palm that is widely cultivated in tropical and subtropical regions of the world. *A. alexandrae* is escaping from plantings and is naturalized in low elevation mesic to wet valleys, especially on the island of Hawaii from Hilo to the Hamakua coast area (Wagner *et al.* 1999). According to Staples and Herbst (2005), *A. alexandrae* is also spreading in a similar fashion on the island of Oahu in the back of Manoa Valley.

***Aristolochia littoralis* -- Calico flower -- (Aristolochiaceae)**
Aristolochia littoralis was found to be sparingly cultivated and naturalized in a few locations, including Honokawai, Lahaina, Waikapu, and Kipahulu. It was recently documented as naturalized from a lowland site near Kipahulu. *A. littoralis*, native to Brazil, is an ornamental vine cultivated in Hawaii and other tropical areas for their colorful and unique pipe shaped flowers. *A. littoralis* is known to spread from initial plantings in several places where it is cultivated, including Hawaii, Florida, South Africa, and other Pacific Islands (Foxcroft 1999, Wagner *et al.* 1999, PIER 2002, FLEPPC

2001). In Hawaii, *A. littoralis* is naturalized on Kauai, Oahu, and Maui (Wagner *et al.* 1999, Imada *et al.* 2000, Starr *et al.* 2003).

***Arundo donax* -- Giant reed -- (Poaceae)**
Arundo donax was sparingly planted in several locations from sea level up to 4,000 ft (1,219 m) elevation. Plantings at higher and more arid climates are usually small patches that appear unhealthy, especially during dry periods. Plantings at lower elevations near sea level and closer to the water table appear healthier and generally these patches cover larger areas. *A. donax*, native to the Mediterranean region, has long been cultivated throughout the world for use in making mats, roofing material, erosion control, and as an ornamental (Neal 1965, Wagner *et al.* 1999). *A. donax* has become invasive in several places where it has been planted, such as California and Florida, where it invades riparian areas and over-runs native plants and riverside habitat (Bodle 1998, Dudley 1998). In Hawaii, *A. donax* is cultivated and reported as naturalized in coastal areas, often in thickets, on Kauai, Oahu, Maui, and Hawaii (Wagner *et al.* 1999). It is also known from a single location on Molokai (Tina Lau pers. comm.).

***Bocconia frutescens* -- Tree poppy -- (Papavaraceae)**
Bocconia frutescens was observed as widely naturalized, scattered throughout the landscape in residential areas, pastures, natural areas, along roads, and on lava flows, sometimes with dense infestations, from Kula to Kahikinui at elevations concentrating near 1,600 ft (488 m) to 4,000 ft (1,219 m). A small outlier population was also observed in Makawao. *B. frutescens*, native to tropical America, is a large shrub to small tree in the poppy family that is cultivated in warm regions of the world as an ornamental plant (Bailey and Bailey 1976, Riffle 1998). *B. frutescens* was introduced to Hawaii as an ornamental (Wester 1992) and was first collected in 1920 on the island of Maui by C.N. Forbes, who reported seeing a single tree on the old government trail in Kanaio (Medeiros *et al.* 1993, Wagner *et al.* 1999). Since then, *B. frutescens* has spread to areas nearby and has become a serious invader in leeward native dry and mesic forests of East Maui. *B. frutescens* is also known from the island of Hawaii (Wagner *et al.* 1999). *B. frutescens* is a Hawaii state noxious weed (HDOA 1992).

***Buddleia davidii* -- Butterfly bush -- (Buddleiaceae)**
Buddleia davidii was observed as sparingly cultivated near Iao, West Maui, and widely cultivated in cool, moist to arid, mid elevation residential areas of "Upcountry" East Maui, including Haiku, Makawao, Pukalani, Piiholo, Olinda, Kula, and Keokea. Signs of spread into nearby pastures were observed from plantings in Kula, elevation 3,800 ft (1,158 m) in a residential/pasture setting. *B. davidii*, native to China, is a large shrub with colorful fragrant flowers that is cultivated as an ornamental garden plant in temperate regions of the world, often planted to attract wildlife, such as butterflies and hummingbirds, which sip nectar from flowers. *B. davidii* is known to spread from gardens and has become invasive in Europe, New Zealand, Australia, and parts of the United States (Binggeli 1998, PLANTS 2002). In Hawaii, *B. davidii* is reported from Kauai and Maui (Shannon and Wagner 1996, Wagner *et al*. 1999, Starr *et al.* 2003).

***Buddleia madagascariensis* -- Smoke bush -- (Buddleiaceae)**

Buddleia madagascariensis was observed sparingly in Makawao, Olinda, and near the Puaakaa State Wayside on Hana Hwy. It was more commonly observed at mid-elevation sites, such as Kula, in large, dense patches sprawling on other plants on the side of the road, in gulches, and waste areas. *B. madagascariensis*, native to Madagascar, is a striking, fragrant ornamental shrub with a sprawling habit that is cultivated and naturalized in tropical areas of the world (Wagner *et al*. 1999). *B. madagascariensis* is an aggressive plant that spreads beyond the garden and invades disturbed areas, creating dense thickets capable of smothering other plants in the way. It is considered invasive in Florida, Australia, South Africa, and some Atlantic Islands (Binggeli 1999, Foxcroft 1999, The Environmental Conservation Section 1999, Randall 2002). In Hawaii, *B. madagascariensis* is reported from Oahu, Maui, Hawaii, and Kauai (Lorence and Flynn 1999, Wagner *et al.* 1999, Oppenheimer and Bartlett 2000).

***Caesalpinia decapetala* -- Cat's claw -- (Fabaceae)**
Caesalpinia decapetala was observed in two locations on East Maui. The larger of the two infestations is restricted to the Halehaku (Kakipi) gulch area and side tributaries. The second and much smaller infestation is located in Ulupalakua. *C. decapetala*, native to tropical Asia, is a woody vine with sharp thorns and yellow flowers that forms impenetrable thickets (Wagner *et al.* 1999). In Hawaii, it is reported from the islands of Niihau, Kauai, Oahu, East Maui, Hawaii, and Molokai (Wagner *et al.* 1999, Tina Lau pers. comm.).

***Carmona retusa* -- Carmona -- (Boraginaceae)**
Carmona retusa was observed as cultivated and spreading from residential plantings, mostly in low elevation neighborhoods, such as Kahului, Wailuku, Lahaina, Paia, Haiku, and Kihei. *C. retusa* is native from India to Malay Peninsula and the Philippines (Bailey and Bailey 1976). It is cultivated as a hedge plant, as a bonsai tree, and for making tea. *C. retusa* can spread from plantings by fruit eating birds and can form dense thickets in certain habitats. In Hawaii, *C. retusa* is reported as naturalized on the islands of Kauai, Molokai, and Maui (Lorence *et al.* 1995, Starr *et al.* 2000, Starr *et al.* 2005).

***Centranthus ruber* -- Valerian -- (Valerianaceae)**
Centranthus ruber was locally scattered on steep gulch walls in Pohakuokala Gulch, East Maui, near 5,000 ft (1,524 m) elevation. *C. ruber*, native to the Mediterranean region, is widely cultivated as an ornamental landscape plant throughout the world (Wagner *et al.* 1999). *C. ruber* is not reported as a major pest anywhere, though it freely sets seeds and often naturalizes where it is planted and is considered weedy in gardens (Brickell and Zuk 1997, Wagner *et al*. 1999). In Hawaii, *C. ruber* is documented from the island of Maui.

***Cinchona pubescens* -- Quinine -- (Rubiaceae)**
Cinchona pubescens was locally abundant in the mesic to wet forests of Makawao Forest Reserve at approximately 2,600-3,800 ft (792-1,158 m) elevation. *C. pubescens*, native from Andean South America north to Costa Rica, has been cultivated in various tropical regions of the world mainly for use in the production of quinine, a medicine used to treat malaria. In some places where *C. pubescens* is cultivated, such as Galapagos and Hawaii,

it is spreading from initial plantings, invading nearby forests, forming dense thickets, and crowding out native plants. In Hawaii, *Cinchona* plantations were planted as early as 1868 on Maui with later plantings by state foresters on Oahu, Maui, and Hawaii in the first half of the 1900's (Wagner *et al.* 1999). *C. pubescens* was reported as naturalized in 1978 from the island of Hawaii and in 1987 from Maui (Wagner *et al.* 1999).

***Cinnamomum burmanni* -- Padang cassia -- (Lauraceae)**
Cinnamomum burmanni was found as cultivated and naturalized in moist to wet disturbed forest areas from sea level up to at least 2,000 ft (610 m) elevation. According to Meidell *et al*. (1997), "Introduced to northern West Maui around 1920-1935, *C. burmanni* has now become extensively naturalized in the area between Honokohau and Honokahua Valleys, elevation 245-610 m (804-2,001 ft), and is viewed by Puu Kukui Watershed Management staff as a serious pest." *C. burmanni* is also naturalized near Nahiku, East Maui, about 5 miles West of Hana. There are also scattered individuals on East Maui near sea level in Keanae and near 1,000 ft (305 m) elevation in Ulumalu, Haiku. *C. burmanni*, native to southeast Asia and Indonesia, is cultivated for use as a spice, for ornamental purposes, and as a forestry tree. In Hawaii, *C. burmanni* is naturalized on Kauai, Oahu, Maui, and Hawaii (Wagner and Herbst 1995, Meidell *et al*. 1997, Wagner *et al*. 1997, Wagner *et al.* 1999, Starr *et al*. 2004).

***Cinnamomum camphora* -- Camphor tree -- (Lauraceae)**
Cinnamomum camphora is cultivated and naturalized on both West and East Maui mostly from 1,000-4,000 ft (305-1,219 m) elevation, in both wet and dry areas. On West Maui, *C. camphora* is cultivated and escaped in Honokohau and Napili (Hank Oppenheimer pers. comm.). On East Maui, *C. camphora* is more widespread and can be found spreading from plantings in various areas including Haiku, Nahiku, Makawao, Piiholo, Waikamoi, Kula, and from Ulupalakua to eastern Auwahi. *C. camphora*, native to parts of Asia, China, Taiwan, and Japan (Dehgan 1998, Wagner *et al*. 1999), is widely cultivated throughout the world and has become naturalized in several places where it is planted, including Hawaii, southern United States, and Australia (FLEPPC 2001, Land Protection 2001). In Hawaii, *C. camphora* is cultivated as an ornamental tree and was historically planted in forest reserves and is now naturalized on Kauai, Oahu, Lanai, and Maui (Wagner *et al*. 1999).

***Citharexylum caudatum* -- Juniperberry -- (Verbenaceae)**
Citharexylum caudatum was found to be naturalized in Lahaina, Kihei, Haiku, and near Kolea stream on Hana Hwy. Most locations occur from sea level to 1,000 ft (305 m) elevation. In the drier sites of Lahaina and Kihei, *C. caudatum* is observed naturalizing in areas that are landscaped and are being irrigated. *C. caudatum* thrives in moist to wet lowland sites such as Ohia gulch and Kolea, Hana Hwy. *C. caudatum* is native from Mexico and Central America to northern South America and the West Indies (Wagner et al. 1999). In Hawaii, *C. caudatum* is invading on the islands of Kauai, Oahu, Maui, and Hawaii where it forms dense thickets in wet habitats (Nagata 1995, Wagner *et al.* 1999, Starr *et al*. 1999, Oppenheimer 2003).

***Citharexylum spinosum* -- Fiddlewood -- (Verbenaceae)**

Citharexylum spinosum was found to be widely planted as a street tree from dry low areas such as Lahaina and Kihei to moist mid-elevation sites, such as Haiku. An occasional cultivated tree was observed in Kula. Naturalized plants were observed in Haiku, Kihei, Lahaina and Wailuku. The wetter areas seemed to have more potential for *C. spinosum* to reproduce, but spread was also noted in dry areas that had irrigation or other water sources. *C. spinosum* is native to the Caribbean (Turner and Wasson 1997). In Hawaii, *C. spinosum* is naturalized on the islands of Oahu and Maui (Herbarium Pacificum Staff, 1998, Wagner *et al*. 1999, Starr *et al*. 2002).

***Clerodendrum inerme* -- Seaside clerodendrum -- (Verbenaceae)**
Clerodendrum inerme was observed in a few locations on Maui, including Wailuku, Pukalani, and Kihei. In south Kihei, a large planting of *C. inerme* was observed on the beach side of the residences along Poolenalena beach where it rambles over naupaka (*Scaevola sericea*) and other native coastal plants. *C. inerme*, native to tropical Asia and the Pacific, is valued in landscaping as a groundcover or hedge plant and has attractive evergreen foliage and fragrant white flowers, and grows well along the beach thriving in salt spray and full sun (Turner and Wasson 1997). In Hawaii, this plant is not documented as naturalized yet, though it shows invasive tendencies and is able to thrive near the ocean at the high tide mark, making it a potential weed in the coastal environment.

***Clerodendrum macrostegium* -- Seaside clerodendrum -- (Verbenaceae)**
Clerodendrum macrostegium was not observed during our survey. *C. macrostegium*, native to the Philippines, are grown for their attractive and unusual flowers. In Hawaii, *C. macrostegium* is naturalized on the island of Kauai (Lorence and Flynn 1997, Wagner *et al*. 1999).

***Clusia rosea* -- Autograph tree -- (Clusiaceae)**
Clusia rosea was observed as densely distributed in lowland urban areas of Kahului, Kapalua, Lahaina, Kahului, Wailuku, Kihei, Paia, Makawao, Haiku, and Hana. One cultivated tree was observed in Kanaio. In these areas, it is commonly planted as a street tree and in parking lots of shopping centers, schools, condominiums and residential areas. Naturalized plants are observed nearby plantings. Plants thrive and spread in a variety of habitats from dry open aa lava to wet forested areas and sheer cliffs. *C. rosea* is dispersed by fruit eating birds and may grow epiphytically on other plants. A native to tropical America, *C. rosea* is widely grown as an ornamental in tropical regions of the world. In Hawaii, *C. rosea* is known to be naturalized on the islands of Kauai, Oahu, Maui, and Hawaii (Wagner *et al.* 1999, Oppenheimer and Bartlett 2000).

***Coccinia grandis* -- Ivy gourd -- (Cucurbitaceae)**
Coccinia grandis was observed in Kahului, Iao, Waikapu, Kihei, Lahaina, Kapalua, Makawao, Paia, and Haiku where it was found sprawling and climbing on rock walls, telephone wires, fences, in hedges, and scrub areas. *C. grandis* is native to Africa, India Asia, and Australia (PIER 2002, Wagner *et al*. 1999). It is widely cultivated and has escaped to become a vigorous pest in Hawaii, Australia, Saipan, Texas, and Florida (PIER 2002, PLANTS 2002). In Hawaii, *C. grandis* is documented as naturalized on

Oahu, Maui, and Hawaii but is also known to have been present on Lanai, Kauai, and Midway Atoll (Wagner *et al.* 1999, Starr *et al.* 1999, Starr and Martz 1999, Oppenheimer and Bartlett 2000). *C. grandis* is a Hawaii state noxious weed (HDOA 1992).

***Cortaderia* spp. -- Pampas grass -- (Poaceae)**
Cortaderia jubata and *C. selloana* were observed cultivated mostly as hedges and garden plants in urban and residential areas of Maui from sea level up to at least 4,000 ft (1,219 m). Plantings were especially common on East Maui from Haiku to Kula at elevations ranging from 1,000 ft (305 m) to 4,000 ft (1,219 m). Naturalized plants were found from dry high alpine areas of Haleakala to wet windward forests on both East and West Maui. *Cortaderia* spp. readily spread from the garden on the wind and are considered pests in numerous places including California, Hawaii, New Zealand, Australia, and South Africa (Loope and Medeiros 1992, Haley 1997, DiTomaso et al. 1999, PIER 2002, Stellenbosch 2003). In Hawaii, *C. jubata* is documented as naturalized on Maui, but it, as well as *C. selloana,* are also known to be present on Kauai, Molokai, and Hawaii (Loope and Medeiros 1992, Meidell *et al*. 1997, Wagner *et al*. 1999, MoMISC, BISC, KISC pers. comm.). *C. jubata* is a Hawaii state noxious weed (HDOA 1992).

***Cotoneaster pannosus* -- Cotoneaster -- (Rosaceae)**
Cotoneaster pannosus was observed to be mostly cultivated in cooler climates of Upcountry, East Maui, including Makawao, Piiholo, Kula, Keokea, and Polipoli. In Makawao and Piiholo, plants observed were mostly cultivated. Naturalized plants were seen along fencelines, in pastures, sprouting in other plantings, and in native shrubland and wooded areas. A dense infestation was observed in native mamane (*Sophora chrysophylla*) shrubland at 2,012 m (6,600 ft) elevation in Polipoli State Park. In Haleakala National Park, a few cultivated plants were found near park housing and a naturalized plant was found where Halemauu trail and the supply trail intersect, 7,800 ft (2,377 m) elevation (Bill Haus pers. comm.). *C. pannosus* is native to China (Neal 1965). *C. pannosus* is a popular ornamental plant that escapes from cultivation and has become a pest in at least Hawaii, California, and Australia (Wagner *et al.* 1999, CalEPPC 1999, DOA-WA 2001). In Hawaii, *C. pannosus* is escaping from landscaping and forestry plantings on Kauai and East Maui (Wagner *et al*. 1999, Lorence *et al.* 1995, Herbarium Pacificum Staff 1999). Wagner *et al*. (1999) also reported *C. pannosus* as persisting but not spreading yet from Volcano, Hawaii.

***Cryptostegia* spp. -- Rubber vine -- (Asclepiadaceae)**
About a dozen locations of rubber vine (*Cryptostegia madagascariensis* and *C. grandiflora*) were found on Maui. Almost all of the sites were comprised of one or a few plants being cultivated in residential areas of Lahaina, Kahului, Kihei, Wailuku, Pukalani, Omaopio, Kula, and Hana. There were two sparingly naturalized locations, one at Kanaha Pond, and the other in Omaopio. Both *C. grandiflora* and *C. madagascariensis* are native to Madagascar (DNRM 2001). In Australia, *C. grandiflora* is a declared plant and is said to be one of the greatest threats to natural ecosystems within national park areas in northern Queensland (McFadyen and Harvey 1991). In Florida, *C. madagascariensis* is reported as a category II weed (FLEPPC 1999). In Hawaii, *Cryptostegia* is naturalized on the islands of Molokai, Maui, and Hawaii, though it has

not been properly documented as so yet. The distribution on the island of Hawaii is uncertain, though there are reports of a large infestation near Kawaihae (Christy Martin pers. comm.). It is also present on Oahu.

***Delairea odorata* -- Cape ivy -- (Asteraceae)**
Delairea odorata was observed naturalizing away from initial plantings in Haiku, Makawao, Olinda, and Piiholo, and Kula, where *D. odorata* filled gulches, climbed trees and other vegetation in a blanketing manner. *D. odorata*, native to Southern Africa, is a popular ornamental climbing vine used in landscaping. *D. odorata* is an aggressive smothering vine that escapes from cultivation and has become a weedy pest in England, California, Oregon, Hawaii, Australia, and New Zealand (Bailey and Bailey 1976, NSW Agriculture 1993, CalEPPC 1994, Wagner *et al.* 1999, PLANTS 2002). *D. odorata* is known from Maui and Hawaii (Wagner *et al.* 1999).

***Derris elliptica* -- Poison vine -- (Fabaceae)**
Derris elliptica was found in the Honopou area of East Maui near Twin Falls, near the Haiku reservoir, at the top of W. Kuiaha Rd, Haiku, and in Nahiku where it covers over 10 acres. *D. elliptica,* native from India to Indonesia, is cultivated in the tropics for the insecticide Rotenone which is derived from the roots of the plant (Bailey and Bailey 1976). *D. elliptica* is an aggressive vine that strangles vegetation and anything else that gets in its way as it spreads.

***Falcataria moluccana* -- Molucca albizia -- (Fabaceae)**
On West Maui, *Falcataria moluccana* was found spreading from plantings at Pohakupule Gulch, 600 ft (183 m) elevation, Honokahau, in Kapalua, on Hwy. 30, near Office Road, and Waihee above the abandoned macadamia nut plantation and surrounding the reservoir. On East Maui, it was also found spreading from plantings in Haiku and along the Hana Hwy. near the Kolea section of the Forest Reserve. *F. moluccana* is native to the Moluccas, New Guinea, New Britain, and the Solomon Islands (Wagner *et al.* 1999). In Hawaii, *F. moluccana* is naturalized in disturbed mesic to wet areas, 25-600 m (82-1,968 ft), on Kauai, Oahu, Molokai, Maui, and Hawaii (Wagner *et al.* 1999, Oppenheimer and Bartlett 2002).

***Ficus benghalensis* -- Indian banyan tree -- (Moraceae)**
There are about a dozen sites on Maui in areas of Lahaina, Kahului, Paia, Haiku, Haliimaile, and Nahiku where *Ficus benghalensis* was being cultivated. Most trees are large specimens with many aerial roots. One of the most well known sites is in Lahaina on Front St. *F. benghalensis* is native to India where it grows from low altitudes to 2,000 ft (610 m), especially in dry regions (Neal 1965). *F. benghalensis* is cultivated in Hawaii and does not spread because of the absence of its pollinator wasp, *Eupristina masoni*. In places where the pollinator wasp is present, such as Florida and Australia, *F. benghalensis* spreads via fruit eating birds and has become a pest (Nadel *et al*. 1992, PIER 2002). Should the associated wasp arrive in Hawaii, there would be the potential for *F. benghalensis* to begin to spread on its own.

***Ficus benjamina* -- Weeping fig -- (Moraceae)**

Ficus benjamina was densely distributed in urban / residential areas from Kapalua to Lahaina, Wailuku, Kahului, Kihei, Puunene, Paia, Haiku, Makawao, Piiholo, Pukalani, Kula, Ulupalakua, Kanaio, along the Hana Hwy., and Hana. It was one of the most commonly planted trees on Maui and occurred basically wherever people lived. *F. benjamina* is native to a large area including India, southern China, Southeast Asia, Malaysia, the Philippines, northern Australia, and the islands of the South Pacific (Riffle 1998). *F. benjamina* is not invasive in Hawaii yet due to the absence of its associated pollinator wasp. The only reference found of this species becoming invasive elsewhere in the world is in Western Australia, where the tree is reported as invading cliffs in a few areas around the lower Swan River in Perth (Randall 2002). Should the associated wasp arrive in Hawaii, there would be the potential for *F. benghalensis* to spread on its own.

***Ficus carica* -- Edible fig -- (Moraceae)**

Ficus carica was also densely planted in urban / residential areas, with the exception of extremely wet areas, such as along Hana Hwy., where this species likely does not grow well. *F. carica* is thought to be native to Western Asia (California Rare Fruit Growers, Inc. 1996). Though *F. carica* is not invasive in Hawaii today due to the unsuccessful introduction of its associated pollinator wasp, *Blastophaga psenses*, in 1909 (Wagner *et al.* 1999), it is considered invasive in riparian habitats in Australia and California (Randall 2002, CalEPPC 1999). Should the associated wasp be reintroduced today in Hawaii, there could be the potential for *F. carica* to begin to spread on its own.

***Ficus* cf. *platypoda* -- Edible fig -- (Moraceae)**

Ficus cf. *platypoda* was found to be planted and naturalized on West Maui in a few locations, including Olowalu, Waihee, Kahului, and Puunene, with the largest population found near Fleming Arboretum. On East Maui, *F.* cf. *platypoda* was found sparingly cultivated in Kula and Pukalani and widely naturalized from Haiku to near the Hana airport. Trees were observed spreading from yards and forestry areas, filling gulches and germinating on fence posts and on other vegetation, including native forest species, such as koa (*Acacia koa*) and ohia (*Metrosideros polymorpha*). *F.* cf. *platypoda* is native to New South Wales and Queensland, Eastern Australia (Bailey and Bailey 1976, Haley 1997b). The associated pollinator wasp, *Pleistodontes imperialis,* has been introduced to New Zealand and Hawaii where this species is now spreading and has become a pest (Haley 1997b, DLNR-DOFAW 2002). In Hawaii, *F.* cf. *platypoda* was a popular forestry tree and several thousands were planted on Oahu, Maui, and Hawaii during the 1920's-1930's (Skolmen 1960). This species is now documented as naturalized on Oahu, Maui, and Hawaii (Nagata 1995, Oppenheimer and Bartlett 2000, Oppenheimer 2003).

***Ficus deltoidea* -- Edible fig -- (Moraceae)**

Ficus deltoidea was found sparingly cultivated in Makawao and Pukalani. *F. deltoidea* is native to S.E. Asia to Borneo, and the Philippines (Brickell and Zuk 1997). *F. deltoidea* is currently not spreading in Hawaii due to the fact that its pollinator wasp is not present. *F. deltoidea* is sparingly cultivated in Hawaii and only a few specimens have been observed in cultivation on the islands of Kauai and Maui. Though this species is not widely known as invasive elsewhere and is not widely planted in Hawaii, if the

associated pollinator wasp was introduced, there would be the potential for it to become naturalized.

***Ficus elastica* -- Rubber tree -- (Moraceae)**
Ficus elastica was found to be widely cultivated in residential, urban, and rural areas of Maui from sea level up to about 3,600 ft (1,097 m) in both moist and dry conditions. *F. elastica* is native to Nepal, Bhutan, northeast India, Myanmar (Burma), Malaya, Sumatra, and Java (Riffle 1998). This species is widely cultivated throughout the world. There is no evidence of it ever becoming invasive anywhere. *F. elastica* currently does not spread in Hawaii.

***Ficus lyrata* -- Fiddle leaf fig -- (Moraceae)**
Ficus lyrata was occasionally observed as a cultivated specimen and street tree in urban areas of both West and East Maui. *F. lyrata* is native to tropical western and central Africa (Brickell and Zuk 1997). It is not considered invasive in other parts of the world. It does not currently spread in Hawaii.

***Ficus macrophylla* -- Moreton Bay fig -- (Moraceae)**
Ficus macrophylla was found occasionally planted as a specimen or street tree near buildings and parks from sea level up to about 3,000 ft (914 m). Naturalized plants were observed from close to sea level up to less than 2,000 ft (610 m). A few plantings of single trees occur in Lahaina and naturalized trees were observed near Olowalu, possibly indicating that there are more trees located in the gulches upslope. A planting in Fleming Arboretum is seemingly the source of seedlings that are invading native mesic to wet forests to over 1,600 ft (488 m). Another area where plants were spreading from initial plantings is in the Haiku area of East Maui. Several large trees were located in a landscape at an old estate. From there, seedlings and small trees were observed mostly growing as epiphytes in surrounding vegetation. A relatively isolated location of a naturalized plant was observed in Nahiku. This area is very moist, close to protected watershed forests, and the furthest east location on Maui to date. *F. macrophylla* is native to tropical Queensland and northern New South Wales in Australia (Riffle 1998). The pollinator wasp for *F. macrophylla, Pleistodontes frogatti,* recently arrived in New Zealand, allowing this species to spread. Invasive characteristics include prolific fruit production, small seeds that are bird dispersed, ability to invade both disturbed and native forests, and difficulty in control due to epiphytic growth and steep terrain. In Hawaii, over 36,000 trees were planted for reforestation between 1910 and 1960, mostly on Hawaii and Oahu, with fewer on Kauai (Skolmen 1960). The pollinator wasp was purposefully introduced to Hawaii in 1921 (Wagner *et al.* 1999). The wasp successfully established and reproduction of *F. macrophylla* has now been documented on Molokai, Maui, and Hawaii (Oppenheimer and Bartlett 2000, Starr *et al.* 2002, Oppenheimer in press.). In addition, two trees, along with the associated wasps, were found on Midway Atoll, though no sign of spread was documented at the time (Starr and Martz 1999).

***Ficus microcarpa* -- Chinese banyan -- (Moraceae)**
Ficus microcarpa was found to be one of the most commonly planted and widely naturalized species during this survey. Both cultivated and naturalized plants were

abundant in most areas where human activity occurs (near houses, buildings, and gardens) from sea level up to 3,500 ft (1,067 m). *F. microcarpa* is native from Ceylon to India, southern China, Ryukyu Islands, Australia, and New Caledonia (Wagner *et al.* 1999). *F. microcarpa* is established in at least Hawaii, Florida, Bermuda, several islands in the Pacific, and from Mexico to South America (McKey 1989, Owen 1996, PIER 2002). *F. microcarpa* has become a well known invader due to several characteristics that allows it to successfully establish and spread. Some of these characteristics include the following: popularity in the horticulture industry and ability to get around the globe in large numbers, intentional and unintentional introduction of pollinator wasps, large fruit production, dispersal agents such as birds, bats, rodents, and others, and ability to grow in inhospitable places with little requirements. *F. microcarpa* has the added ability to disperse more often due to its small fruit size which allows the fruit to be taken by a larger number of dispersal agents. In addition, Bronstein (1989) proposes that *F. microcarpa* has the ability to establish with a smaller population size due to its "asynchronous" fruiting cycle which allows wasps to find fruits of all life stages throughout the year. In Hawaii, Wagner *et al*. (1999) report the naturalized distribution of *F. microcarpa* from the islands of Oahu, Maui, and Hawaii, but probably all of the main islands. It has also been reported from Molokai (Hughes 1995), Kauai (Lorence *et al*. 1995), and Midway Atoll (Starr *et al*. 2002).

***Ficus nota* -- Fig -- (Moraceae)**

Ficus nota was not observed during this survey. *F. nota* is native to the Philippines and Northern Bornea (Herbarium Pacificum Staff 1998). In Hawaii, over 25,000 trees were planted in forest reserves from 1922-1932 on the islands of Kauai, Oahu, and Hawaii. It is now naturalized on Oahu and Hawaii (Herbarium Pacificum Staff 1998, Wagner *et al*. 1999).

***Ficus pseudopalma* -- Philippine fig -- (Moraceae)**

Ficus pseudopalma was found being cultivated as a specimen tree in very few places including Honokahau, Wailuku, Wailea, and Haliimaile. *F. pseudopalma*, native to the Philippines (Neal 1965), is not known to be invasive elsewhere. In Hawaii, this species is not known to have become naturalized anywhere.

***Ficus pumila* -- Creeping fig -- (Moraceae)**

Ficus pumila was well distributed from sea level up to about 3,900 ft (1,189 m) in both moist and dry sites. It was common in residential and urban areas where it was grown along rock walls, on buildings, or up tree trunks. *F. pumila* was heavily planted in Kihei, Lahaina, and Kahului. It was moderately planted in Paia, Haiku, Makawao, Pukalani, and Kula. Only a few cultivated plants were observed in Hana. *F. pumila*, native from South China through Malaysia, is a creeping vine like fig plant that is commonly planted as an ornamental in Hawaii and other warm climates of the world as a cover on rock walls, trees, and other structures. In Hawaii and most other places where *F. pumila* is cultivated, sexual reproduction of the plant does not occur because without its associated pollinator wasp present, the seeds are not viable. Though not known to spread by seeds yet, *F. pumila* is capable of aggressive vegetative growth and can become a nuisance by

climbing high into trees and growing beyond the desired area. It is not documented as naturalized in Hawaii.

***Ficus religiosa* -- Bo tree -- (Moraceae)**
Ficus religiosa was observed in only a few (about 9) cultivated locations. A few temples near the coast in Lahaina and Baldwin Beach, Paia have one large tree each located near the temple. It is also cultivated as an ornamental or specimen tree in the Flemming Arboretum on West Maui, along the Mokulele Hwy. near Kihei, by buildings in Kahului at the Maui Community College, and in yards in Wailuku Heights, Haiku and Kula. *F. religiosa* is a sacred tree native to India where it grows up to elevations of 5,000 ft (1,524 m) (Neal 1965). It is said to be the tree that Buddha was born under and also where he sat for six years of meditation and enlightenment. Elsewhere in the world and in Hawaii, trees are occasionally cultivated and are most often seen planted near temples. In Israel, where *F. religiosa* is also cultivated, the pollinator wasp, *Blastophaga quadraticeps*, has successfully invaded and established (Galil and Eisikowitch 1968) and is now producing seedlings near irrigated areas and in exceptionally moist microhabitats. The wasp is currently not present in Hawaii and as a result, trees do not spread. Should the associated wasp arrive in Hawaii, there would be the potential for *F. religiosa* to begin to spread on its own.

***Grevillea banksii* -- Kahili flower -- (Proteaceae)**
Grevillea banksii was observed as sparingly cultivated in residential settings in Haiku and Olinda, East Maui. One naturalized location was noted from expert interviews from Haiku. Naturalized plants were observed along the road near Kahakuloa, West Maui, forming thickets in low dry disturbed scrub. *G. banksii* is native to Australia and is widely cultivated and naturalized throughout the world. In Hawaii, it is naturalized in disturbed, dry to wet forest, on all of the main islands except Lanai and Kahoolawe (Wagner *et al.* 1999).

***Hiptage benghalensis* -- Hiptage -- (Malpighiaceae)**
Hiptage benghalensis was not found on Maui during our survey. *H. benghalensis*, native from India to the Philippines, is cultivated in the tropics for its fragrant flowers and sometimes for medicinal purposes (Whistler 2000). *H. benghalensis* spreads via wind born seeds and has aggressive vine like growth that can smother vegetation in its way. There are a few places where *H. benghalensis* is reported as a weed, including La Reunion, Mauritius, Hawaii, Florida, and Australia (FLEPPC 2001, PIER 2002, Randall 2002). *H. benghalensis* is reported from Kauai and Oahu, though it is not documented in Wagner *et al.* (1999) as naturalized.

***Hyparrhenia rufa* -- Thatching grass -- (Poaceae)**
There were only a few locations of *Hyparrhenia rufa* found. On West Maui, it was reported from only one location, the Kapunakea Preserve, in Wahikuli gulch (Pat Bily pers. comm.). On East Maui, there were a few sites observed along the Hana Hwy. at Huelo and near Keanae. A few locations were reported from Kaupo, one at the entrance to Kaupo Ranch where about 20 plants are located (Steve Anderson pers. comm.). There was also a location reported from Kalepa, between Kipahulu and Kaupo (Bill Haus pers.

comm.). *H. rufa,* often cultivated as a pasture grass, is native to tropical and South Africa (Wagner *et al*. 1999). *H. rufa* is a persistent, fire adapted plant that produces abundant seeds and easily establishes in tropical areas where it is planted, such as Florida, Central America, and Hawaii (Wagner *et al.* 1999, PIER 2002). In Hawaii, *H. rufa* has spread from initial plantings and is now naturalized in disturbed areas and along roadsides at 10-660 m (33-2,165 ft) on Kauai, Oahu, Molokai, Maui and Hawaii (Wagner *et al.* 1999). It has recently been reported from roadsides up to 1,219 m (4,000 ft) elevation within the Hawaii Volcanoes National Park (HAVO) (Stone and Pratt 1994).

***Hypericum canariense* -- Canary Islands St. John's wort -- (Clusiaceae)**
Hypericum canariense was found to be locally dense in Kula near what appeared to be the epicenter located at Kaonoulu Gulch where Kekaulike Ave. crosses, at about 3,000 ft (914 m) elevation, with scattered pockets of plants spreading along roads, in yards, gulches, and pastures. From there, the infestation extends over approximately 175 acres (71 hectares) eastward to Pohakuokala Gulch and upwards to about 4,000 ft (1,219 m) elevation. *H. canariense* is native to Canary Islands and Madeira where it is widely cultivated as an ornamental. It is occasionally cultivated in botanical gardens elsewhere in the world. In California and Hawaii, *H. canariense* produces numerous tiny seeds and spreads from plantings, forming dense monotypic thickets, and crowding out other vegetation (Wagner *et al*. 1999, TNC 2002). It has also recently been collected from the southwestern part of Western Australia (Sandy Lloyd pers. comm.). In Hawaii, *H. canariense* is known only from Kula, East Maui.

***Leptospermum* spp. -- New Zealand tea tree -- (Myrtaceae)**
Leptospermum morisonii was observed in the Koolau Forest Reserve along irrigation roads and in plantations. Some large mature trees were observed near the ditch trail and in gulches just beyond the trail. Most appeared planted and there was little evidence of naturalization, except for one instance where it appeared that there was a seedling on a stump. Other *Leptospermum* species, probably *L. laevigatum* and *L. scoparium* were commonly planted in residential areas from 1,000-4,000 ft (305-1,219 m) elevation in the areas of Kula, Pukalani, Makawao, Olinda, Piiholo, and Haiku of East Maui. One plant was observed in Kahului and one in Kihei (hot lowland areas). No plants were observed on West Maui. The genus *Leptospermum*, mostly native from Australia but also from S. E. Asia to New Zealand, are valued in horticulture for their shrubby habit, sometimes aromatic foliage, and numerous attractive small flowers (Brickell and Zuk 1997). Several species are known to spread and form shrubby thickets that crowd out desirable plants. In Hawaii, five *Leptospermum* species are known to be naturalized, *L. laevigatum*, *L. morisonii*, *L. petersonii*, *L. polygalifolium* and *L. scoparium* (Herbarium Pacificum Staff 1999, Wagner et al. 1999). Since this survey, *L. scoparium* has been found naturalized in Polipoli and near Crater Rd.

***Ligustrum sinense* -- Privet -- (Oleaceae)**
Ligustrum sinense was found cultivated at one residence in Kula. *L. sinense* is native to temperate Asia. In Hawaii, *L. sinense* was recently reported as naturalized on the islands of Kauai and Hawaii (Herbarium Pacificum Staff 1999, Lorence and Flynn 1999, Wagner *et al*. 1999). On Kauai, according to Lorence and Flynn (1999), "This species has

become naturalized profusely around the cabins at Kokee State Park and now extends far into the forest". Collections were made along Halemanu road near cabins in degraded *Acacia koa* mesic forest, and on Faya road in *Acacia/Metrosideros* forest at an elevation of 1,060 m (3,478 ft). On the island of Hawaii, *L. sinense* was collected in Hawaii Volcanoes National Park, near the Thurston Lava Tube, at an elevation of 3,800 ft (1,158 m), in closed *Metrosideros* forest (Herbarium Pacificum Staff 1999).

***Livistona chinensis* -- Chinese fan palm -- (Arecaceae)**
Livistona chinensis was commonly cultivated in residential and urban areas in many areas including Kapalua, Lahaina, Wailuku, Kahului, Kihei, Paia, Kula, Makawao, and from Haiku to Hana. Naturalized plants were most common in moist lowland areas such as near Iao, West Maui and from Haiku to Hana, East Maui. In these areas, numerous seedlings and saplings were observed spreading from plantings into nearby ditches, water ways, stream beds, gulches, and shady disturbed secondary forests. *L. chinensis* is native to Southern Japan and central China, Ryukyu Islands, and Taiwan (Dehgan 1998, Wagner *et al.* 1999). In Hawaii, *L. chinensis* is naturalized on the islands of Oahu and Maui (Wagner *et al.* 1999, Oppenheimer 2003).

***Lonicera japonica* -- Japanese honey suckle -- (Caprifoliaceae)**
Lonicera japonica was widely planted in a variety of conditions from sea level up to 4,200 ft (1,280 m). *L. japonica* was densely planted in residential and urban areas of "Upcountry" including Makawao, Pukalani, and Kula as well as in a few lower elevation urban areas including Kahului and Wailuku. It is less densely planted in lower elevation areas of Lahaina, Kihei, and Hana. Several naturalized locations were observed from 3,000-4,200 ft (914-1,280 m) in the cool arid climate of Kula. Naturalized plants were also observed at low elevations on a stream bank in the wet area near Wahinepee upslope of the Hana Hwy. On West Maui, *L. japonica* was planted near the Hilau cabin and is now spreading vegetatively into the adjacent gulch at an elevation of 3,000 ft (914 m). Another semi-wild population is at the Waikapu golf course on West Maui, located at about 800 ft (244 m) elevation, spreading vegetatively into the unmaintained surrounding disturbed forest. *L. japonica* is native to Asia (Wagner *et al.* 1999). *L. japonica* is considered a major pest in the United States and New Zealand due to its ability to escape from cultivation and invade both disturbed and natural areas (Nuzzo 1997, Williams and Timmins 1997).

***Macaranga mappa* -- Bingabing -- (Euphorbiaceae)**
Macaranga mappa was found during surveys only in one site being cultivated as an ornamental plant in a yard in Olinda, approximately 2,000 ft (610 m) elevation. *M. mappa* is native to the Philippines (Wagner *et al.* 1999). It is cultivated in tropical areas as an ornamental and forestry tree. *M. mappa* is a large leaved tree in Hawaii that is spread by fruit eating birds and forms large dense stands in low elevation moist to mesic areas, 0-220 m (722 ft), on the islands of Oahu and Hawaii (Wagner *et al.* 1999). Since the survey, *M. mappa* has been found in a Kihei nursery, arriving as a contaminant in potted plants shipped to Maui from the island of Hawaii.

***Macaranga tanarius* -- Parasol leaf tree -- (Euphorbiaceae)**

Macaranga tanarius was found widely naturalized on West Maui in the Waikapu area. Here, *M. tanarius* fills valleys, streams, and disturbed areas up to the summit of Kapilau, elevation 4,426 ft (1,349 m) and south towards Mokulele Hwy. On East Maui, only a single cultivated *M. tanarius* was observed from a residential planting in Haiku. *M. tanarius*, native to Malaysia, is a medium size tree that is cultivated for ornament and reforestation in Hawaii and other tropical regions of the world. In Hawaii, *M. tanarius* is naturalized in disturbed mesic valleys on Kauai, Oahu, and Maui (Oppenheimer *et al*. 1999, Wagner *et al.* 1999).

***Melastoma* spp. -- Melastoma -- (Melastomataceae)**
Melastoma candidum and *M. sanguineum* were found sparingly cultivated in a few locations in Makawao and Pukalani. *M. candidum* is native to Vietnam, southern China, Philippine Islands, Taiwan, Ryukyu Islands, and southern Japan. *M. sanguineum* is native to the Malay Peninsula, Java, Sumatra, Vietnam, and southeastern China (Wagner *et al.* 1999). *Melastoma* spp. are cultivated in Hawaii and other tropical regions. *Melastoma* spp. spread from plantings and form dense monotypic thickets up to 2 m tall and crowd out native vegetation. *M. candidum* is now naturalized on Kauai, Oahu, and Hawaii in mesic to wet areas and bog margins (Conant 1996, Wagner *et al.* 1999). *M. sanguineum* also escapes cultivation and naturalizes in mesic sites on the island of Hawaii in the Keaukaha area and along the highway between Volcano and Hilo (Wagner *et al.* 1999). *Melastoma* spp. are Hawaii state noxious weeds (HDOA 1992).

***Melochia umbellata* -- Melochia -- (Sterculiaceae)**
Melochia umbellata was not observed during roadside surveys. However, during expert interviews, it was reported from near the Waikapu Reservoir, Waikapu Valley, about 1,500 ft (457 m) elevation, where several hundred trees occur around the reservoir and up the steep south slope (Fern Duvall pers. comm.). *M. umbellata* is a small tree native from India east to New Guinea that is cultivated in warm regions of the world as a shade tree for coffee plants and young forestry trees (Neal 1965). *M. umbellata* is naturalized on the island of Hawaii in the Hilo and Puna districts, especially the Waiakea area, where it was aerially seeded after a fire in 1928 (Wagner *et al.* 1999). It is also commonly observed along Volcano Road near the turnoff to Kulani, along the Stainback Highway, and near Hilo Airport (Little and Skolmen 1989). *M. umbellata* is also cultivated on the islands of Kauai, Oahu, Maui, and Lanai (Little and Skolmen 1989, Wagner *et al.* 1999).

***Morella cerifera* -- Wax myrtle -- (Myricaceae)**
Morella [Myrica] cerifera was found in one location on East Maui, in Haiku, where it was being cultivated as a hedge. It is also reported as naturalized in mesic to wet forests on West Maui, escaping from Maunalei Arboretum where it was originally planted by D. T. Fleming in December 1932 (Meidell *et al*. 1997). *M. cerifera* is an evergreen shrub to small tree that is native to the coastal southeastern United States from Maryland to Texas (Dehgan 1998). *M. cerifera* has several invasive characteristics, such as rapid growth, production of numerous bird dispersed fruits, nitrogen-fixing capabilities, and ability to colonize and dominate disturbed areas in a variety of habitat. In Hawaii, *M. cerifera* is naturalized on West Maui (Meidell *et al.* 1997, Wagner *et al.* 1999).

***Morella faya* -- Fire tree -- (Myricaceae)**
Morella[Myrica] faya was observed on the windward slope of Haleakala from 3,000-7,000 ft (914-2,134 m) elevation from Puu Nianiau on the east to Polipoli State Park on the west. Most trees observed were naturalized, spreading in pastures, gulches, and roadsides, sometimes forming dense stands. In addition, there were a couple plants that were reported from above Lahaina on West Maui (H. Oppenheimer pers. comm.). *M. faya* is native to the Canary Islands, Madeira, and the Azores (Wagner *et al*. 1999). *M. faya* was introduced to Hawaii in the late 1800's presumably by Portuguese laborers for ornamental purposes and for making wine out of the fruits (Little and Skolmen 1989). It was then cultivated and planted throughout the Hawaiian Islands in reforestation efforts (Skolmen and Little 1989). It is also cultivated as an ornamental tree in yards and gardens. In Hawaii, *M. faya*, is now naturalized and considered a serious pest, becoming dominant in many areas, occurring in mesic to wet forest, 150-1,310 m (492-4,298 ft), on Kauai, Oahu, Lanai, Maui, and Hawaii (Oppenheimer *et al.* 1999, Wagner *et al.* 1999). *M. faya* is a Hawaii state noxious weed (HDOA 1992).

***Ochna* spp. -- Mickey mouse plant -- (Ochnaceae)**
Ochna spp. were particularly popular and widely planted and naturalized in a few lowland residential areas, including Lahaina, Wailuku, and Kahului. *Ochna* species were less commonly observed in Kapalua, Haiku, Pukalani, Kula, and Kipahulu. In Kipahulu, Park staff discovered *O. thomasiana* in a disturbed mesic lowland forest in the Kaapahu district of Haleakala National Park. *O. serrulata* is native to the eastern Cape of Good Hope region in South Africa (Palgrave 1988). *O. thomasiana* is native to southeastern Africa (Whistler 2000). In Hawaii, both species are known to spread from initial plantings via bird dispersed fruits and frequently volunteer nearby homes, gardens, and disturbed areas. *O. serrulata* is naturalized at Manuka, Hawaii (Herbarium Pacificum staff 1998). *O. thomasiana* is naturalized on Oahu and Maui (Herbarium Pacificum staff 1998, Oppenheimer 2003, Oppenheimer 2004).

***Olea europaea* subsp. *cuspidata* -- African olive -- (Oleaceae)**
Olea europaea subsp. *cuspidata* was observed as sparingly cultivated on West Maui and widely planted and naturalized on East Maui, especially in "Upcountry" areas where the climate is cool and dry, from Paia and Haiku east to Kula and Ulupalakua at about 300-5,000 ft (91-1,524 m) elevation where it was observed spreading along roads, in pastures, forest margins, and waste areas nearby plantings. It was also occasionally planted and naturalized in Kihei in areas where irrigation or other water sources occurred. A few outlier cultivated locations were noted in Hana, Kanaio, and Kaupo. *O. e.* subsp. *cuspidata* is native to the Mediterranean region (Wagner *et al.* 1999). In Hawaii, this particular subspecies is commonly cultivated as a hedge or windbreak and sometimes as single trees. This species is widely planted and is spread by fruit eating birds into nearby areas. In Hawaii, it is naturalized on the islands of Hawaii, Kauai, and Maui (Wagner *et al.* 1999; Lorence *et al*. 1995; Starr *et al*. 1999). A single cultivated tree is known from Midway Atoll (Starr and Martz 1999).

***Olea europaea* subsp. *europaea* -- European olive -- (Oleaceae)**

Olea europaea subsp. *europaea* was occasionally planted in similar areas as *O. e*. subsp. *cuspidata*, including Lahaina, Kihei, Wailuku, Kahului, Kihei, and from Haiku to Kula. However, it was not nearly as common. A few naturalized locations were noted in the Kula area around 3,000 ft (914 m) elevation. *O. e.* subsp. *europaea* is native to the Mediterranean region (Brickell and Zuk 1997). The olive tree has been in cultivation for over 4,000 years (Neal 1965), for use in olive oil or as olives and also for landscaping. Fruits are presumably spread by game birds to nearby areas. In Hawaii, *O. e.* subsp. *europaea* is naturalized on Hawaii and Maui (Starr *et al*. 1999, Wagner *et al*. 1999).

***Oxyspora paniculata* -- Oxyspora -- (Melastomataceae)**
Oxyspora paniculata was not observed during our survey. *O. paniculata* is native to the Himalayas from Nepal through Bhutan, northeastern India, and Burma to southwestern China (Wagner *et al.* 1999). In Hawaii, *O. paniculata* is a state noxious weed and is naturalized on the island of Oahu (Wagner *et al.* 1999).

***Paederia foetida* -- Maile pilau -- (Rubiaceae)**
Paederia foetida was not widespread anywhere, but was locally common in Wailua, and occasionally observed in Haiku, Makawao, and Kula. Vines were often observed climbing on surrounding vegetation forming a blanket and reaching heights up to at least 10 m (33 ft) in the canopy. *P. foetida*, native to eastern Asia, is cultivated in warm regions of the world as an ornamental vine. *P. foetida* has become invasive in several places where it has been introduced including the southern United States and Hawaii. In Hawaii, this species is naturalized on the islands of Kauai, Oahu, Maui, and Hawaii where it is often locally common in disturbed mesic forest, coastal sites, dry forest, and subalpine woodland, 1-1,830 m (1-6,004 ft) (Starr *et al*. 1999, Wagner *et al*. 1999).

***Parkinsonia aculeata* -- Jerusalem thorn -- (Fabaceae)**
Parkinsonia aculeata was observed in two locations, one in Kula where a single tree was cultivated in a yard, and a roadside planting on the Lahaina Pali, Honoapiilani Hwy., near the parking lot for the Lahaina Pali trail where several trees appeared planted along with several small seedlings and saplings near larger presumably planted trees. *P. aculeata* is a shrubby, thorny tree, similar to kiawe (*Prosopis pallida*), native to the West Indies and South America (Wagner *et al*. 1999). *P. aculeata* is widely cultivated and is known to spread from initial plantings in North America, including the states of California, Arizona, and Florida, Australia, Hawaii, and Micronesia (DNR 1998, PIER 2002, Wagner *et al*. 1999). In Australia, it forms impenetrable thickets along water courses and seeds spread downstream to cause further infestations. In Hawaii, *P. aculeata* is naturalized on Kauai, Oahu, and Maui (Wagner *et al.* 1999).

***Passiflora laurifolia* -- Water lemon -- (Passifloraceae)**
Passiflora laurifolia was observed as naturalized, scattered in lowland moist sites near Honokohau, West Maui, and from Huelo to Hana on East Maui. A few sites were also reported from Olinda and Polipoli. *P. laurifolia* is native to the West Indies, Guianas, and South America from Venezuela to eastern Brazil (Wagner *et al*. 1999). In Hawaii, *P. laurifolia* is naturalized in mesic to wet, disturbed areas, climbing over vegetation, 0-280

m, on Kauai, Oahu, Molokai, Maui, and Hawaii (Meidell *et al.* 1998, Starr *et al*. 1999, Wagner *et al*. 1999).

***Passiflora mollissima* -- Banana poka -- (Passifloraceae)**
Passiflora mollissima was locally common in the Kula area from about 2,800 to over 6,500 ft (1,981 m) elevation spreading in native mesic forest and sub-alpine shrubland, and non-native mesic wattle / pine / faya tree (*Acacia mearnsii* / *Pinus* spp. / *Morella faya*) forests. Other locations from the Olinda area were reported as well. *P. mollissima*, native to the Andes of South America, is a climbing, semi-woody vine that forms a dense canopy, and smothers vegetation, fences, forests, pastures, and farm land. Initially introduced for ornament and fruit, *P. mollissima* has become one of the worst forest destroying weeds in the Hawaiian islands, covering thousands of acres of forest on Kauai, Maui, and Hawaii (Wagner *et al*. 1999, Oppenheimer and Bartlett 2000). *P. mollissima* is a Hawaii state noxious weed (HDOA 1992).

***Pennisetum setaceum* -- Fountain grass -- (Poaceae)**
Pennisetum setaceum was observed mostly as naturalized in several sites including Waihee, Wailuku, Kahakuloa, and Kula. In these areas, scattered plants were locally abundant, but nowhere widespread. It has also been reported from Waikapu, Wailea, near Maalaea, and Kanaio. *P. setaceum* is native to northern Africa. It is an aggressive fire adapted grass that can form monotypic stands and is considered a pest plant in many parts of North America and Hawaii. In Hawaii, *P. setaceum* is known from the islands of Kauai, Oahu, Lanai, Kahoolawe, Maui, and Hawaii (Wagner *et al*. 1999, Starr *et al.* in press). *P. setaceum* is a Hawaii state noxious weed (HDOA 1992).

***Philadelphus karvinskyanus* -- Philadelphus -- (Hydrangeaceae)**
Philadelphus karvinskyanus was found to be cultivated and sparingly naturalized in the Kula area where it was grown as a hedge or border plant in yards and displayed aggressive vegetative growth climbing up and into surrounding vegetation. *P. karvinskyanus* is native to Mexico and is cultivated as an ornamental for its fragrant flowers and climbing habit. In Hawaii, *P. karvinskyanus* was first reported as a new naturalized record by Lorence *et al.* (1995) from Kokee, Kauai, where this species was spreading vegetatively from plantings around cabins and blanketing large areas on slopes and streams in koa (*Acacia koa*) forest. It is also reported as naturalized from Kula, Maui (Starr *et al*. 2002).

***Phormium tenax* -- New Zealand flax -- (Agavaceae)**
Phormium tenax was found occasionally cultivated in gardens in Haiku, Piiholo, and Kula. A naturalized location was reported from the Puu Kukui watershed, West Maui, about 3,000 ft (914 m) elevation, near the Hilau cabin. *P. tenax* is native to New Zealand and is cultivated as a specimen plant in gardens. *P. tenax* has been cultivated in Hawaii since at least 1871 and is now known to be naturalized on the islands of Kauai and Molokai (Wagner *et al*. 1999). On Molokai, established populations occur in Kamakou Preserve, in ohia (*Metrosideros polymorpha*) forest, disturbed grassland, boggy soils, and pig disturbances, at approximately 3,750 ft (1,143 m); and along roads in forest reserves at an elevation of about 2,500 ft (762 m) (Tina Lau pers. comm.).

***Pimenta dioica* -- Allspice -- (Myrtaceae)**
Pimenta dioica was observed as widely cultivated in yards, botanical gardens, and as a street or parking lot tree in Kapalua, Lahaina Wailuku, Kahului, Kihei, and from Haiku to Kula. Naturalized plants were found in moist disturbed lowlands. Many seedlings and scattered juveniles were observed in a thicket of guava (*Psidium guajava*), elevation 400 ft (120 m), in Haiku, but it was also naturalized along Baldwin Ave., in Wailuku, and even in drier Kihei when irrigation was available. *P. dioica*, native to the West Indies, southern Mexico, and Central America, is widely cultivated in warm regions of the world (Riffle 1998). *P. dioica* is spread by fruit eating birds and has escaped from cultivation in some areas, including Tonga and Hawaii (PIER 2003). In Hawaii, *P. dioica* has long been cultivated. It was recently published as naturalized for the islands of Kauai and Maui (Lorence *et al*. 1995, Wagner *et al.* 1999, Starr *et al*. 2003). It is also spreading on Oahu (Charles Chimera pers. comm.).

***Pinus* spp. -- Pines -- (Pinaceae)**
Pinus spp. were widely cultivated in urban areas such as Kapalua, Lahaina, Wailuku, Kahului, Kihei, and from Paia and Haiku to Ulupalakua. Large plantations occurred in forest reserves in Makawao, Hosmer's Grove, and Kula. Naturalized plants were mostly found above 4,000 ft (1,219 m). Two of the more aggressive species include Mexican weeping pine (*P. patula*) and Monterey pine (*P. radiata*). Both of these were planted by the thousands: Skolmen (1960) reports that over 14,000 *P. patula* and about 80,000 *P. radiata* were planted on Maui between 1910-1960. Pines are large quick spreading trees that dominate and shade out all other plants in their way. Pines thrive in sub-alpine and mesic forest habitat and pose a severe threat to Haleakala National Park, where numerous pines are removed every year to prevent their encroachment.

***Pittosporum undulatum* -- Victorian box -- (Pittosporaceae)**
Pittosporum undulatum was not observed during our survey. We were unfamiliar with this species and did not have a good search image for it. Since then, it has been observed in about half a dozen locations mostly in Kula and some in Makawao. Most plantings are large cultivated trees in yards, some covered with orange fruits. A few naturalized saplings have been observed in Kula nearby plantings. *P. undulatum*, native to Australia, is widely cultivated throughout the world as an ornamental plant (Wagner *et al.* 1999). *P. undulatum* is considered invasive in several places, including Hawaii, Jamaica, South Africa, and other Pacific and Atlantic islands (Binggeli 1998). In these areas, it spreads via bird dispersed fruit and invades moist disturbed forests from low to middle elevations. In Hawaii, *P. undulatum* was introduced as early as 1875 and is now naturalized on Lanai and Hawaii in disturbed mesic forest, 500-1,200 m (1,640-3,937 ft) (Wagner *et al.* 1999). *P. undulatum* is a Hawaii state noxious weed (HDOA 1992).

***Pittosporum viridiflorum* -- Cape pittosporum -- (Pittosporaceae)**
Pittosporum viridiflorum was found to be locally spreading in the Kula vicinity, elevation ca. 3,200 ft (975 m), with a relatively cool and dry climate in disturbed residential, pasture, and agriculture land use. Plants can be observed spreading here and there in yards and waste areas. *P. viridiflorum*, native to South Africa, is cultivated in Hawaii as

an ornamental plant (Wagner *et al.* 1999). In Hawaii, *P. viridiflorum* was first collected in 1954. It spreads from plantings via bird dispersed seeds and is now naturalized on the islands of Hawaii, Lanai, and Maui (Starr *et al*. 1999, Wagner *et al*. 1999).

***Podranea ricasoliana* -- Podranea -- (Bignoniaceae)**
Podranea ricasoliana was occasionally planted in Wailuku and more commonly planted in Paia, Haiku, Makawao, Kula, and Keokea. Naturalized plants were found from Haiku, near sea level to Kula, about 4,000 ft (1,219 m). This vine like plant appeared to be planted near houses and was spreading vegetatively and through underground tuberous roots into nearby vegetation and scrub areas. In a few places, such as Makawao and Haiku long pod like fruits with winged seeds were seen but were not common. *P. ricasoliana* is native to South Africa and is widely cultivated. It has vigorous growth and can spread from plantings, mostly vegetatively, and can smother surrounding vegetation.

***Pueraria montana* var. *lobata* -- Kudzu -- (Fabaceae)**
Pueraria montana var. *lobata* was found mostly in windward lowland areas along the Hana Hwy. at Honomanu, Wailua, Keanae, Nahiku, and near the Hana airport. In these areas, *P. m.* var. *lobata* covers large areas forming blankets on hillsides and other vegetation. *P. m.* var. *lobata* is native to southeastern Asia from India, China, and Japan, perhaps also Malesia (Wagner *et al.* 1999). It is a notorious pest in southeastern United States and is a Hawaii state noxious weed (HDOA 1992). In Hawaii, *P. m.* var. *lobata* is naturalized in lowland disturbed forests and streams and is mostly a pest to taro farmers near infestations. It is documented from the islands of Kauai, Oahu, Maui, and Hawaii (Wagner *et al*. 1999).

***Pyracantha* spp. -- Firethorn -- (Rosaceae)**
Pyracantha spp. were sparingly cultivated in Iao and Wailuku. They were more common in cooler higher elevation areas from Haiku to Kula and Keokea. Naturalized plants were mostly observed in Kula, 2,000-4,000 ft (610-1,219 m), where plants were observed spreading from plantings into nearby pastures and disturbed areas. Several species, mostly native to China and Taiwan, are widely cultivated for their attractive fruit and are known to spread by fruit eating birds forming thorny thickets and becoming pests where they are planted. In Hawaii, *P. angustifolia* is naturalized on Kauai; *P. crenatoserrato* is naturalized on Kauai and Hawaii; and *P. koidzumii* is naturalized on Kauai, Maui, and Hawaii (Herbarium Pacificum staff, Staples *et al*. 2003, Wagner *et al*. 1999).

***Rhodomyrtus tomentosa* -- Downy rose myrtle -- (Myrtaceae)**
Rhodomyrtus tomentosa was found in a few locations on East Maui. One location was found on Haiku Rd. on the east wall of Pauwela gulch at an elevation of about 150 m (500 ft). The plants are growing on a steep bank on the side of the road. Some plants were 2-3 m tall and a few smaller plants were also observed. Another location was reported from a residence in Haiku Hill where a hedge of *R. tomentosa* was planted along a driveway in a relatively new neighborhood. There was also a plant found in the neighbor's yard that had apparently come on its own. *R. tomentosa,* native from India to southeastern Asia and the Philippines, is an attractive ornamental plant with edible fruit and pretty rose colored flowers (Wagner *et al*. 1999). It readily escapes from gardens

forming dense impenetrable thickets and crowding out desirable species. In Florida, heavy infestations occur in several central and southern counties where it is now considered to be potentially worse than Brazilian pepper tree (*Schinus terebinthifolius*) (Langeland and Burks 1998). According to PIER (2002) it was reported as a serious problem on Raiatea, French Polynesia. In Hawaii, *R. tomentosa* is naturalized on Kauai, Oahu, and Hawaii where it covers large acreage and often dominates areas it invades (Wagner *et al*. 1999). *R. tomentosa* is a Hawaii state noxious weed (HDOA 1992).

***Rubus discolor* -- Himalayan blackberry -- (Rosaceae)**
Rubus discolor was reported from a small area on East Maui in the Ainahou flats, 6,300 ft (1,920 m) elevation. It was also reported from West Maui, from near the beginning of the trail that leads to Puu Kukui where is thought to have originally been planted. *R. discolor*, native to western Europe, has become a pest plant in moist temperate regions of the world where it has been introduced. In North America, this species is spreading along the west coast and several north eastern states where it invades disturbed habitat forming thorny dense impenetrable thickets through rapid growth (PLANTS 2002). Spread is facilitated by fruit eating birds and mammals. In Hawaii, *R. discolor* is documented as naturalized on Oahu, the Maui populations have not yet been published as naturalized (Conant 1996, Wagner *et al.* 1999).

***Rubus ellipticus* -- Yellow Himalayan raspberry -- (Rosaceae)**
Rubus ellipticus was reported from two locations in Kula, elevation 2,500-3,500 ft (m), where they were found growing out of hapuu (*Cibotium* sp.) ferns. Hapuu ferns are harvested from the island of Hawaii, where *R. ellipticus* is established, and sold for ornamental purposes on Maui. *R. ellipticus* is apparently a contaminate on hapuu ferns that may not be noticeable at the time of shipment but eventually sprout once they are planted. *R. ellipticus* is a brambling raspberry with yellow fruits, native to tropical and subtropical India and Asia. This species has spread from cultivation and has become a pest in wet disturbed forests of Hawaii. *R. ellipticus* forms impenetrable thickets and crowds out native species in moist to wet disturbed areas on the island of Hawaii from 2,270-5,580 ft (700-1,700 m) elevation. Some have deemed *R. ellipticus* the worst of the *Rubus* invaders in Hawaii. *R. ellipticus* is a Hawaii state noxious weed (HDOA 1992).

***Rubus glaucus* -- Andean raspberry -- (Rosaceae)**
Rubus glaucus was found to be established in several areas of East Maui, including along the Waikamoi Flume Rd., along Crater Rd., Kula; and near Polipoli. In these areas, *R. glaucus* is capable of forming dense thorny thickets, filling gulches, and climbing high into trees. *R. glaucus* is native from Mexico to Ecuador (St. John 1973). It is cultivated for its edible fruits. In Hawaii, *R. glaucus* is naturalized on the island of Maui and Hawaii (Wagner *et al*. 1999, Starr *et al*. 2003).

***Rubus niveus* f. a -- Hill raspberry -- (Rosaceae)**
Rubus niveus form a was found to be widespread on East Maui, in disturbed areas, 500-4,200 ft (152-1,280 m) elevation, from moist areas of Haiku to arid areas of Keokea and Kula. It was common in Kula and Keokea and scattered in Haiku, Makawao, and Pi'iholo. It was observed mostly in disturbed areas, such as roadsides, gulches, pastures,

and urban areas. *R. niveus*, native from Indian to southeastern Asia, the Philippines, and Indonesia, is now known to be naturalized on Kauai, Maui, and Hawaii (Nagata 1995, Flynn and Lorence 1998, Wagner *et al.* 1999). *R. niveus* is a Hawaii state noxious weed (HDOA 1992).

***Rubus niveus* f. b -- Hill raspberry -- (Rosaceae)**
Rubus. niveus form b was found in the Kula and the Polipoli area. In this area, *R. niveus* f. b was common and well established in degraded pasture, shrubland, native mesic forests, and disturbed forestry plantations, 3,000-6,500 ft (914-1,981 m). In the Polipoli area, *R. niveus* f. b runs rampant and is increasingly becoming a nuisance for hunters, hikers, and bikers in the area. *R. niveus* is native from Indian to southeastern Asia, the Philippines, and Indonesia, is now known to be naturalized on Kauai, Maui, and Hawaii (Nagata 1995, Flynn and Lorence 1998, Wagner *et al.* 1999). A second form "form b" is also known from Maui (Gerrish *et al.* 1992). Form b is distinguished by having red stems and more brambling habit, whereas form a has white stems and a more upright habit. Where their distribution overlaps, they may grow side by side. *R. niveus* is a Hawaii state noxious weed (HDOA 1992).

***Salsola tragus* -- Tumbleweed -- (Chenopodiaceae)**
Salsola tragus was first documented from the Omaopio area, 274 m (899 ft) elevation (Oppenheimer and Bartlett 2002). In this area, plants were found naturalized along the road which is bordered by agriculture (pineapple) fields. The climate is relatively dry and the habitat is disturbed. Numerous plants were observed here lining the roadsides. *S. tragus* was also sparingly observed in disturbed semi-native areas of Puu o kali. Plants were also reported from Olinda (Pat Bily pers. comm.). *S. tragus*, native to Eurasia, is a weedy shrub that is naturalized in various places of the world. *S. tragus* can break off at the ground level once mature, tumble across the landscape, and become clogged up against fences and obstructions. Numerous seeds are dispersed during this tumbling motion and readily naturalize in dry disturbed places. In Hawaii, *S. tragus* is known from the islands of Maui, Molokai, Kahoolawe, and Hawaii (Wagner *et al*. 1999, Herbst and Wagner 1999, Oppenheimer and Bartlett 2002, Starr *et al.* in press). *S. tragus* is a Hawaii state noxious weed (HDOA 1992).

***Schefflera actinophylla* -- Octopus tree-- (Araliaceae)**
Schefflera actinophylla was found to be widely cultivated and naturalized throughout the island. This species was one of the most commonly encountered plants. It was found cultivated as an ornamental and naturalized mostly in low elevation areas in moist to wet areas as well as dry areas that provided irrigation or other water sources. It was observed spreading extensively in the areas of Kapalua, Iao Valley, and from Haiku to Hana and Kipahulu. Plants were observed growing on steep cliffs and as epiphytes in trees. In some places, dense stands were observed. Seeds are bird dispersed. *S. actinophylla* is native to Australia and New Guinea and is widely cultivated as a tropical ornamental (Wagner *et al.* 1999). In Hawaii, *S. actinophylla* is naturalized in relatively low elevation, mesic, disturbed areas at least on Kauai, Oahu, Maui, and Hawaii, but probably on all the main islands (Wagner *et al*. 1999).

***Schizachyrium condensatum* -- Tufted beard grass-- (Poaceae)**
Schizachyrium condensatum was not observed during our survey. *S. condensatum*, native to tropical and subtropical America, is naturalized on the island of Hawaii in Hawaii Volcanoes National Park, along roadsides and in open sites in mesic shrubland and grassland, elevation 689-4,298 ft (210-1,310 m) (Wagner *et al.* 1999). It is also known from Oahu.

***Senecio confusus* -- Mexican flame vine -- (Asteraceae)**
Senecio confusus was found to be sparingly cultivated in a few locations including Olowalu, Waikapu, Haiku, Huelo, Wailua, Hana, and Kipahulu. It showed signs of escaping into nearby adjacent areas in Olowalu, Huelo, and Hana. *S. confusus*, native to Mexico and Central America, is an attractive vine grown as an ornamental. It has aggressive growth and may become invasive nearby plantings. In Hawaii, *S. confusus* is commonly cultivated and appears to escape into adjacent areas, but is not yet naturalized (Wagner *et al.* 1999).

***Senecio madagascariensis* -- Fireweed -- (Asteraceae)**
Senecio madagascariensis was found to be widely naturalized in pastures and disturbed areas on both East and West Maui, but more so on East Maui. On West Maui scattered plants were observed and reported from Honokawai, Hanaula, Iao, Kahului, and Waikapu up to 2,000 ft (610 m). On East Maui, *S. madagascariensis* was commonly observed in relatively dry disturbed areas and pastures from Haiku to Ulupalakua. Plants have been observed in Haleakala National Park where it likely was introduced on fencing material that came from the island of Hawaii. *S. madagascariensis* is native to Madagascar and South Africa (Motooka *et al.* 1996. *S. madagascariensis* is toxic to livestock and grazing animals, is a heavy seeder which easily disperses and forms dense stands. It is a pest in Australia, New Zealand, and Hawaii. In Hawaii, *S. madagascariensis* is now naturalized on Kauai, Maui, and Hawaii (Lorence *et al*. 1995, Starr *et al*. 1999, Wagner *et al*. 1999, Oppenheimer and Bartlett 2002). It is a Hawaii state noxious weed (HDOA 1992).

***Sideroxylon persimile* -- Bully tree -- (Sapotaceae)**
Sideroxylon persimile was found in the Maunaolu area, about 800 ft (244 m) elevation, where it was locally common and spreading from initial plantings to nearby disturbed areas in open fields, along roads, scrub areas, and gulches from Haliimaile, 1,100 ft (335 m) elevation, to Paia, 500 ft (152 m) elevation, east to Giggle Hill, Kokomo. A second site was found on leeward Maui in Ulupalakua, 1,800 ft (549 m) elevation, where a single large tree and a few small saplings occur. *S. persimile* is a large thorny tree native from Mexico through Central America to northern South America. Not much is known about this tree but it was recently published as a new naturalized plant record for the State of Hawaii from Maui (Starr *et al*. 2002).

***Solandra maxima* -- Cup of gold -- (Solanaceae)**
Solandra maxima was occasionally to commonly cultivated and sparingly escaped in many urban areas including Waihee, Kahului, Spreckelsville, Kihei, Paia, Haiku, Makawao, Piiholo, Olinda, Kula, Ulupalakua, and along the Hana Hwy. to Kipahulu. Plants grew as vines were escaping into nearby adjacent areas. *S. maxima* is native to

Mexico and is commonly cultivated in tropical areas for its large showy fragrant flowers. In Hawaii, it has long been cultivated and is said to persist, especially near Hilo, Hawaii (Wagner *et al*. 1999).

***Solanum robustum* -- Silverleaf nightshade -- (Solanaceae)**
Solanum robustum was first collected in 1977 by Robert Hobdy from guava infested cattle pastures, about 230 m (755 ft) elevation, in Kailua Gulch (Wagner *et al.* 1999). During surveys, *S. robustum* was found along the Hana Hwy. in the same area. Plants were observed on steep rock gulch walls near the road as well as in disturbed sites near the road. *S. robustum* is native to South America (Wagner *et al*. 1999). In Hawaii, *S. robustum* is only known from the island of Maui (Wagner *et al*. 1999). *S. robustum* is a Hawaii state noxious weed (HDOA 1992).

***Solanum torvum* -- Turkeyberry -- (Solanaceae)**
Solanum torvum was found in several lowland disturbed sites on both East and West Maui. On West Maui, *S. torvum* is sparingly cultivated in Lahaina. Established populations occur mostly in agriculture fields and pastures from Waihee to near Maalaea. On East Maui, *S. torvum* is established in pastures in Haiku, Nahiku, and near the Hana Airport. *S. torvum* is native to the Antilles (Wagner *et al*. 1999). *S. torvum* is a large prickly shrub that forms dense thickets in disturbed areas. In Hawaii, *S. torvum* is reported from Maui, Oahu, and Hawaii (Oppenheimer *et al.* 1999, Wagner *et al.* 1999, Starr *et al.* 2003). *S. torvum* is a Hawaii state noxious weed (HDOA 1992).

***Tetrastigma pubinerve* -- Tetrastigma-- (Vitaceae)**
Tetrastigma pubinerve was found in Honokohau Valley along the stream where it was climbing and smothering other nearby vegetation, covering about 4 acres, elevation 180 ft (55 m). *T. pubinerve* is native to Hainan, China (Staples and Herbst 2005). In Hawaii, it is reported as naturalized from the island of Maui (Oppenheimer and Bartlett 2000).

***Thunbergia alata* -- Black-eye Susan vine -- (Acanthaceae)**
Thunbergia alata was found to be popular in the landscape and was cultivated and naturalized from Haiku to Keokea, at approximately 300-4,000 ft (91-1,219 m) elevation, in relatively moist and dry sites. *T. alata*, native to tropical eastern Africa, is a sprawling vine that is often cultivated for its attractive flowers. It is widely cultivated and naturalized in other tropical regions of the world. In Hawaii, *T. alata* was first reported from Oahu in 1864-1865 and is now known from at least Kauai, Molokai, Maui, and in Hilo and Volcano Village, Hawaii (Wagner *et al.* 1999, Oppenheimer 2003).

***Thunbergia fragrans* -- Sweet clock vine -- (Acanthaceae)**
Thunbergia fragrans was found to be a common roadside weed in moist lowland disturbed areas. Mostly naturalized plants were found from sea level to 1,700 ft (518 m). In these areas, *T. fragrans* was often observed along roadsides, ditches, and scrub vegetation. *T. fragrans* is native to India and Ceylon (Wagner *et al*. 1999). In Hawaii, *T. fragrans* was first collected on Kauai in 1916 and is now naturalized on probably all of the main islands (Wagner *et al*. 1999).

***Thunbergia grandiflora* -- Trumpet vine -- (Acanthaceae)**
Thunbergia grandiflora was found being cultivated from sea level to 3,000 ft (914 m). It was extremely popular in the Wailea area where it is planted on trellises near the entrance to Wailea, at the Wailea Shopping Center, and at numerous resorts and restaurants located in the area. Other areas on Maui where *T. grandiflora* is cultivated, but to a lesser extent, include residential and urban areas of Lahaina, Wailuku, Kahului, Haiku, Makawao, Pukalani, and Kula, where it is observed growing on fences and in yards. Most *T. grandiflora* plants on Maui appeared to be cultivated. Though, it was sparingly naturalized in the Makawao area, 1,250 ft (381 m) elevation, near Maliko Gulch, where it was spreading from plantings into un-maintained woodland borders (Starr *et al*. 2002). *T. grandiflora* is native to India (Wagner *et al.* 1999). *T. grandiflora* is an aggressive climber and is difficult to control once established due to large underground tuberous roots. In Australia, *T. grandiflora* is a declared noxious weed (Weeds Australia 2000). In Hawaii, *T. grandiflora* was first collected on Oahu in 1937 and is now sparingly adventive along hiking trails or margins of urban areas at least on Kauai, Oahu, Maui, and Hawaii (Wagner *et al.* 1999, Starr *et al*. 2002).

***Thunbergia laurifolia* -- Blue trumpet vine -- (Acanthaceae)**
Thunbergia laurifolia was not as widely cultivated as the related species *T. grandiflora*. Cultivated plants were observed in Wailuku, Paia, Haiku, Makawao, Pukalani, Kula, and Hana. Naturalized populations were observed in Wailua, Honomanu, and Kokomo, mostly lowland moist disturbed areas of East Maui. In these areas, *T. laurifolia* appeared to be spreading vegetatively from plantings into nearby disturbed lowland scrub. *T. laurifolia* is native to India (Wagner *et al.* 1999). It has similar aggressive growth and invasive attributes as *T. grandiflora*. In Hawaii, *T. laurifolia* was first collected on Oahu in 1890 and is now sparingly adventive along hiking trails or margins of urban areas at least on Kaua'i, Oahu, and Maui (Starr *et al*. 1999, Wagner *et al.* 1999).

***Tibouchina urvilleana* -- Glory bush -- (Melastomataceae)**
Tibouchina urvilleana was found to be widely planted on East Maui where it was especially popular in the Kula area, elevation 2,000-4,000 ft (610-1,219 m), where the climate is relatively dry, mild, and cool. In these areas, no signs of reproduction were observed. *T. urvilleana* was also fairly popular in residential Piiholo, at similar elevations as Kula, but this area tends to be a bit more moist. No regeneration was observed in this area either. Areas where *T. urvilleana* seems to show aggressive tendencies were in moist disturbed lowlands, where it was planted, including several areas along the Hana Hwy. In these areas, *T. urvilleana* appeared to be spreading vegetatively and forming large patches and thickets often in the understory of other non-native trees that have also been planted in the area. On West Maui, *T. urvilleana* was reported during an expert interview from a planting in Iao Valley. *T. urvilleana* is native to southern Brazil (Rio Grande do Sul to Rio de Janeiro) (Wagner *et al*. 1999). *T. urvilleana* forms dense thickets in moist areas of Hawaii (Smith 1985). *T. urvilleana* was first collected on the island of Hawaii in 1917 and is now naturalized on Kauai, Oahu, Maui, and Hawaii (Wagner *et al*. 1999). *T. urvilleana* is a Hawaii state noxious weed (HDOA 1992).

***Verbascum thapsus* -- Common mullein -- (Scrophulariaceae)**
Verbascum thapsus was reported from cultivated plants in an herb garden in Kula. No other locations were found. The following includes information on previous locations for Maui that no longer exist. *V. thapsus* was first discovered in 1986 in Haleakala National Park at 9,150 ft (2,789 m) below Kalahaku lookout (Medeiros *et al.* 1999). It was found again in the Park in 1988 at 6,900 ft (2,103 m) below headquarters (Medeiros *et al.* 1999). Both plants were destroyed. Cultivated plants were then found in a Kula Nursery and were also destroyed. *V. thapsus* is an herbaceous plant native to Europe that is cultivated and naturalized in temperate areas of the world, including North America, Hawaii, Reunion, Australia, and New Zealand. *V. thapsus* can become invasive by quickly colonizing disturbed areas. *V. thapsus* plants produce numerous seeds that may remain dormant in the soil for over 100 years. In Hawaii, *V. thapsus* is known from the Island of Hawaii, where it infests roadsides at elevations from 5,000-10,000 ft (1,524-3,048 m) and is particularly dense around 6,562 ft (2,000 m) forming a monotypic cover that can out-compete native vegetation. *V. thapsus* is a Hawaii state noxious weed (HDOA 1992).

***Washingtonia* spp. -- Mexican and California fan palm -- (Arecaceae)**
Washingtonia spp. were widely cultivated and naturalized in urban areas from sea level to 4,000 ft (1,219 m) elevation on both East and West Maui. *Washingtonia* spp. thrive in lowland, hot, wetland type, urban areas where the water table is close to the ground surface. Some areas where *Washingtonia* spp. were readily cultivated and naturalized include Lahaina, Kihei, and Kahului. In these areas, numerous naturalized plants were observed in cracks in sidewalks, ponds, coastal wetlands, along water ditches, roadsides, and scrub areas. Areas where *Washingtonia* spp. are widely cultivated, but not as widely naturalized, include Paia, Haiku, Makawao, Pukalani, Kula, Keokea, and Nahiku. These areas are suitable for *Washingtonia* spp., but are not as preferred, and plants tend to naturalize to less of an extent. Oppenheimer and Bartlett (2002) report, "Plants have been observed in hot, dry areas, as well as along the shoreline, and at the margins of streams. Numerous seedlings can sometimes be seen far from mature trees, and it is not always possible to assign young plants to species." *W. filifera* (California palm), *W. robusta* (Mexican fan palm), and *W.* x *filabusta* (hybrids between the former two species) are large fan palms native to the west coast of the United States and Mexico that are commonly cultivated as ornamental street and landscape trees. In Hawaii, these palms were recently reported as naturalized on the island of Maui (Oppenheimer and Bartlett 2002).

LIST OF TARGET SPECIES

This list includes scientific and common names for target species searched for during roadside surveys on Maui (2000). For each species it is noted whether it was found or not (Found?), whether it was observed as naturalized or not (Nat?), and the number of locations that were found (# Loc).

Scientific Name	Common Name	Found?	Nat?	# Loc
Anredera cordifolia	Madeira vine	Yes	Yes	39
Archontophoenix spp.	Alexander palm	Yes	Yes	80
Aristolochia littoralis	Calico flower	Yes	Yes	7
Arundo donax	Giant reed	Yes	Yes	40
Bocconia frutescens	Tree poppy	Yes	Yes	598
Buddleia davidii	Butterfly bush	Yes	Yes	88
Buddleia madagascariensis	Smoke bush	Yes	Yes	43
Caesalpinia decapetala	Cat's claw	Yes	Yes	17
Carmona retusa	Carmona	Yes	Yes	444
Centranthus ruber	Valerian	Yes	Yes	1
Cinchona pubescens	Quinine tree	Yes	Yes	317
Cinnamomum burmanni	Padang cassia	Yes	Yes	34
Cinnamomum camphora	Camphor tree	Yes	Yes	200
Citharexylum caudatum	Juniperberry	Yes	Yes	174
Citharexylum spinosum	Fiddlewood	Yes	Yes	279
Clerodendrum inerme	Seaside clerodendrum	Yes	Yes	9
Clerodendrum macrostegium	Velvetleaf glorybower	No	--	0
Clusia rosea	Autograph tree	Yes	Yes	764
Coccinia grandis	Ivy gourd	Yes	Yes	213
Cortaderia spp.	Pampas grass	Yes	Yes	626
Cotoneaster pannosus	Cotoneaster	Yes	Yes	187
Cryptostegia spp.	Rubber vine	Yes	Yes	42
Delairea odorata	Cape ivy	Yes	Yes	52
Derris elliptica	Poison vine	Yes	Yes	9
Falcataria moluccana	Molucca albizia	Yes	Yes	169
Ficus benghalensis	Indian banyan tree	Yes	No	31
Ficus benjamina	Weeping fig	Yes	No	1377
Ficus carica	Edible fig	Yes	Yes	167
Ficus cf. *platypoda*	Port Jackson fig	Yes	Yes	434
Ficus deltoidea	Mistletoe fig	Yes	No	3
Ficus elastica	Rubber tree	Yes	No	271
Ficus lyrata	Fiddle leaf fig	Yes	No	76
Ficus macrophylla	Moreton bay fig	Yes	Yes	45
Ficus microcarpa	Chinese banyan	Yes	Yes	1244
Ficus nota	Ficus	No	--	0
Ficus pseudopalma	Philippine fig	Yes	No	5
Ficus pumila	Creeping fig	Yes	No	296
Ficus religiosa	Bo tree	Yes	No	12
Grevillea banksia	Kahili flower	Yes	Yes	12
Hiptage benghalensis	Hiptage	No	--	0
Hyparrhenia spp.	Thatching grass	Yes	Yes	8
Hypericum canariense	Canary Islands St. John's Wort	Yes	Yes	29
Leptospermum morisonii	Tea tree	Yes	?	5
Leptospermum spp.	Tea tree	Yes	?	148

Scientific Name	Common Name	Found?	Nat?	# Loc
Ligustrum sinense	Privet	Yes	No	1
Livistona chinensis	Chinese fan palm	Yes	Yes	193
Lonicera japonica	Japanese honeysuckle	Yes	Yes	172
Macaranga mappa	Bingabing	Yes	No	1
Macaranga tanarius	Parasol leaf tree	Yes	Yes	64
Melastoma spp.	Melastome	Yes	No	2
Melochia umbellata	Melochia	Yes	Yes	1
Morella [Myrica] cerifera	Wax myrtle	Yes	Yes	9
Morella [Myrica] faya	Fire tree	Yes	Yes	317
Ochna spp.	Mickey mouse plant	Yes	Yes	98
Olea europaea cuspidata	European olive	Yes	Yes	520
Olea europaea europaea	African olive	Yes	Yes	42
Oxyspora paniculata	Oxyspora	No	--	0
Paederia foetida	Maile pilau	Yes	Yes	15
Parkinsonia aculeata	Jerusalem thorn	Yes	Yes	4
Passiflora laurifolia	Water lemon	Yes	Yes	10
Passiflora mollissima	Banana poka	Yes	Yes	41
Pennisetum setaceum	Fountain grass	Yes	Yes	34
Philadelphus karvinskyanus	Philadelphus	Yes	?	33
Phormium tenax	New Zealand flax	Yes	Yes	18
Pimenta dioica	Allspice	Yes	Yes	135
Pinus spp.	Pine tree	Yes	Yes	1543
Pittosporum undulatum	Victorian box	No	--	0
Pittosporum viridiflorum	Cape pittosporum	Yes	?	6
Podranea ricasoliana	Podranea	Yes	Yes	88
Pueraria montana var. *lobata*	Kudzu	Yes	Yes	40
Pyracantha spp.	Fire thorn	Yes	Yes	62
Rhodomyrtus tomentosa	Downy rose myrtle	Yes	?	3
Rubus discolor	Blackberry	Yes	Yes	3
Rubus ellipticus	Yellow Himalayan raspberry	Yes	?	2
Rubus glaucus	Raspberry	Yes	Yes	13
Rubus niveus f. *a*	Hill raspberry - white stem	Yes	Yes	99
Rubus niveus f. *b*	Hill raspberry - red stem	Yes	Yes	74
Salsola tragus	Tumble weed	Yes	Yes	37
Schefflera actinophylla	Umbrella plant	Yes	Yes	2060
Schizachyrium condensatum	Beard grass	No	--	0
Senecio confusus	Flame vine	Yes	Yes	14
Senecio madagascariensis	Fireweed	Yes	Yes	178
Sideroxylon persimile	Bully tree	Yes	Yes	38
Solandra maxima	Cup of gold	Yes	?	76
Solanum robustum	Prickly Solanum	Yes	Yes	3
Solanum torvum	Turkey berry	Yes	Yes	89
Tetrastigma pubinerve	Tetrastigma	Yes	Yes	2
Thunbergia alata	Black-eyed Susan vine	Yes	Yes	50
Thunbergia fragrans	Sweet clock vine	Yes	Yes	155
Thunbergia grandiflora	Trumpet vine	Yes	Yes	48
Thunbergia laurifolia	Trumpet vine	Yes	Yes	16
Tibouchina urvilleana	Glory bush	Yes	Yes	70
Verbascum thapsus	Common mullein	Yes	No	1
Washingtonia spp.	California and Mexican fan palm	Yes	Yes	723

LIST OF TARGET SPECIES FOUND, SORTED BY NUMBER OF LOCATIONS

This list includes target species located during roadside surveys on Maui (2000). Information on number of locations (#Loc) and naturalized status (Nat?) is given. The list is sorted by number of locations with the least at the top and the most at the bottom.

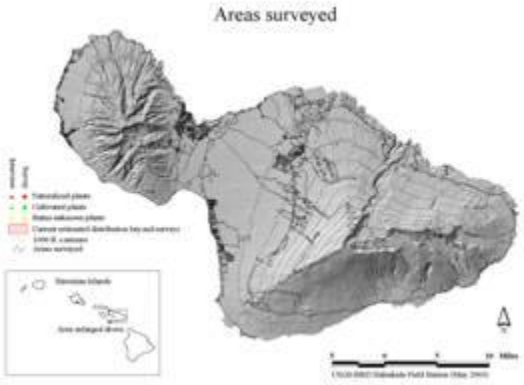
# Loc	Scientific Name	Nat?
1	*Centranthus ruber*	Yes
1	*Ligustrum sinense*	No
1	*Macaranga mappa*	No
1	*Melochia umbellata*	Yes
1	*Verbascum thapsus*	No
2	*Melastoma* spp.	No
2	*Rubus ellipticus*	?
2	*Tetrastigma pubinerve*	Yes
3	*Ficus deltoidea*	No
3	*Rhodomyrtus tomentosa*	?
3	*Rubus discolor*	Yes
3	*Solanum robustum*	Yes
4	*Parkinsonia aculeata*	Yes
5	*Ficus pseudopalma*	No
5	*Leptospermum morisonii*	?
6	*Pittosporum viridiflorum*	?
7	*Aristolochia littoralis*	Yes
8	*Hyparrhenia* spp.	Yes
9	*Clerodendrum inerme*	Yes
9	*Derris elliptica*	Yes
9	*Morella [Myrica] cerifera*	Yes
10	*Passiflora laurifolia*	Yes
12	*Ficus religiosa*	No
12	*Grevillea banksia*	Yes
13	*Rubus glaucus*	Yes
14	*Senecio confusus*	Yes
15	*Paederia foetida*	Yes
16	*Thunbergia laurifolia*	Yes
17	*Caesalpinia decapetala*	Yes
18	*Phormium tenax*	Yes
29	*Hypericum canariense*	Yes
31	*Ficus benghalensis*	No
33	*Philadelphus karvinskyanus*	?
34	*Cinnamomum burmanni*	Yes
34	*Pennisetum setaceum*	Yes
37	*Salsola tragus*	Yes
38	*Sideroxylon persimile*	Yes
39	*Anredera cordifolia*	Yes
40	*Arundo donax*	Yes
40	*Pueraria montana* var. *lobata*	Yes
41	*Passiflora mollissima*	Yes
42	*Cryptostegia* spp.	Yes
42	*Olea europaea europaea*	Yes

# Loc	Scientific Name	Nat?
43	*Buddleia madagascariensis*	Yes
45	*Ficus macrophylla*	Yes
48	*Thunbergia grandiflora*	Yes
50	*Thunbergia alata*	Yes
52	*Delairea odorata*	Yes
62	*Pyracantha spp.*	Yes
64	*Macaranga tanarius*	Yes
70	*Tibouchina urvilleana*	Yes
74	*Rubus niveus* f. *b*	Yes
76	*Ficus lyrata*	No
76	*Solandra maxima*	?
80	*Archontophoenix* spp.	Yes
88	*Buddleia davidii*	Yes
88	*Podranea ricasoliana*	Yes
89	*Solanum torvum*	Yes
98	*Ochna* spp.	Yes
99	*Rubus niveus* f. *a*	Yes
135	*Pimenta dioica*	Yes
148	*Leptospermum* spp.	?
155	*Thunbergia fragrans*	Yes
167	*Ficus carica*	Yes
169	*Falcataria moluccana*	Yes
172	*Lonicera japonica*	Yes
174	*Citharexylum caudatum*	Yes
178	*Senecio madagascariensis*	Yes
187	*Cotoneaster pannosus*	Yes
193	*Livistona chinensis*	Yes
200	*Cinnamomum camphora*	Yes
213	*Coccinia grandis*	Yes
271	*Ficus elastica*	No
279	*Citharexylum spinosum*	Yes
296	*Ficus pumila*	No
317	*Cinchona pubescens*	Yes
317	*Morella [Myrica] faya*	Yes
434	*Ficus* cf. *platypoda*	Yes
444	*Carmona retusa*	Yes
520	*Olea europaea cuspidata*	Yes
598	*Bocconia frutescens*	Yes
626	*Cortaderia* spp.	Yes
723	*Washingtonia* spp.	Yes
764	*Clusia rosea*	Yes
1244	*Ficus microcarpa*	Yes
1377	*Ficus benjamina*	No
1543	*Pinus* spp.	Yes
2060	*Schefflera actinophylla*	Yes

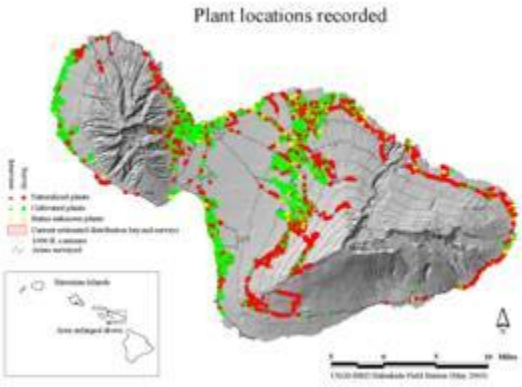
SUMMARY OF EXPERT INTERVIEWS AND LOCATIONS GATHERED

During this project, we surveyed 1,246 miles(2,005 km) of roads; recorded 16,031 locations for 94 species; and interviewed 12 expert field botanists, acquired GPS data, and reviewed literature, adding 964 plant locations for 79 species.

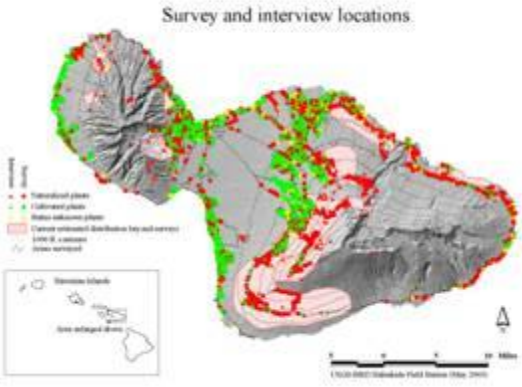
Surveyed 1,246 miles (2,005 km) of roads



Recorded 16,031 locations for 94 species during survey

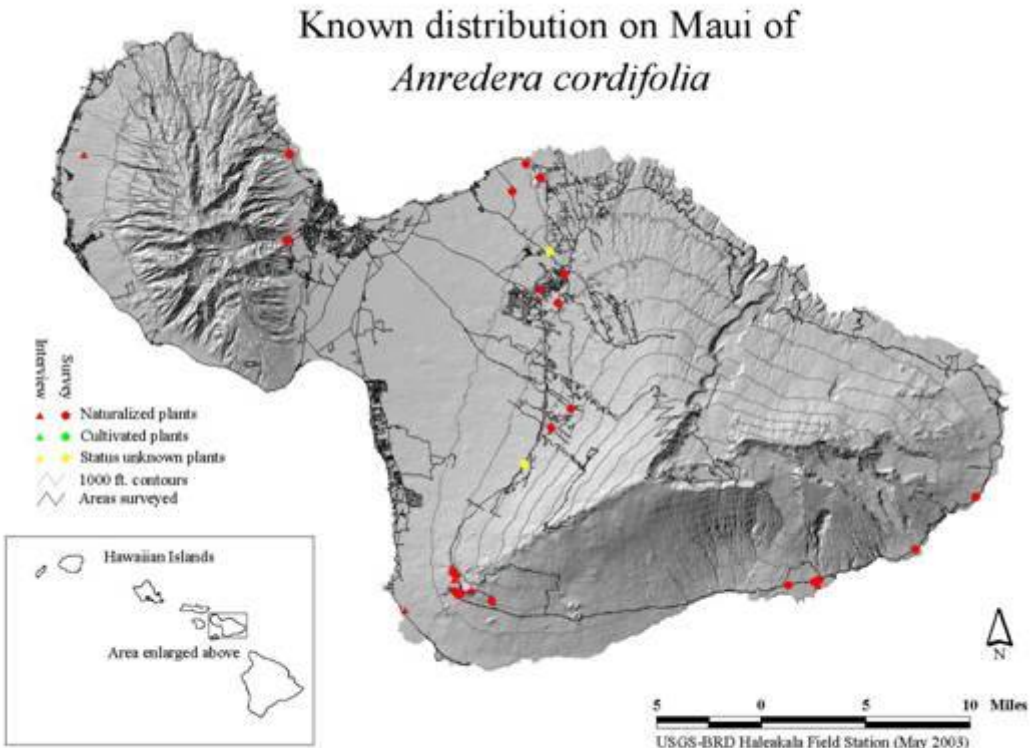


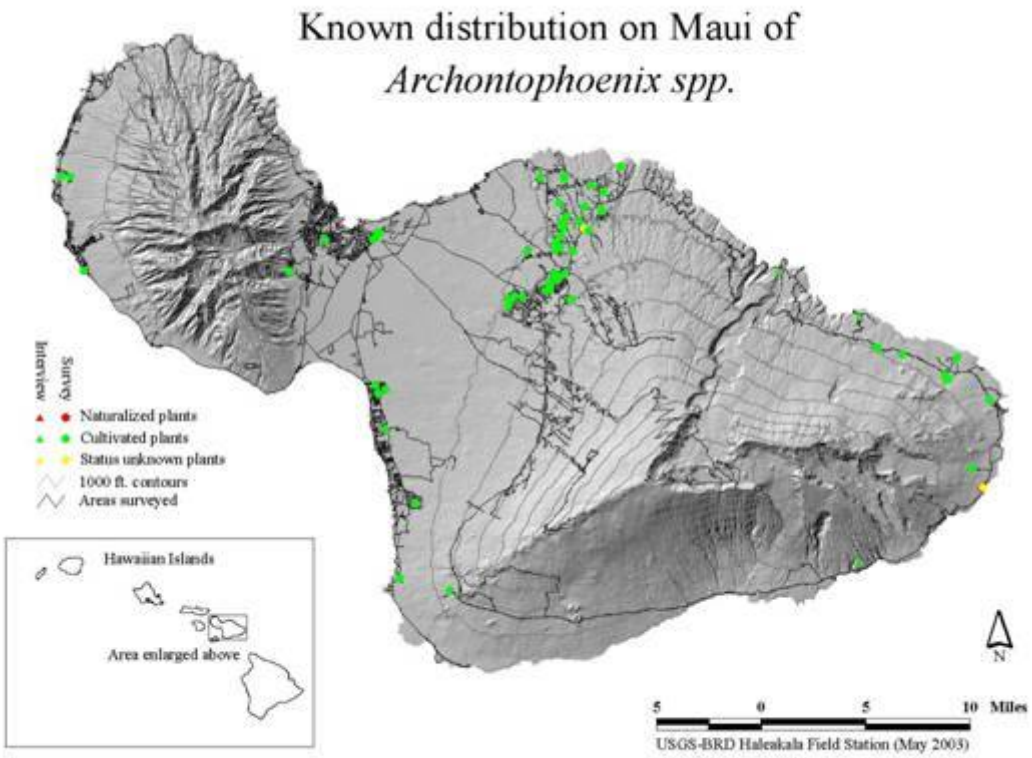
Added 964 locations for 79 species though expert interviews

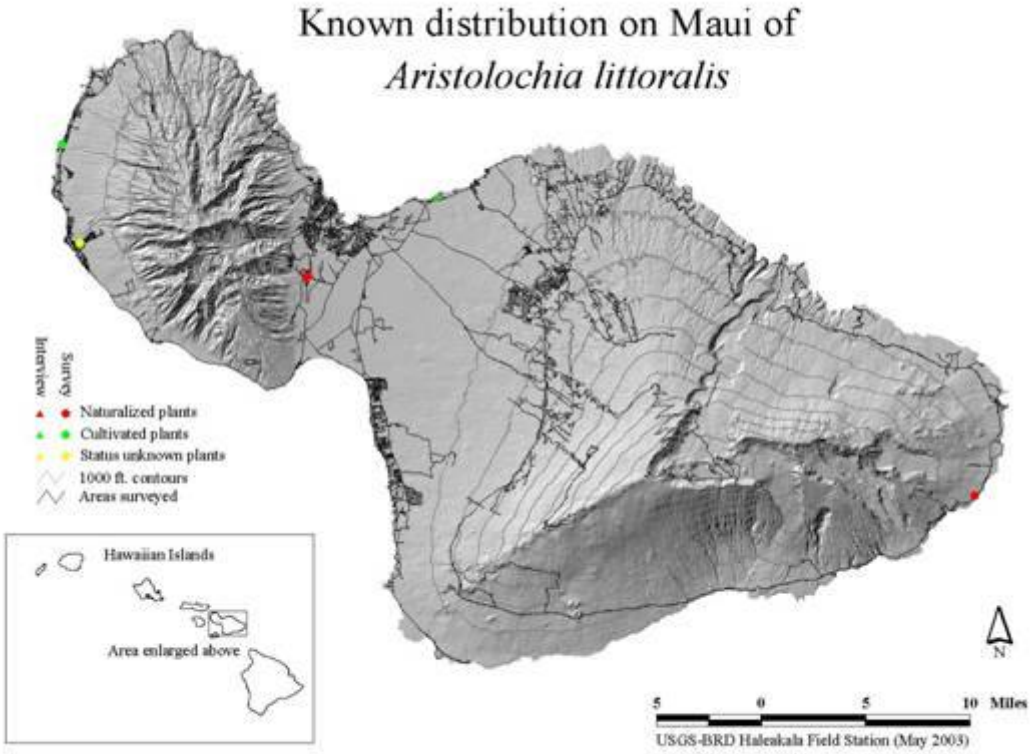


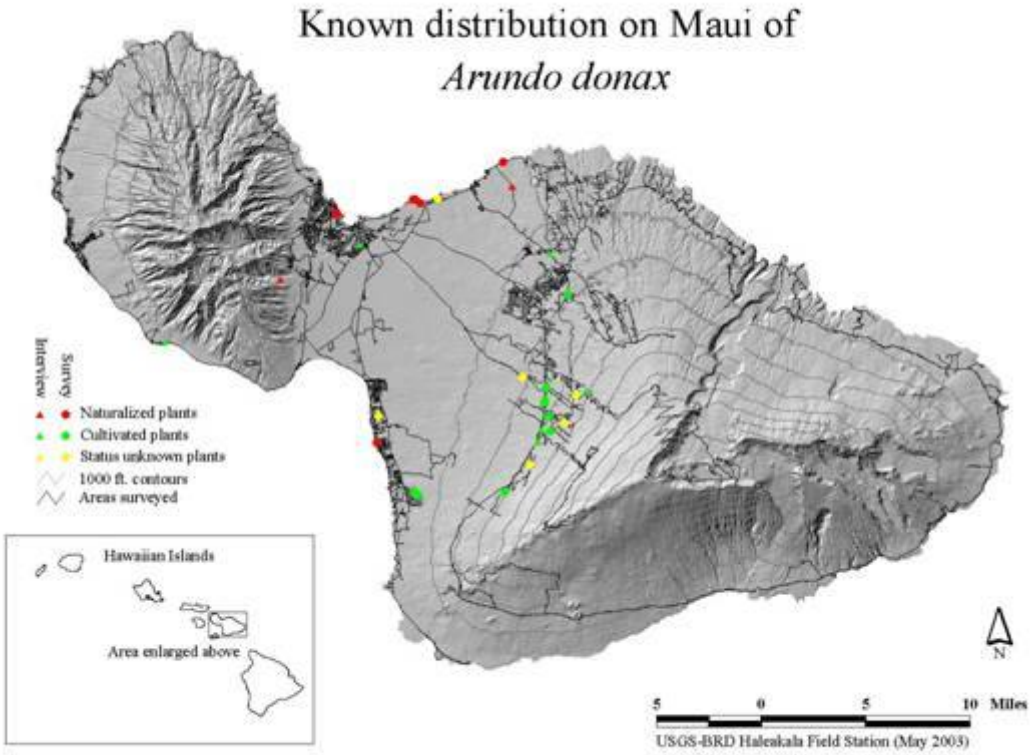
DISTRIBUTION MAPS

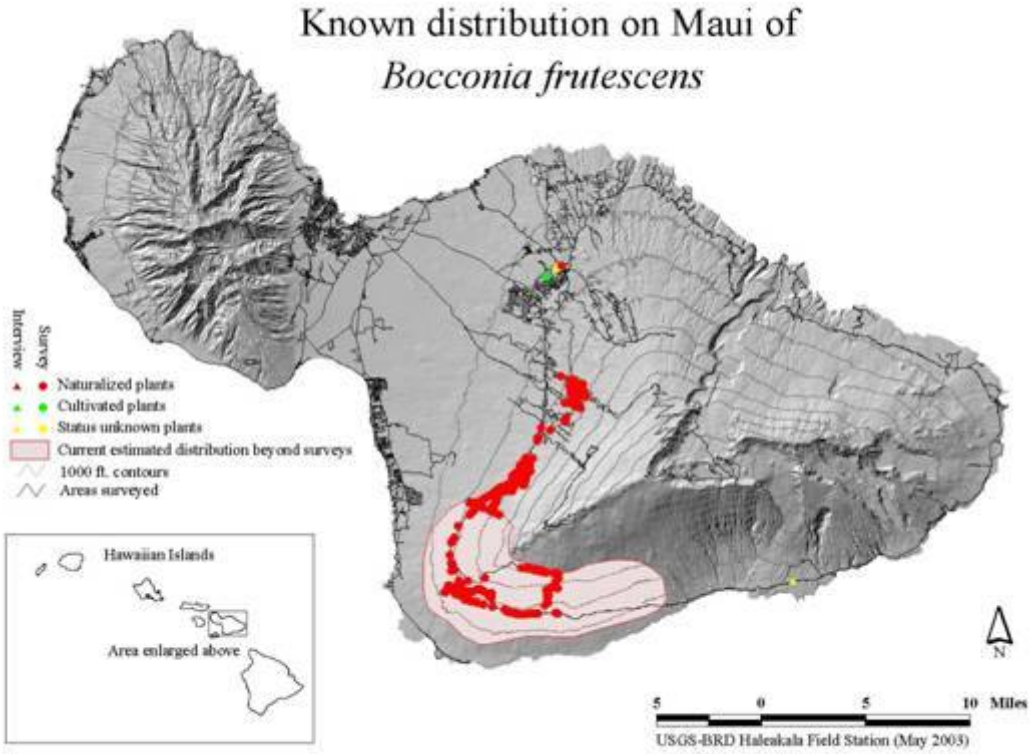
Below are maps of known distribution of select species on the island of Maui, products of the roadside botanical survey and expert interviews.

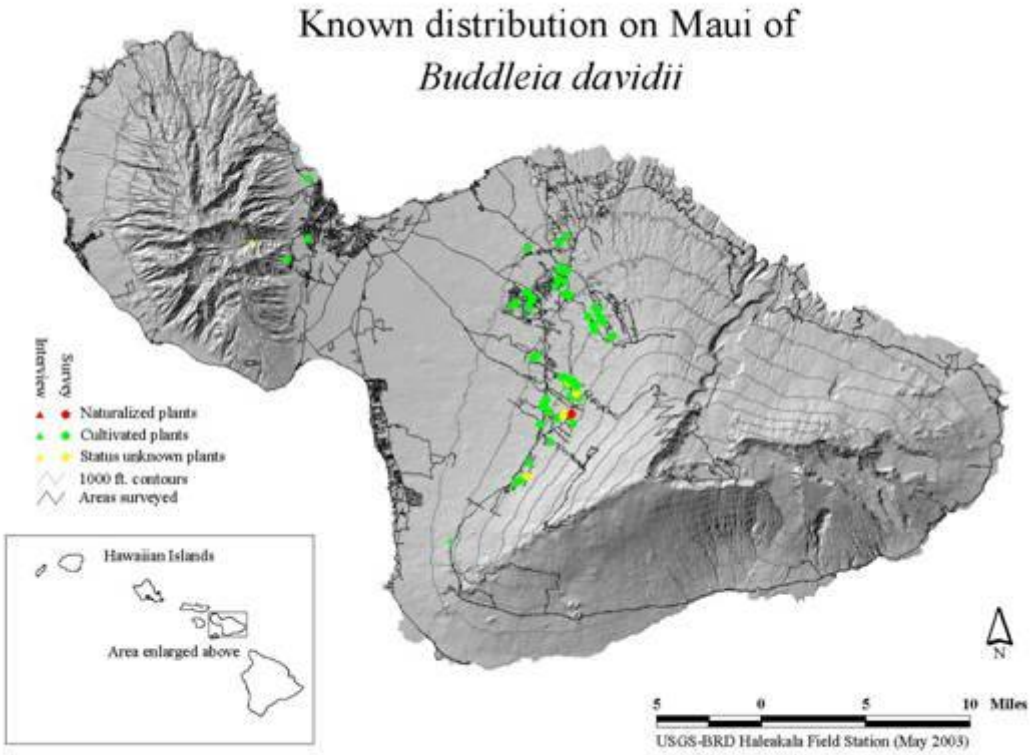


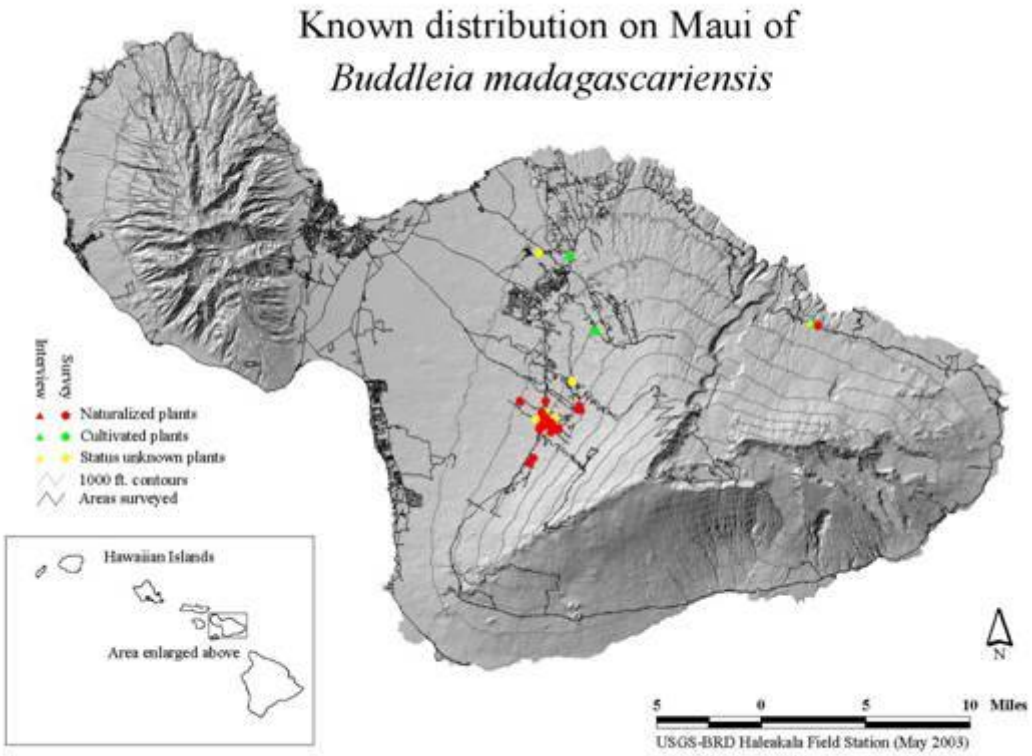


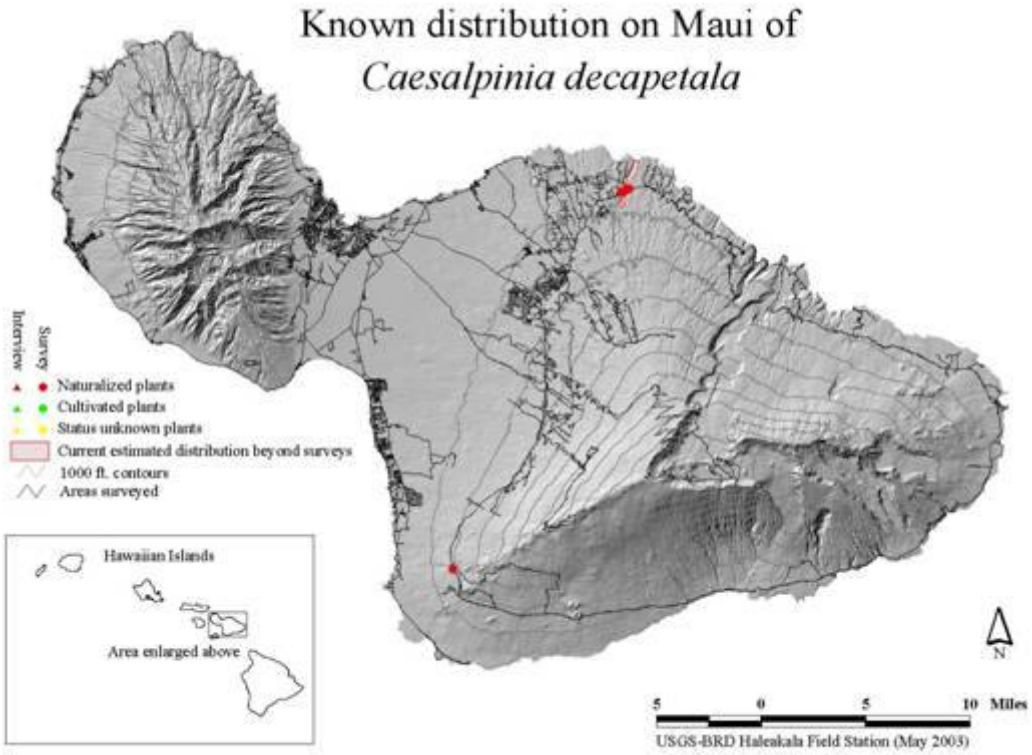

Known distribution on Maui of
Aristolochia littoralis
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

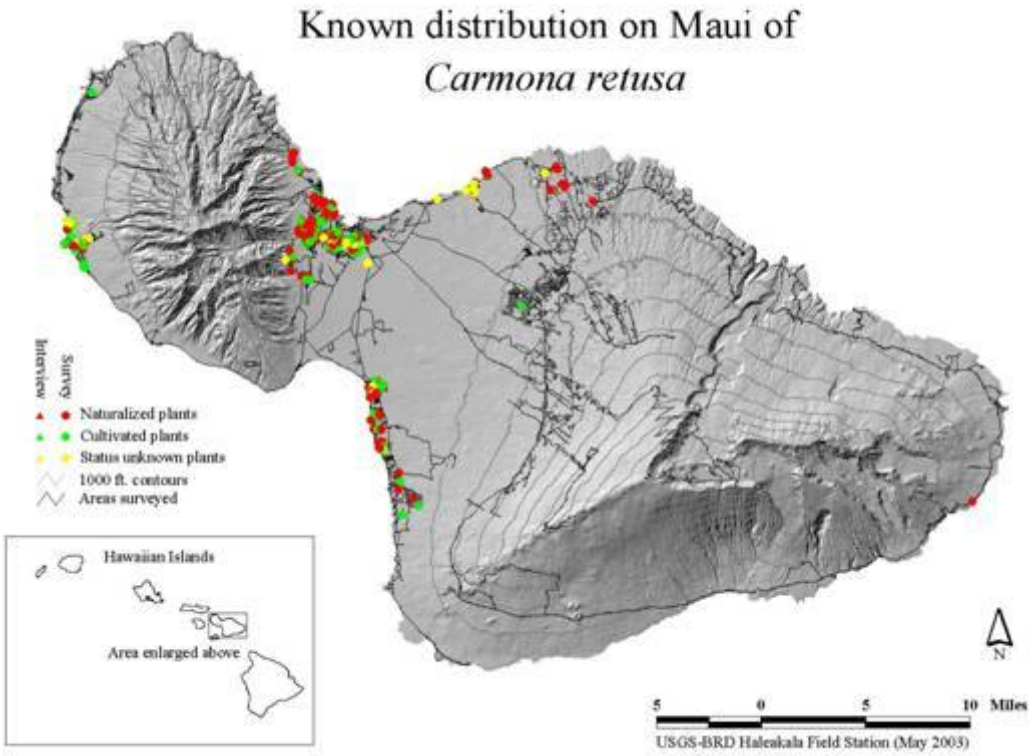

Known distribution on Maui of
Arundo donax
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

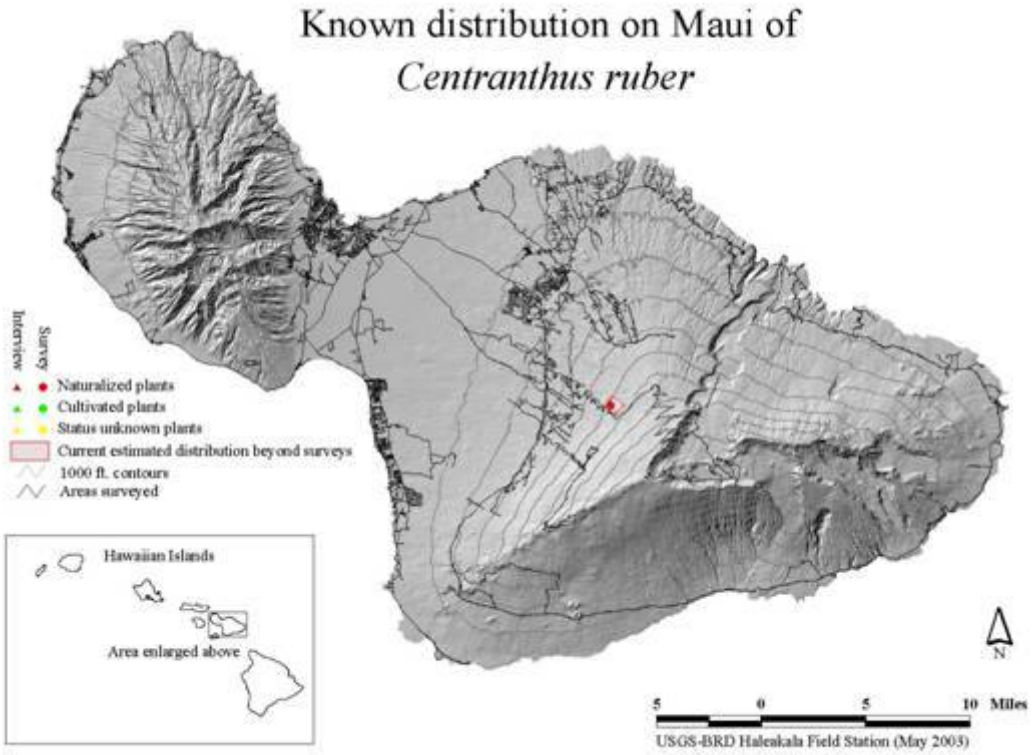

Known distribution on Maui of
Bocconia frutescens
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

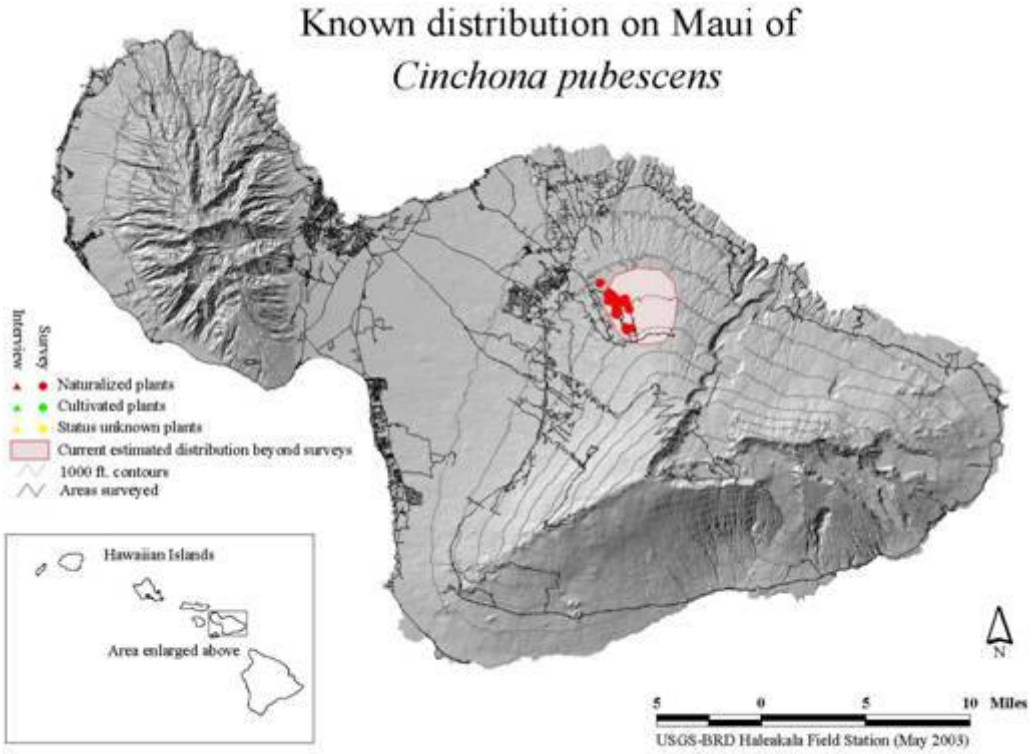

Known distribution on Maui of
Buddleia davidii
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

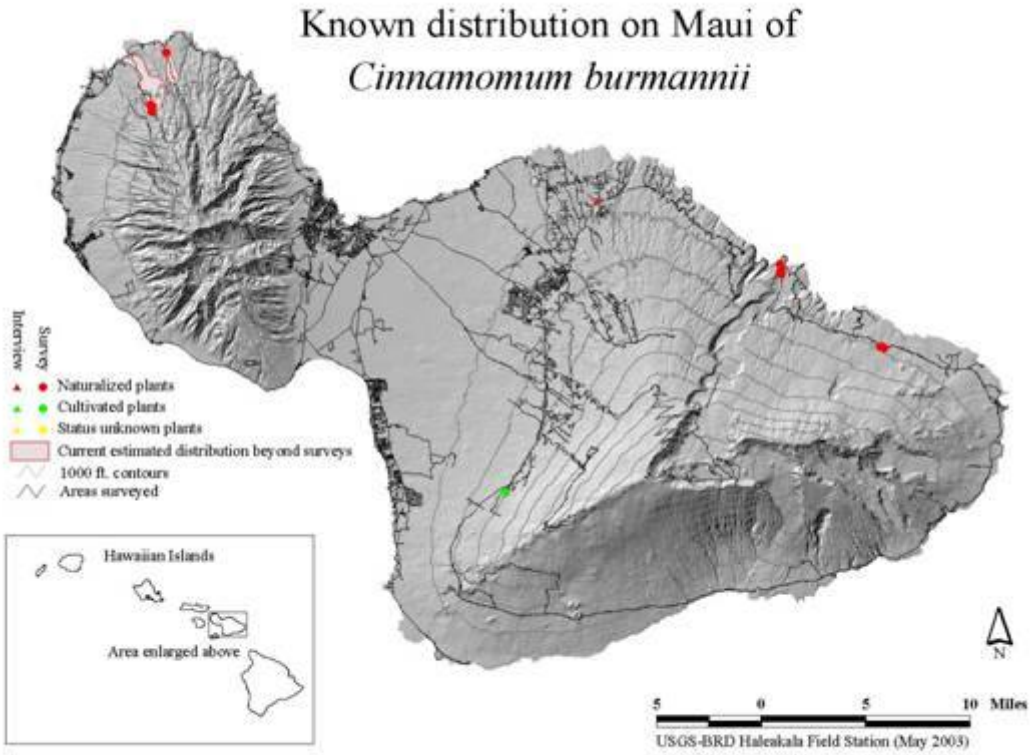

Known distribution on Maui of
Buddleia madagascariensis
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

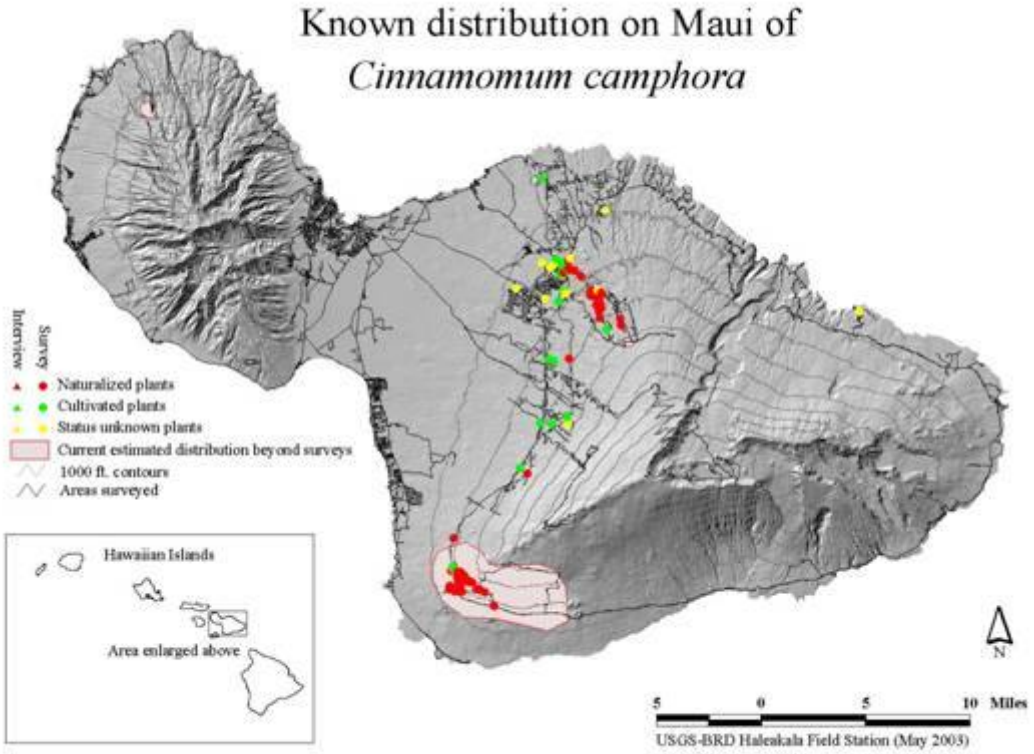

Known distribution on Maui of
Caesalpinia decapetala
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

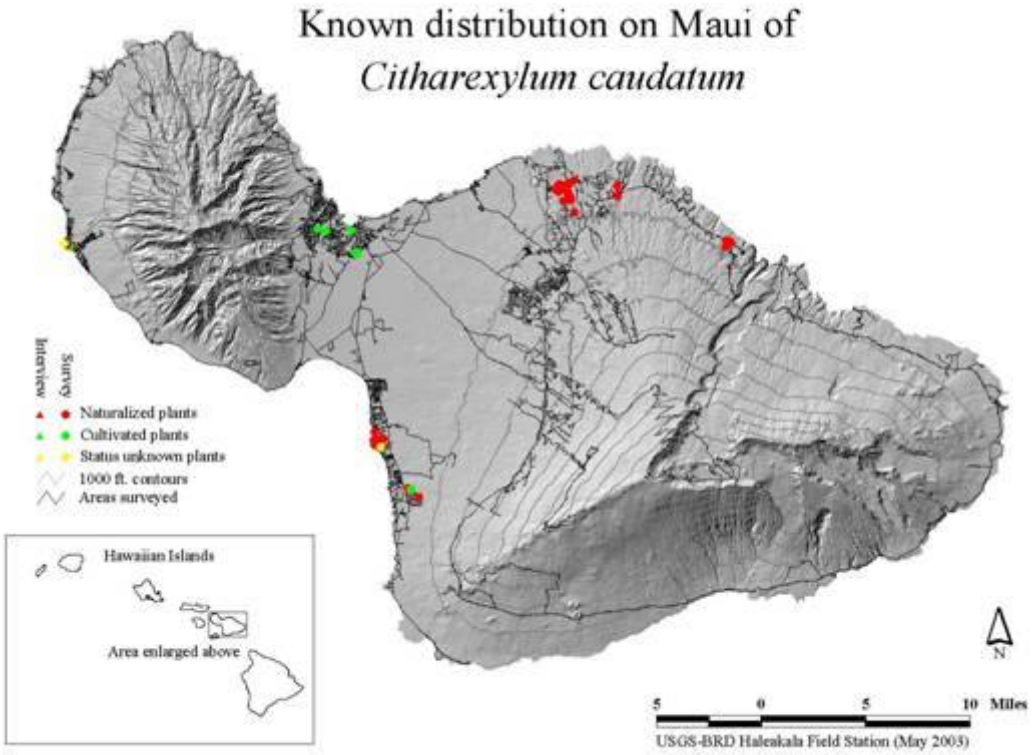

Known distribution on Maui of
Carmona retusa
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

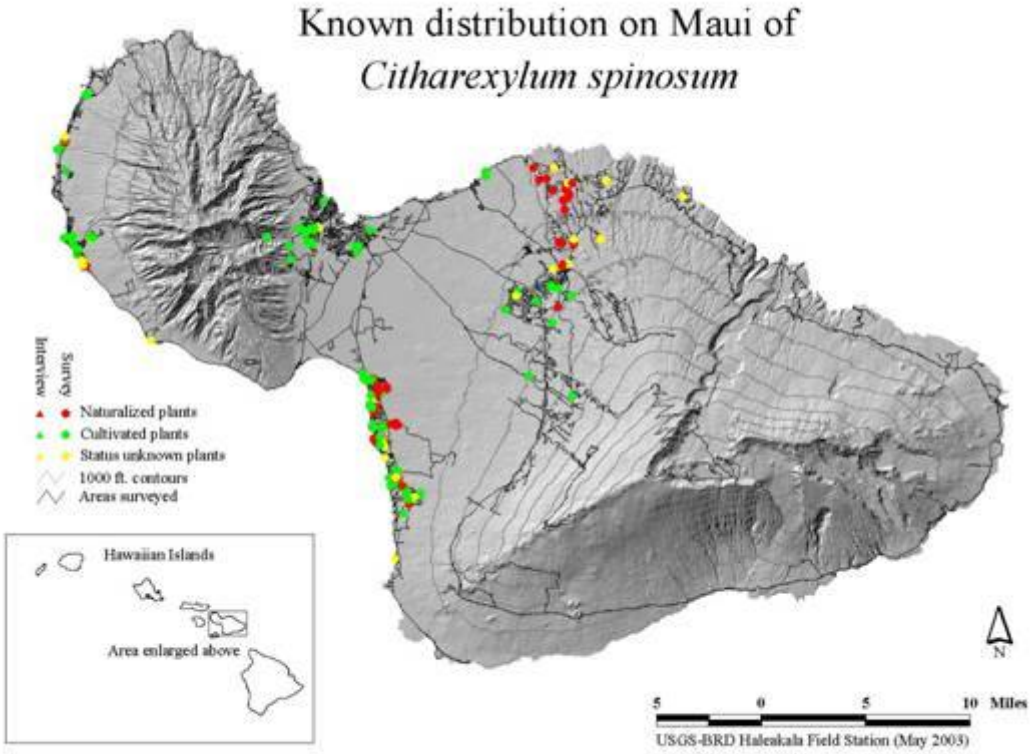

Known distribution on Maui of
Centranthus ruber
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

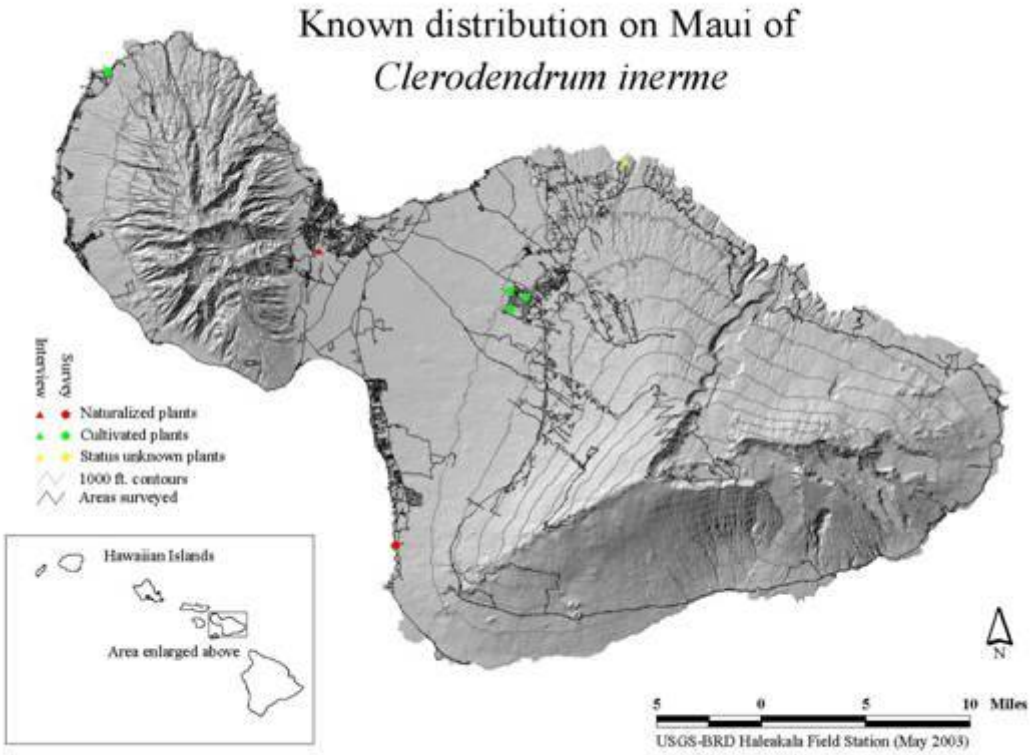

Known distribution on Maui of
Cinchona pubescens
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

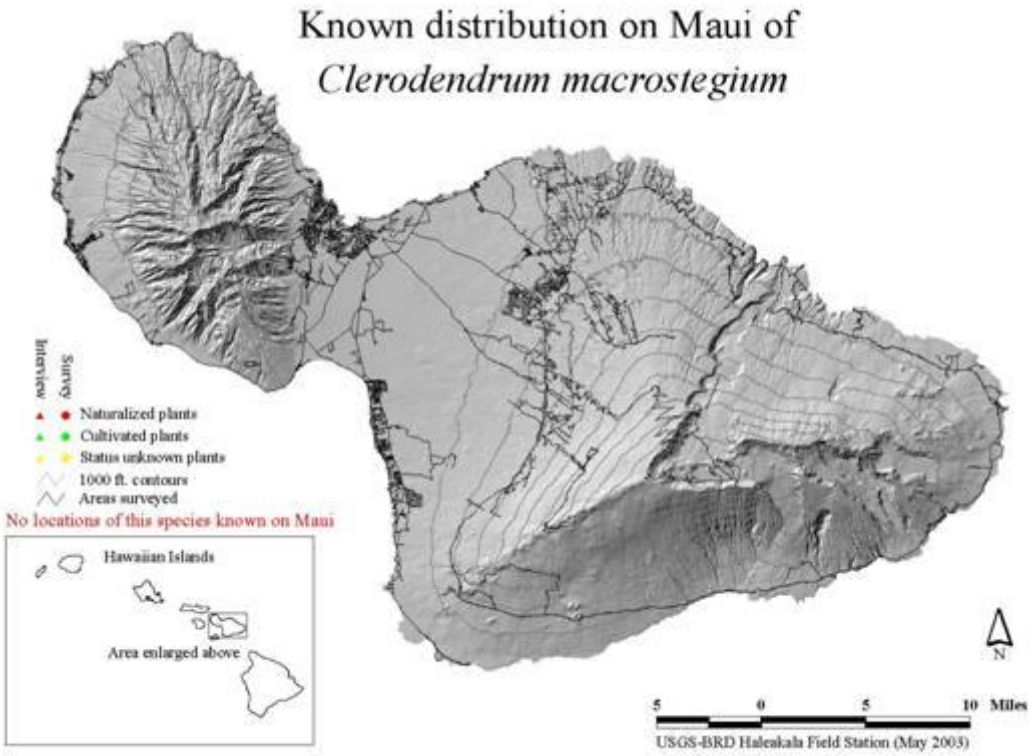

Known distribution on Maui of
Cinnamomum burmannii
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

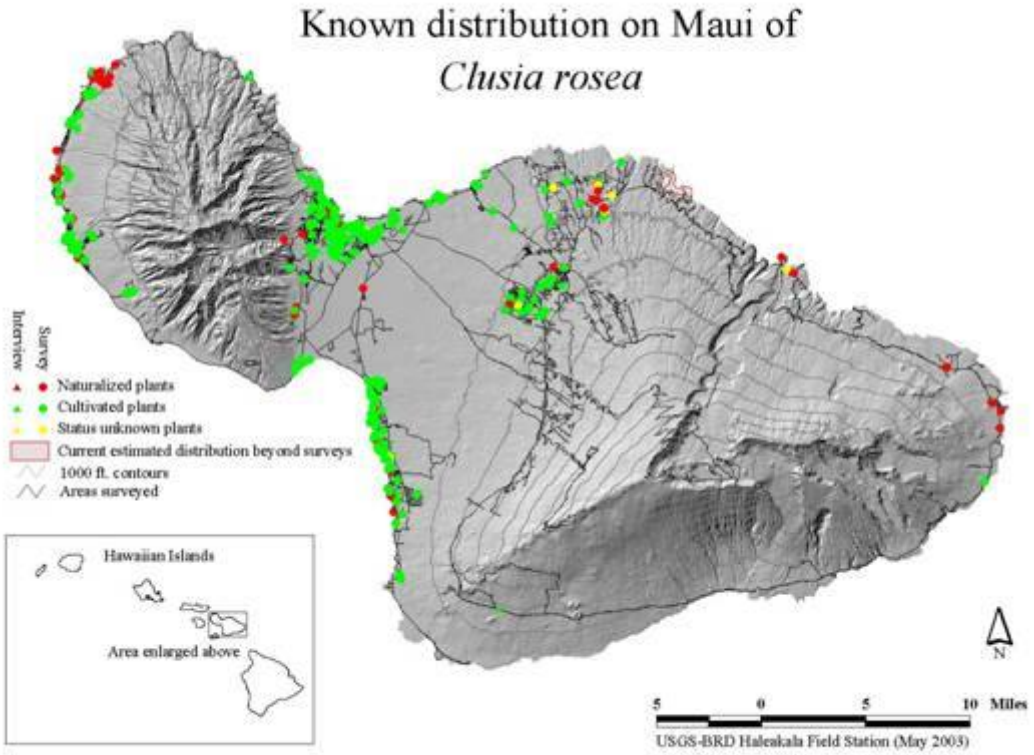

Known distribution on Maui of
Cinnamomum camphora
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

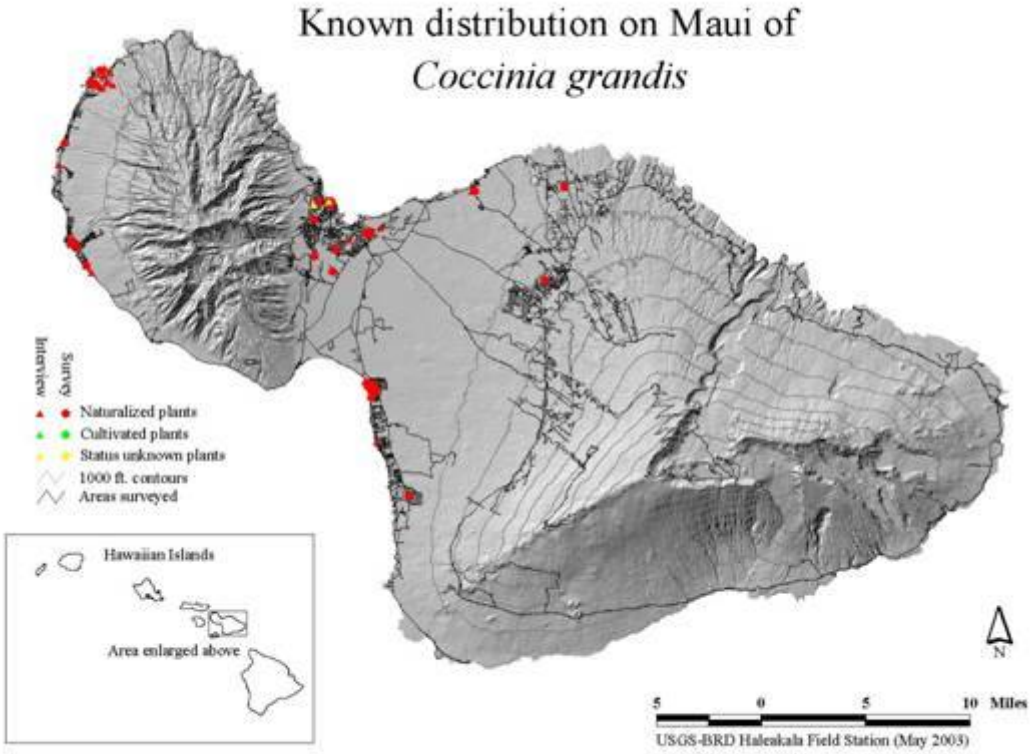

Known distribution on Maui of
Citharexylum caudatum
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

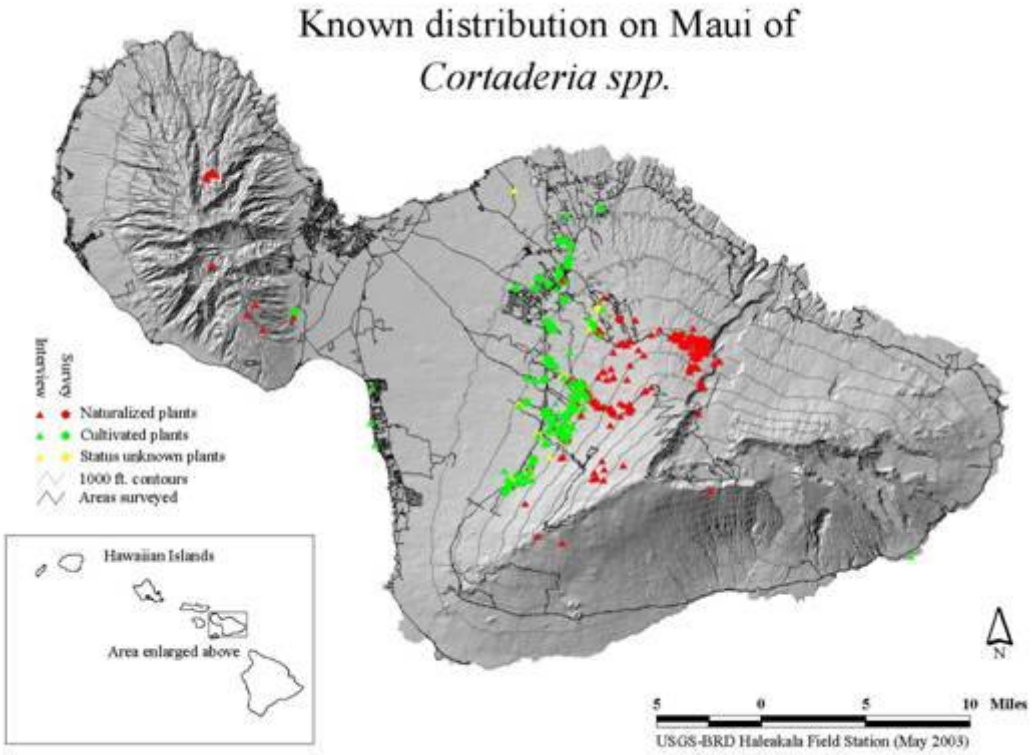

Known distribution on Maui of
Citharexylum spinosum
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

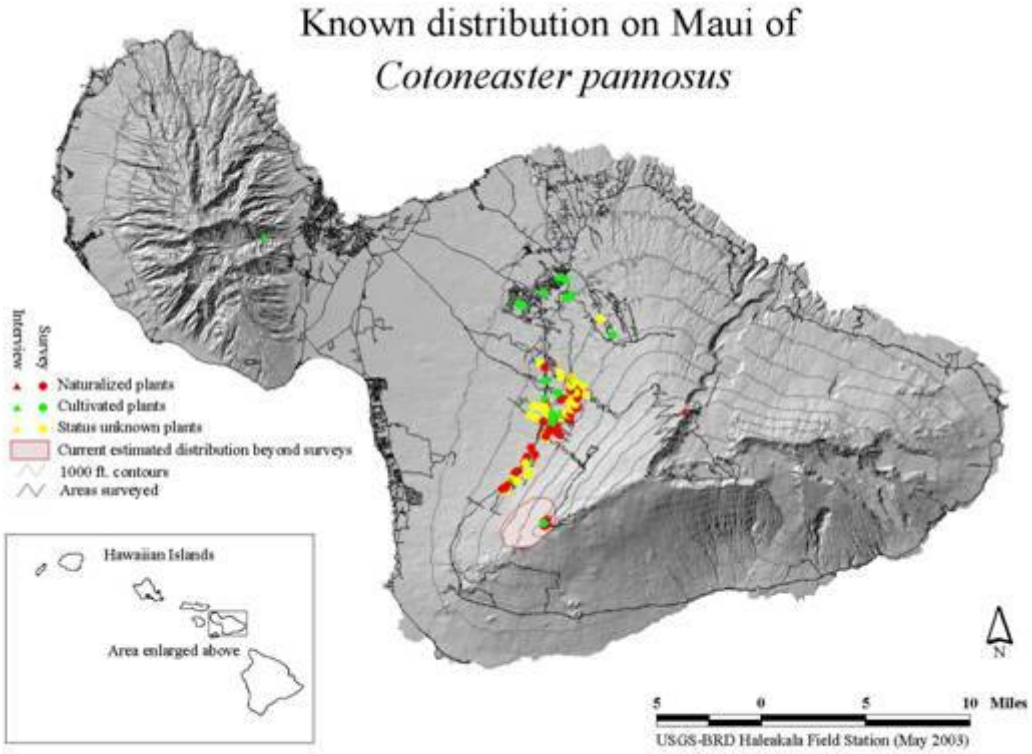

Known distribution on Maui of
Clerodendrum inerme
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

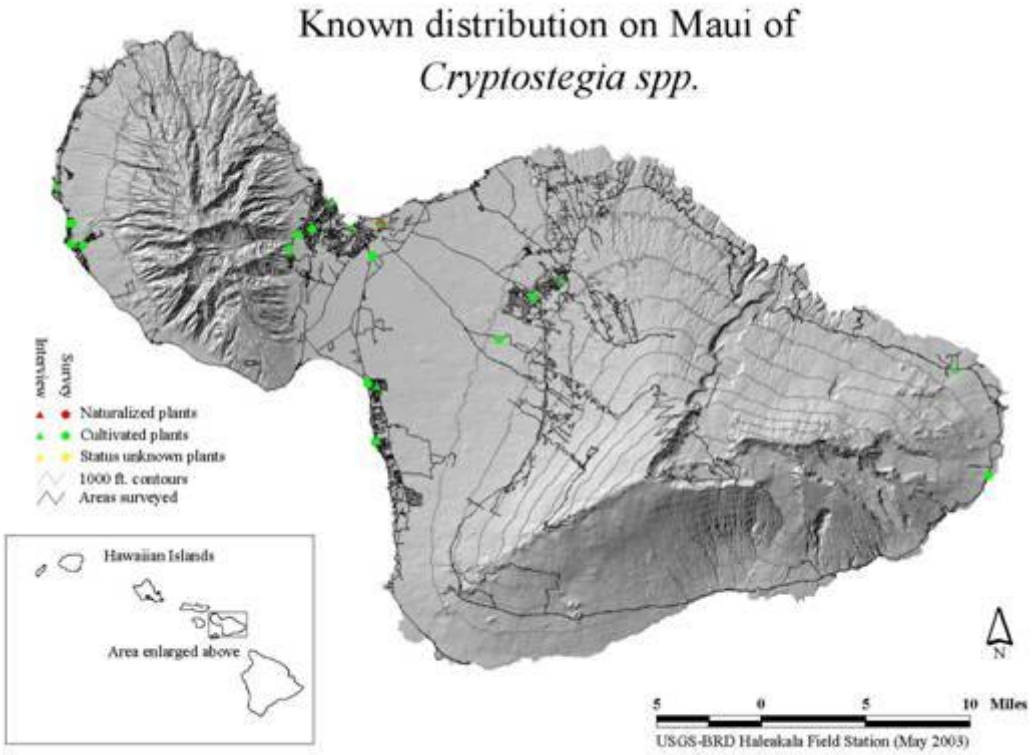

Known distribution on Maui of
Clerodendrum macrostegium
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
No locations of this species known on Maui
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

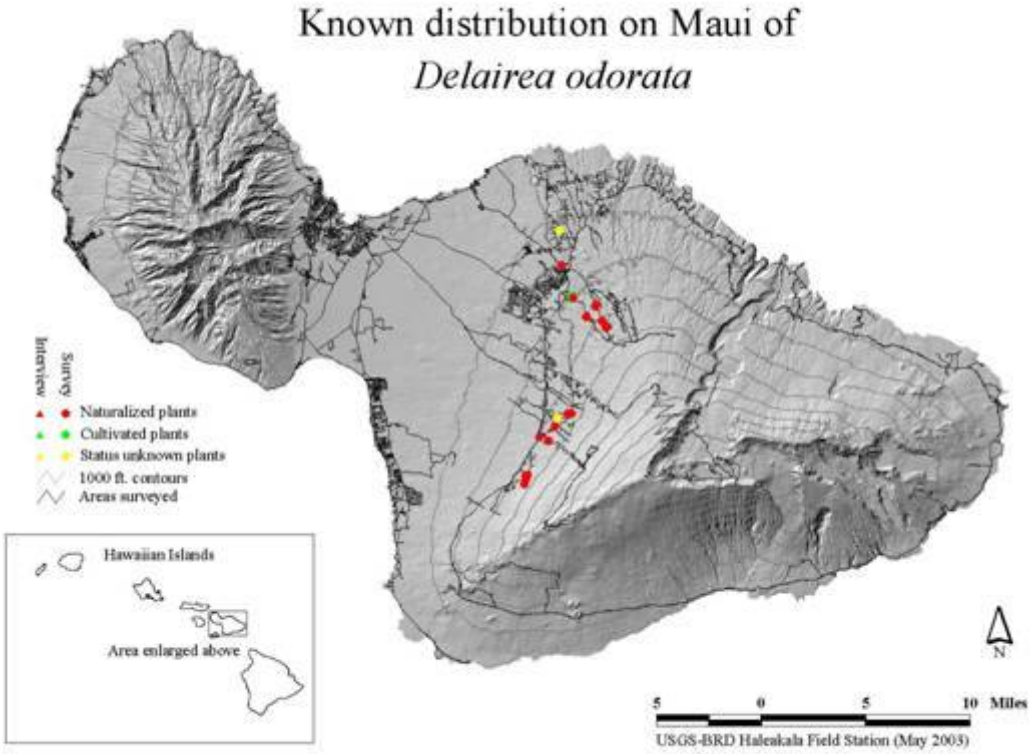

Known distribution on Maui of
Clusia rosea
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

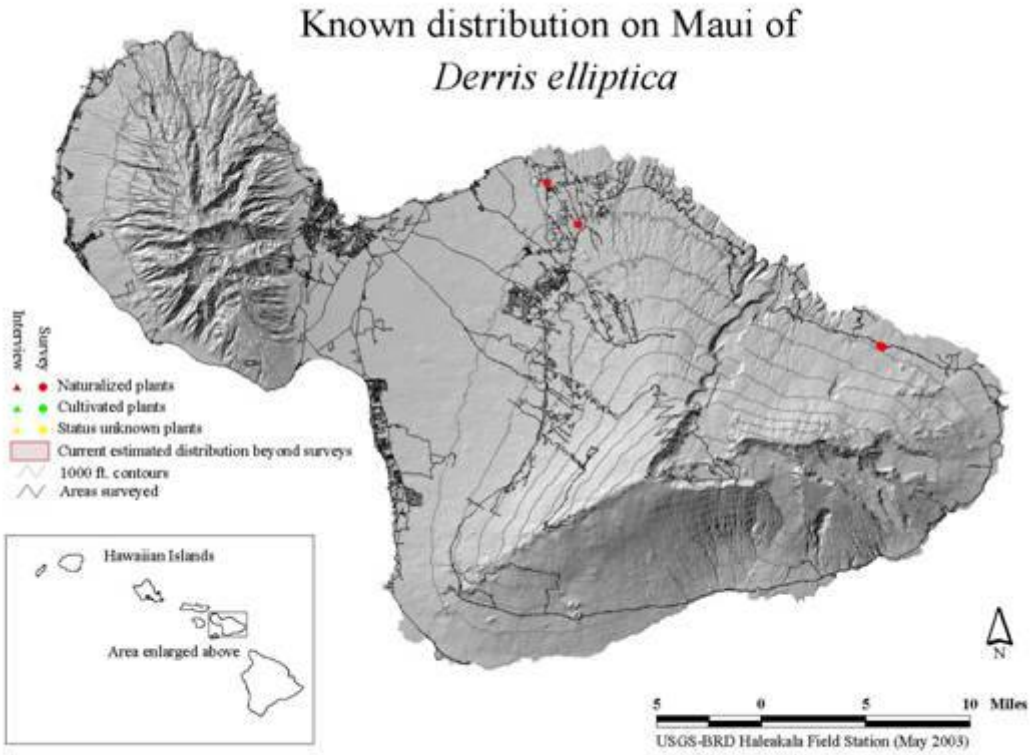

Known distribution on Maui of
Coccinia grandis
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

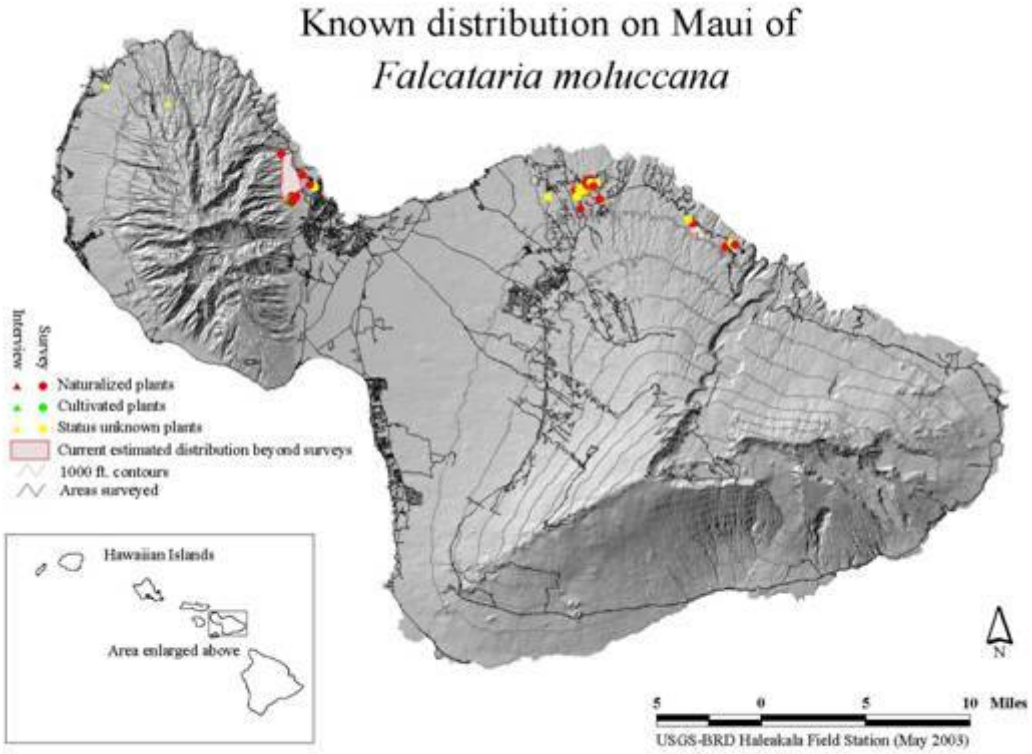

Known distribution on Maui of
Cortaderia spp.
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

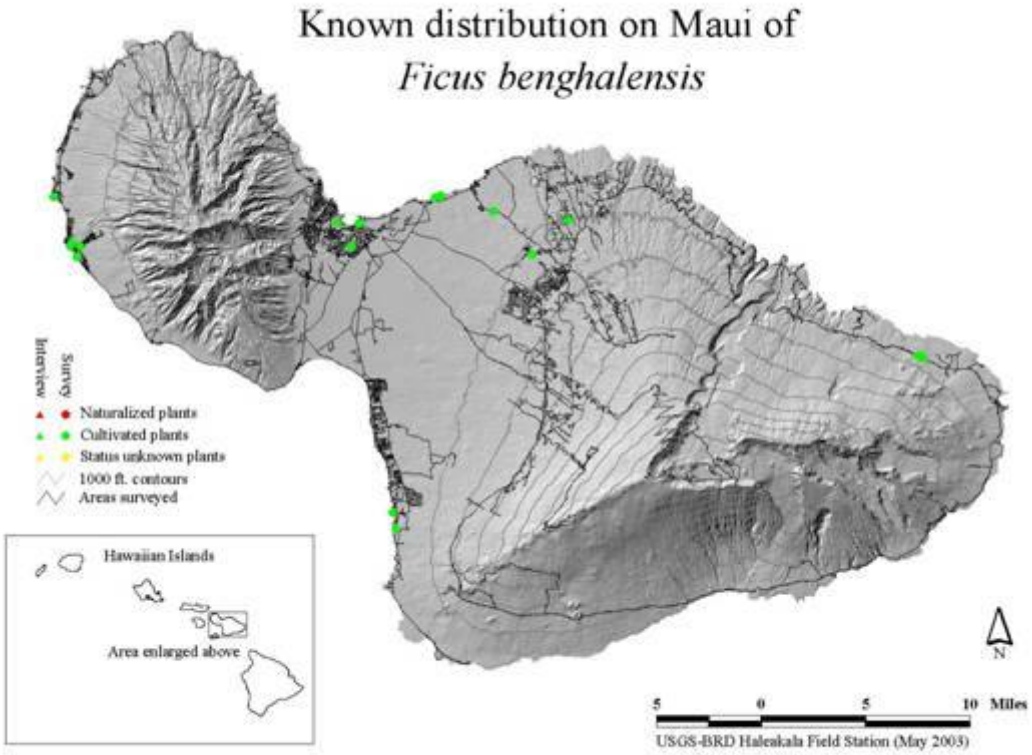

Known distribution on Maui of
Cotoneaster pannosus
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

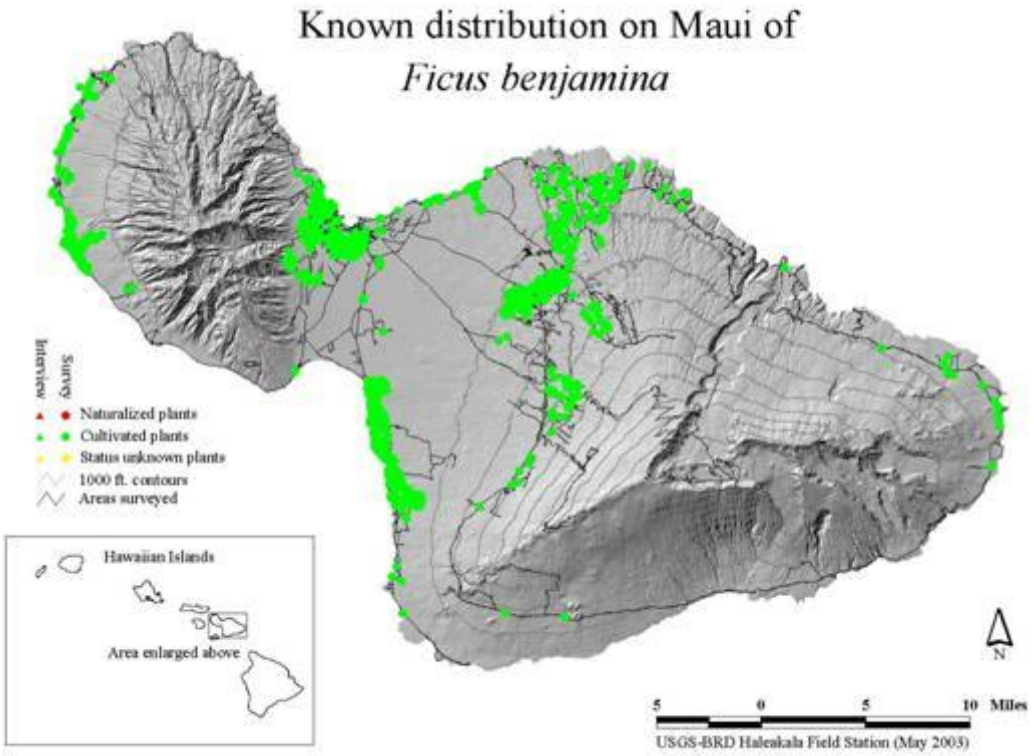

Known distribution on Maui of
Cryptostegia spp.
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

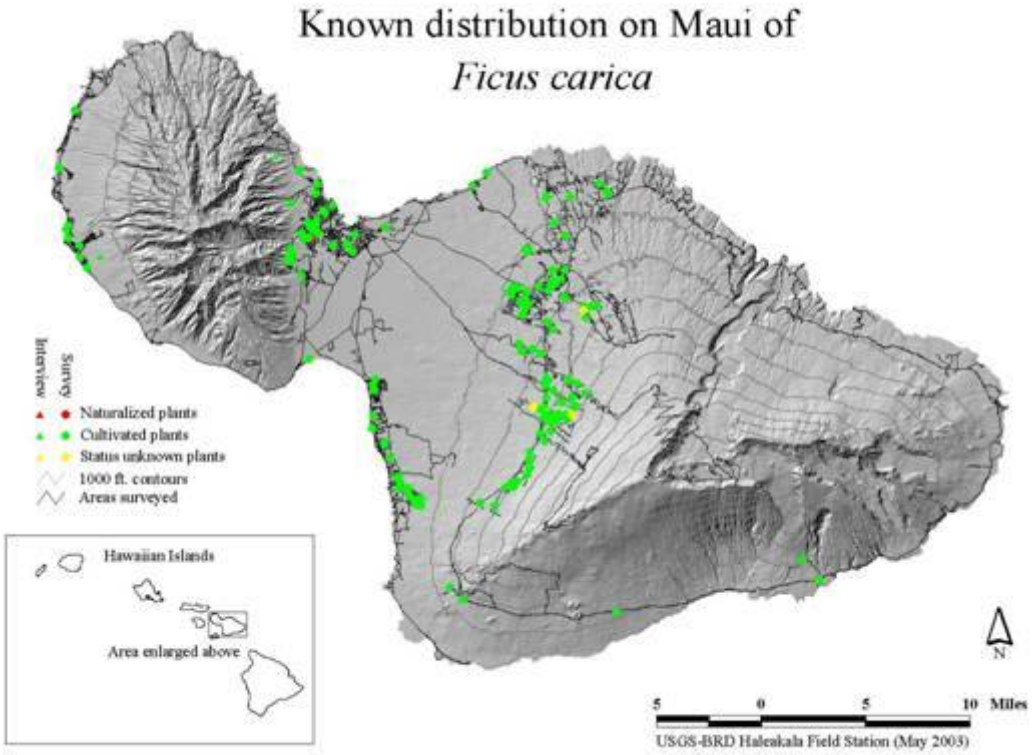

Known distribution on Maui of
Delairea odorata
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

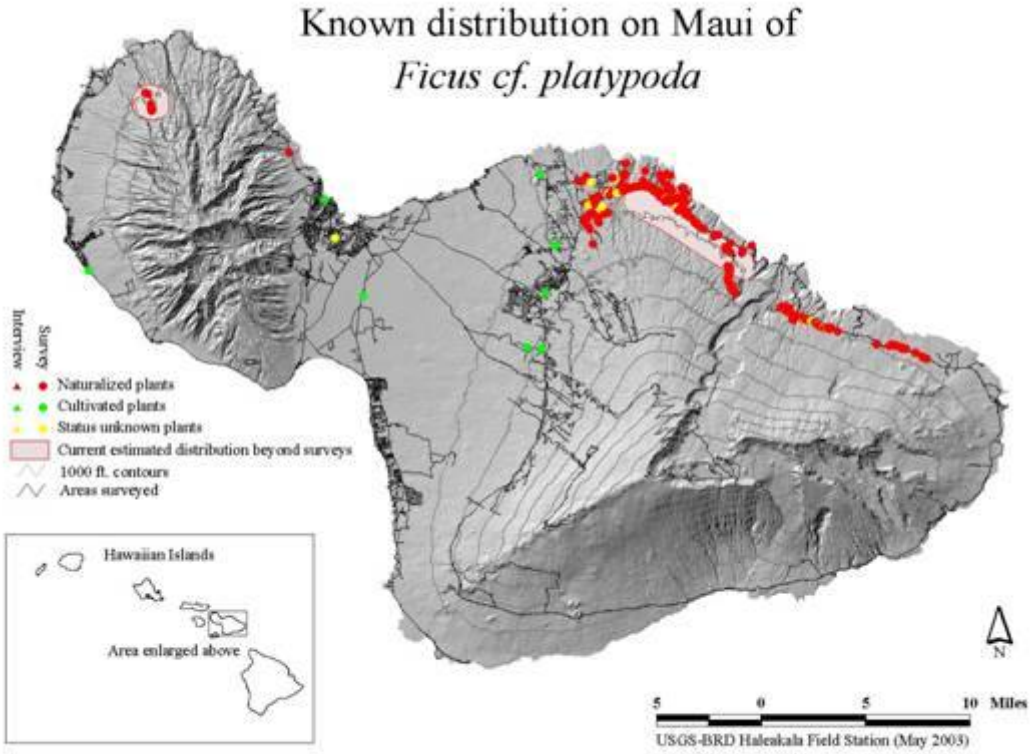

Known distribution on Maui of
Derris elliptica
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

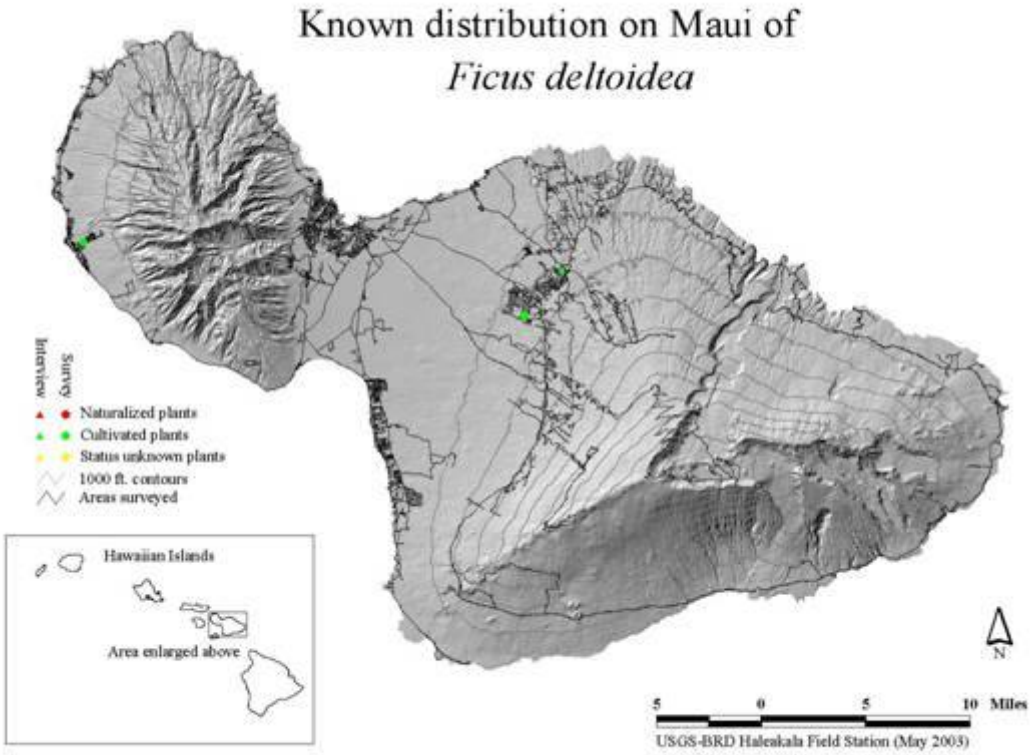

Known distribution on Maui of
Falcataria moluccana
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

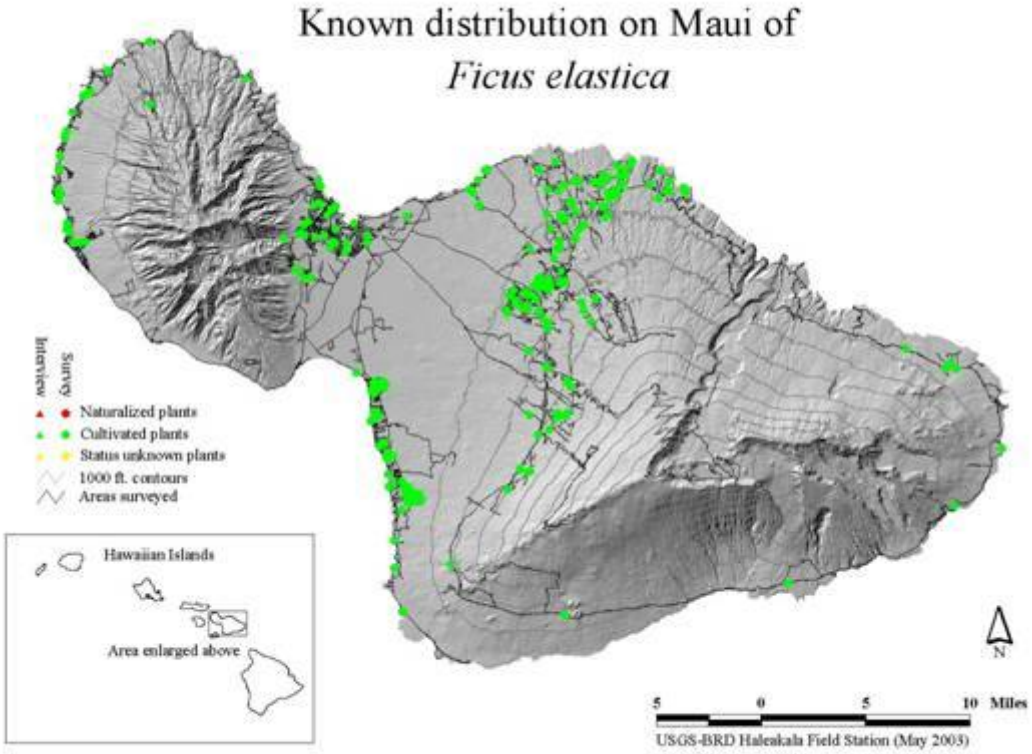

Known distribution on Maui of
Ficus benghalensis
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

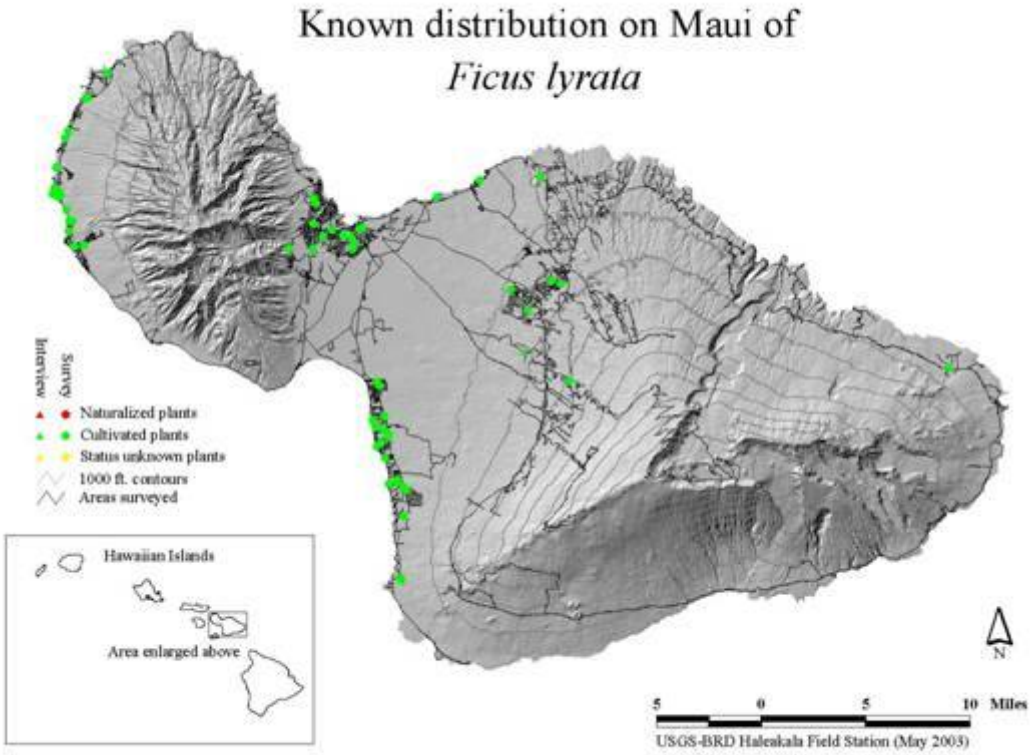

Known distribution on Maui of
Ficus benjamina
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

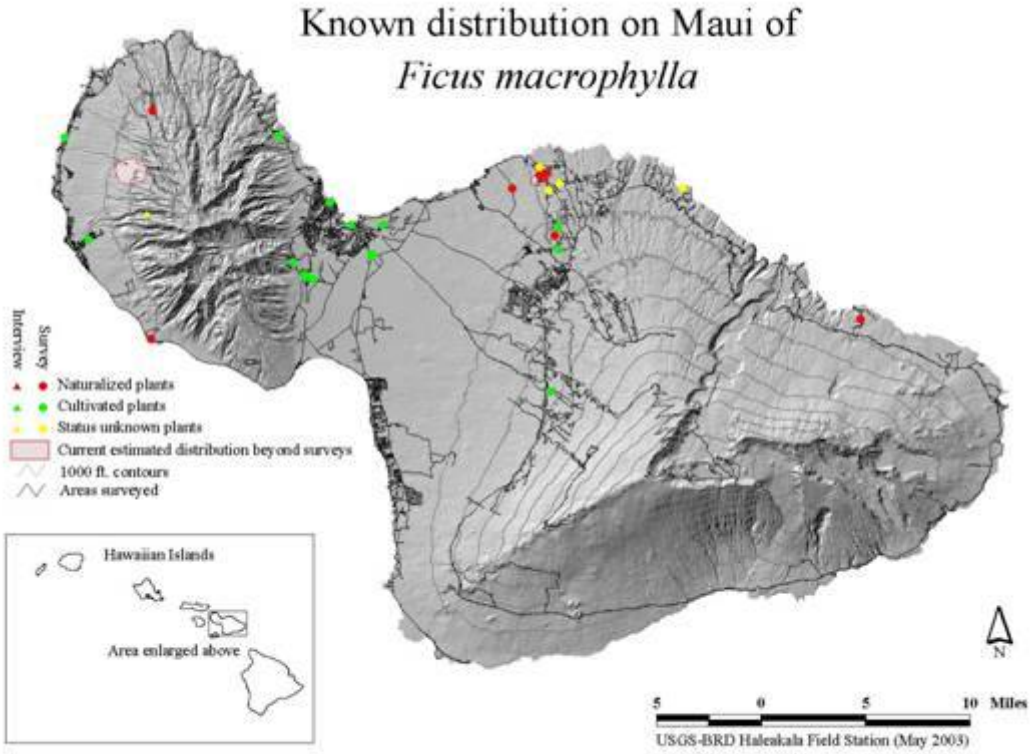

Known distribution on Maui of
Ficus carica
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

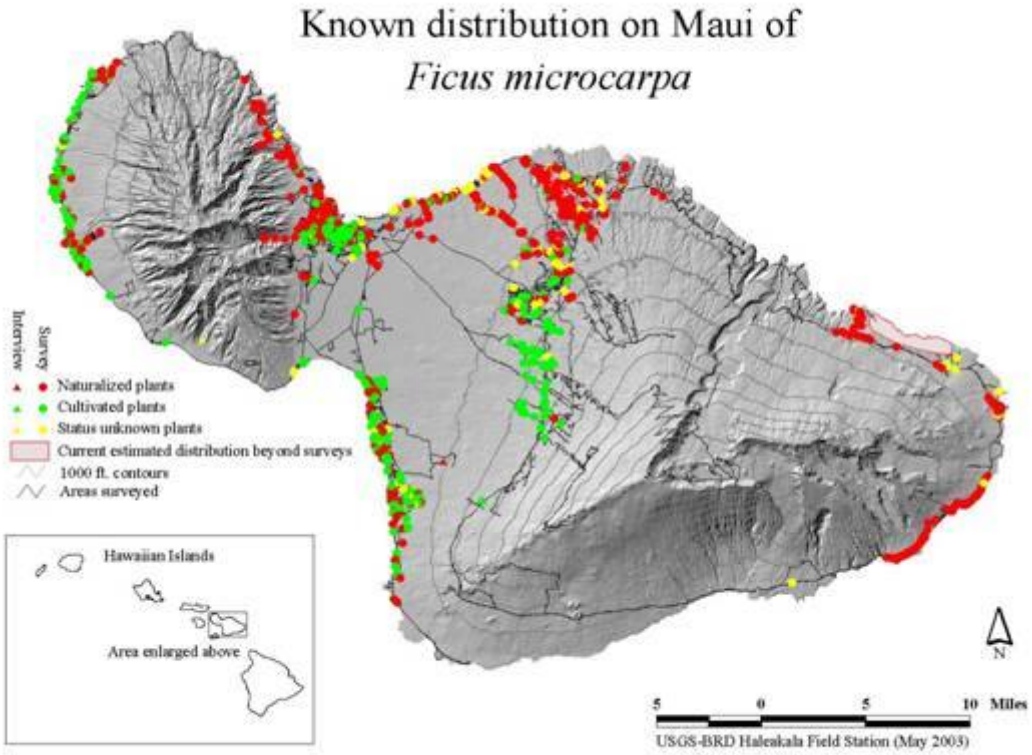

Known distribution on Maui of
Ficus cf. platypoda
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

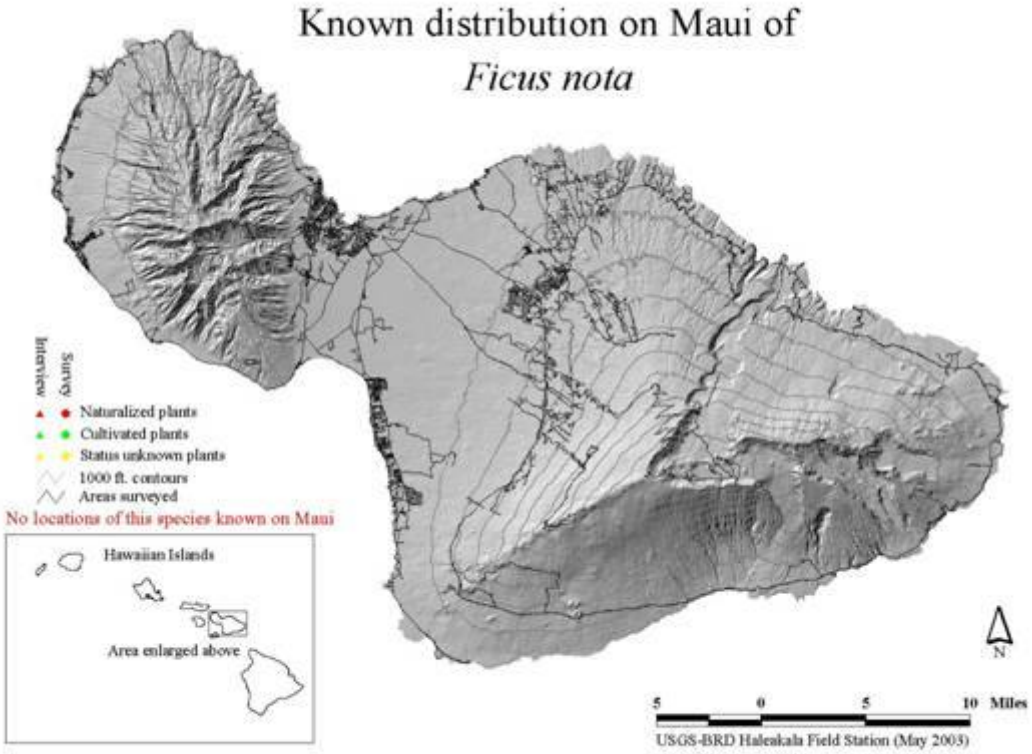

Known distribution on Maui of
Ficus deltoidea
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

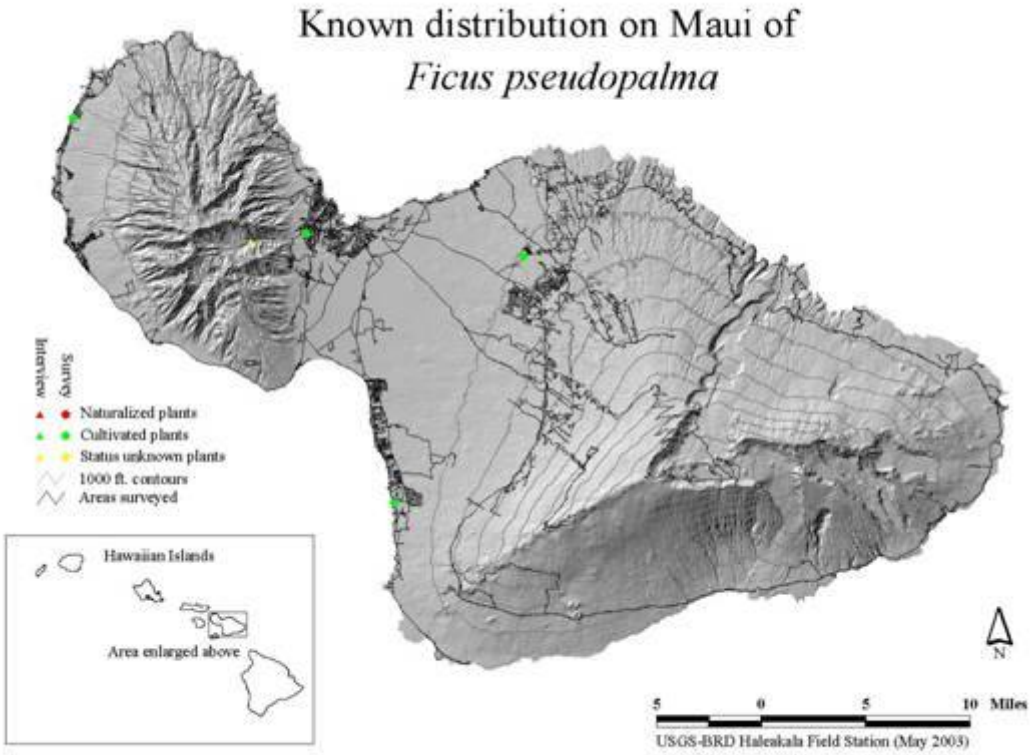

Known distribution on Maui of
Ficus elastica
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

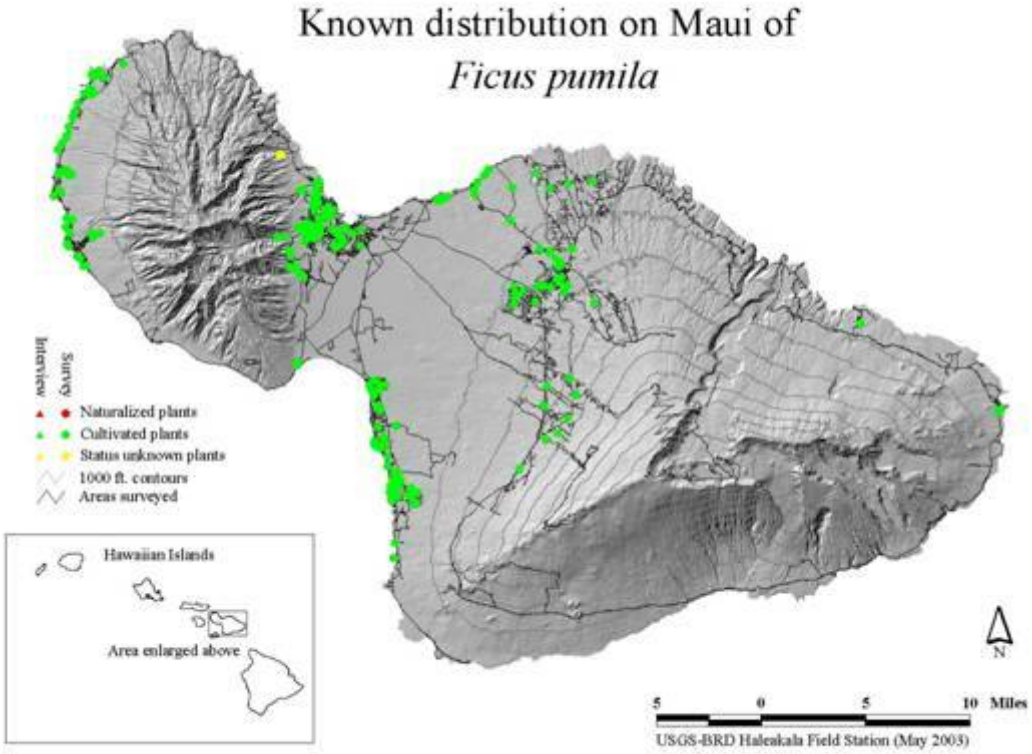

Known distribution on Maui of
Ficus lyrata
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

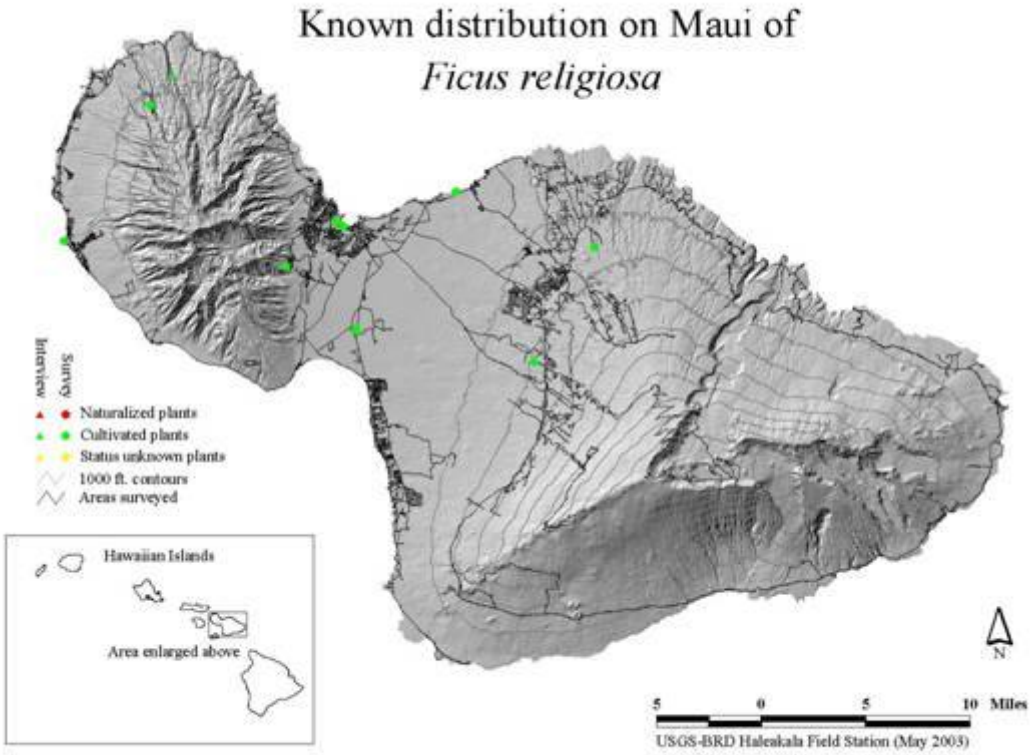

Known distribution on Maui of
Ficus macrophylla
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

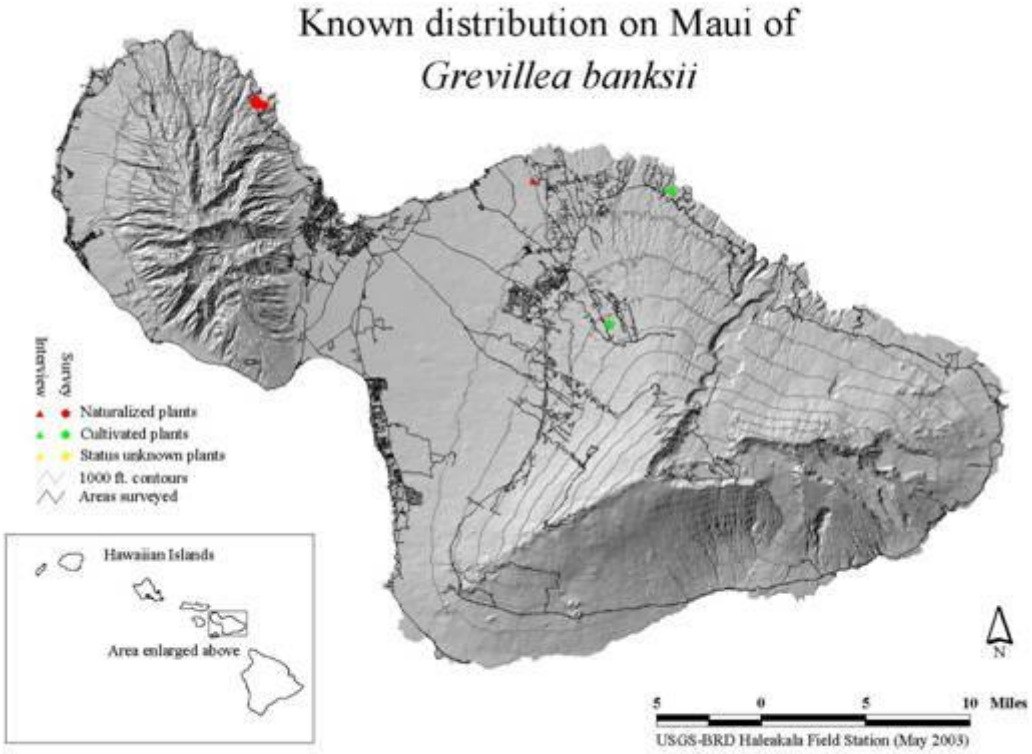

Known distribution on Maui of
Ficus microcarpa
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

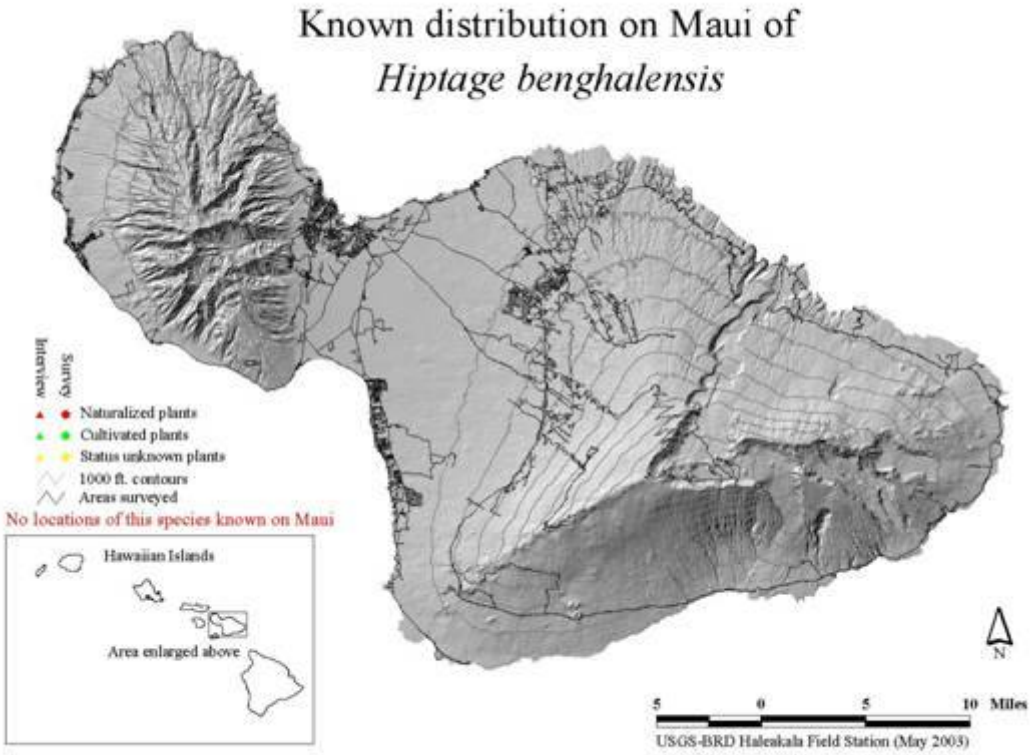

Known distribution on Maui of
Ficus nota
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
No locations of this species known on Maui
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

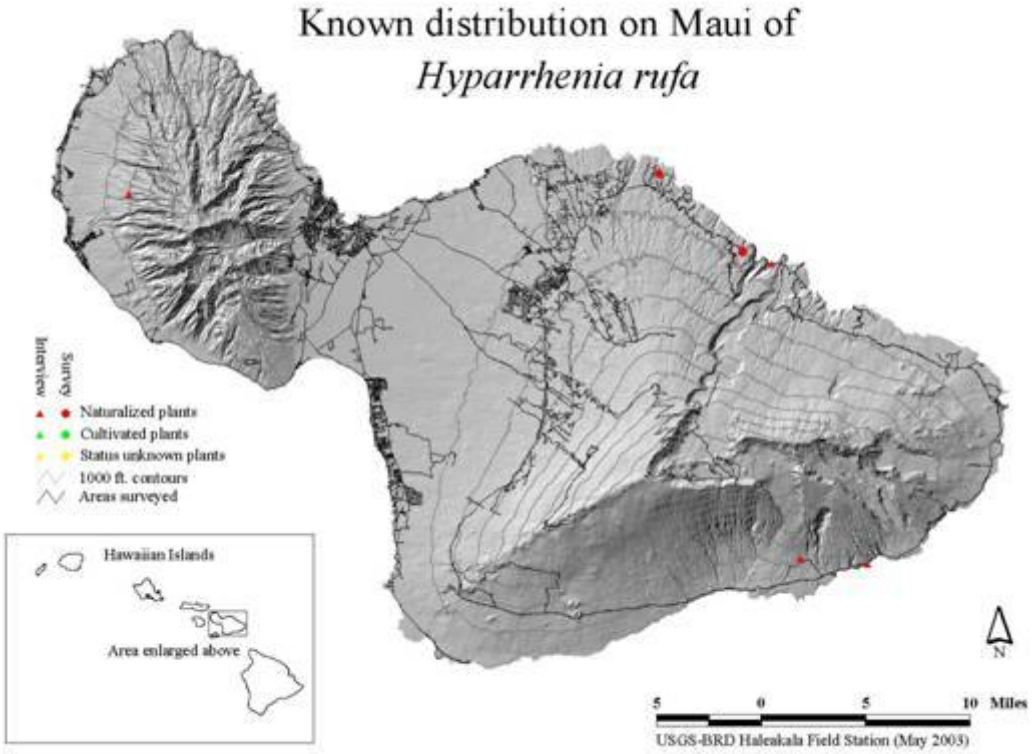

Known distribution on Maui of
Ficus pseudopalma
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

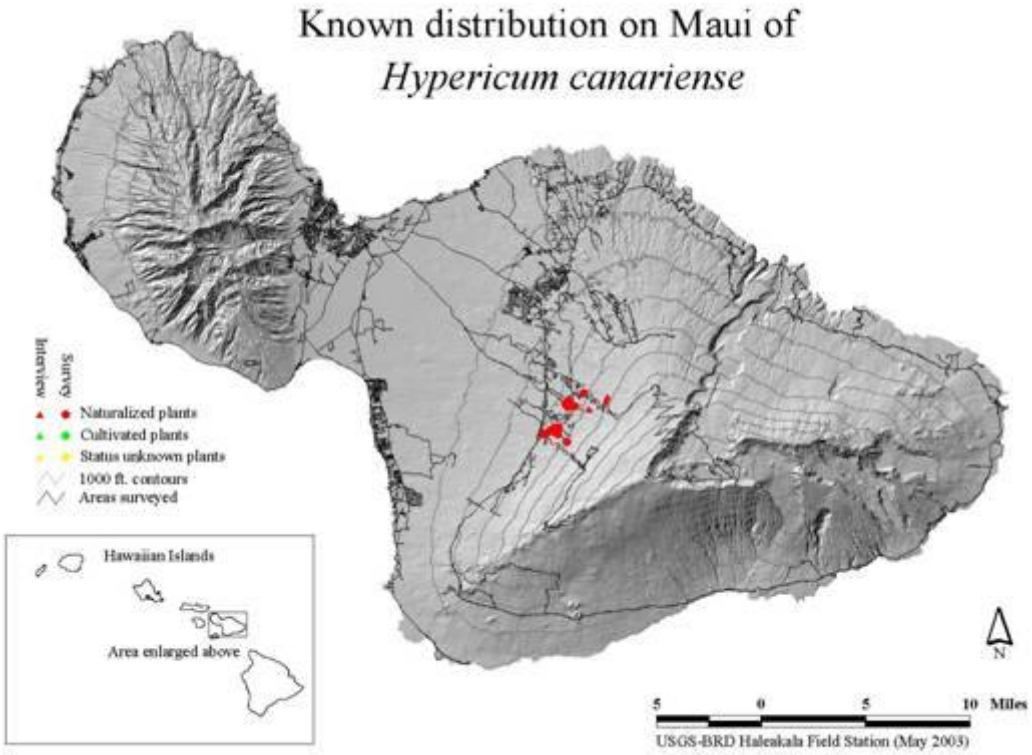

Known distribution on Maui of
Ficus pumila
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

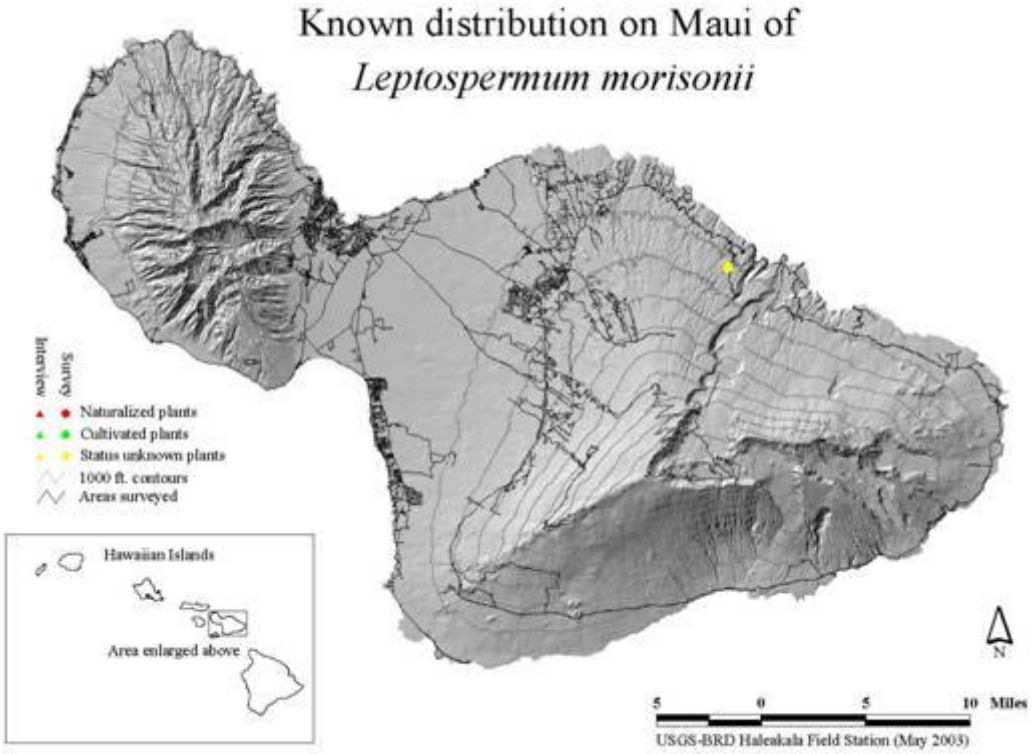

Known distribution on Maui of
Ficus religiosa
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

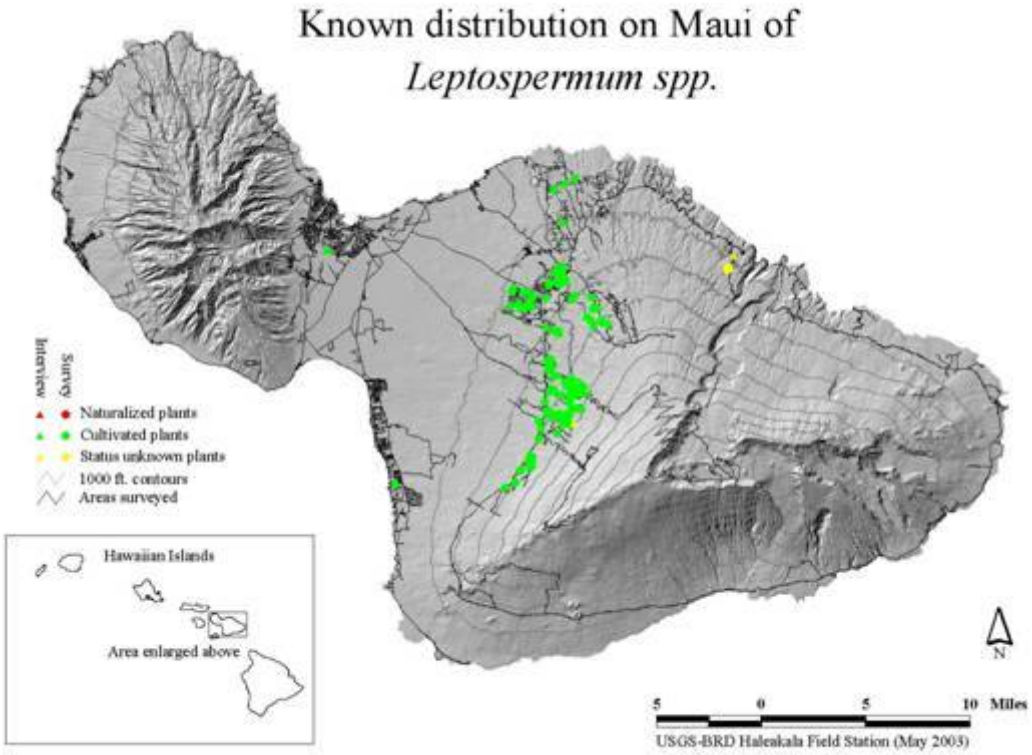

Known distribution on Maui of
Grevillea banksii
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

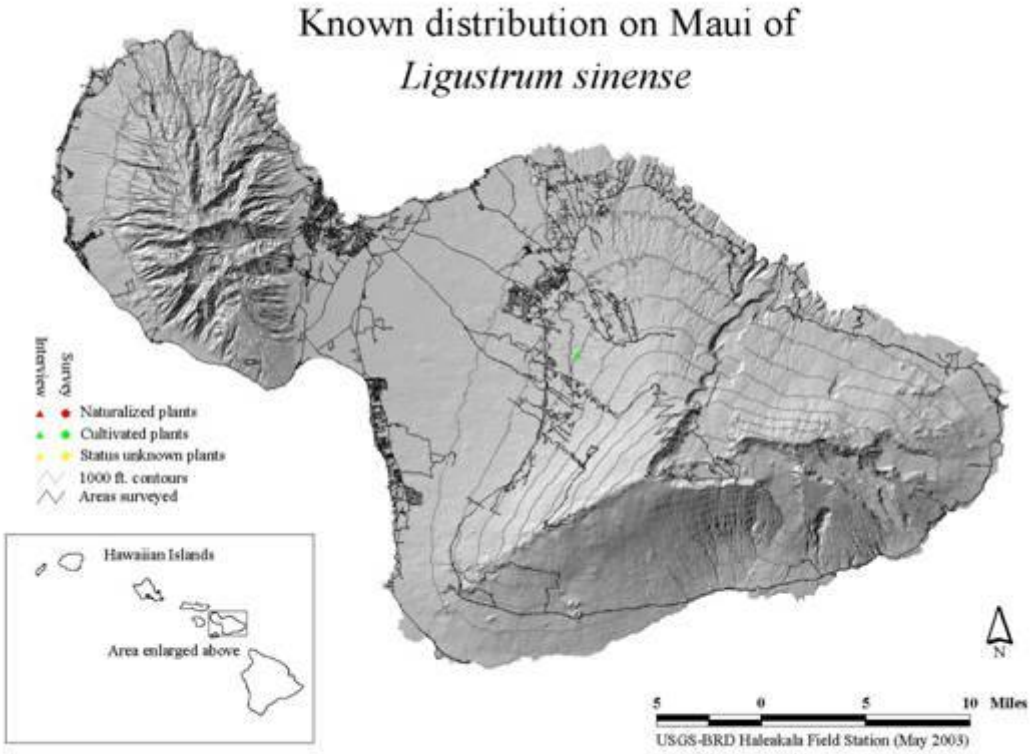

Known distribution on Maui of
Hiptage benghalensis
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
No locations of this species known on Maui
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

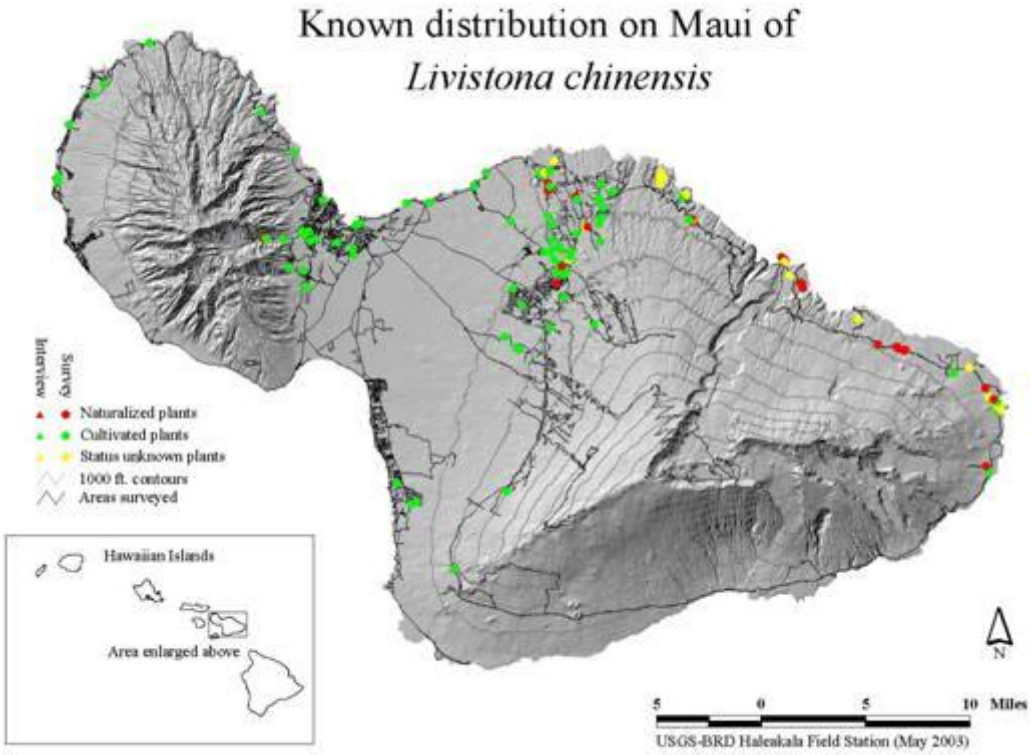

Known distribution on Maui of
Hyparrhenia rufa
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

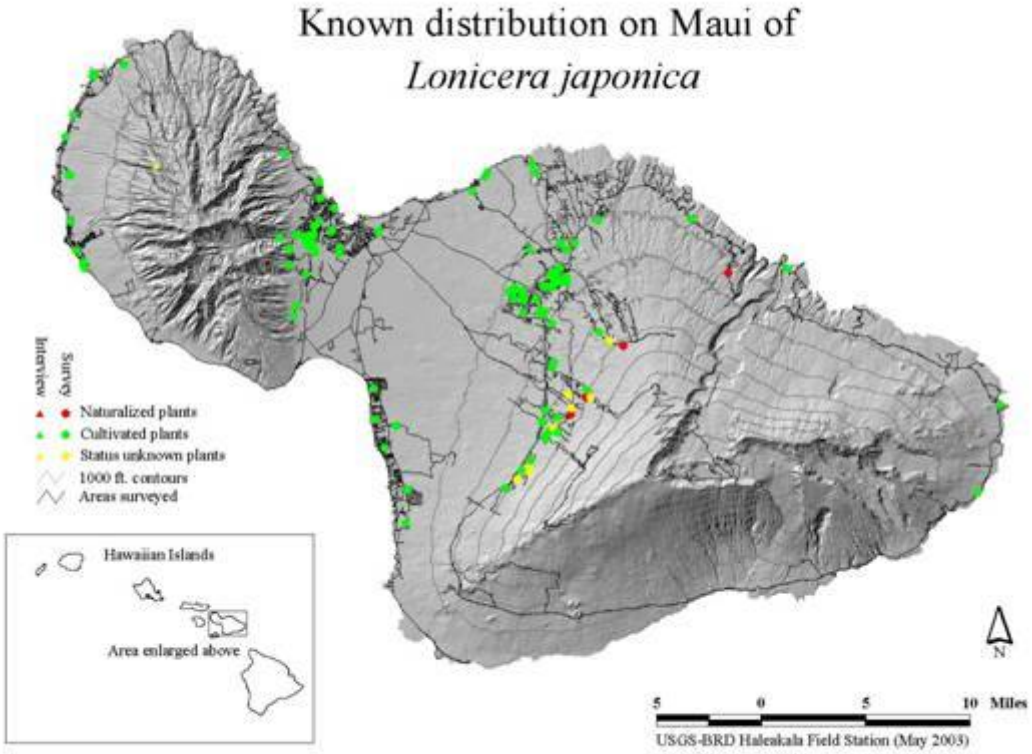

Known distribution on Maui of
Hypericum canariense
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

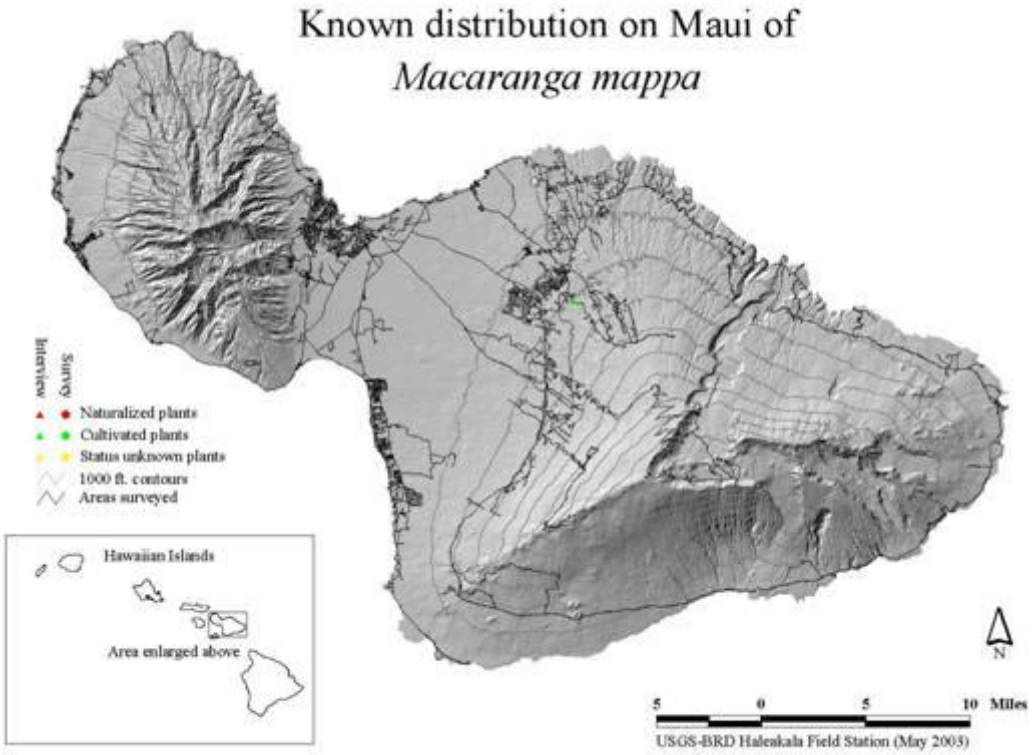

Known distribution on Maui of
Leptospermum morisonii
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

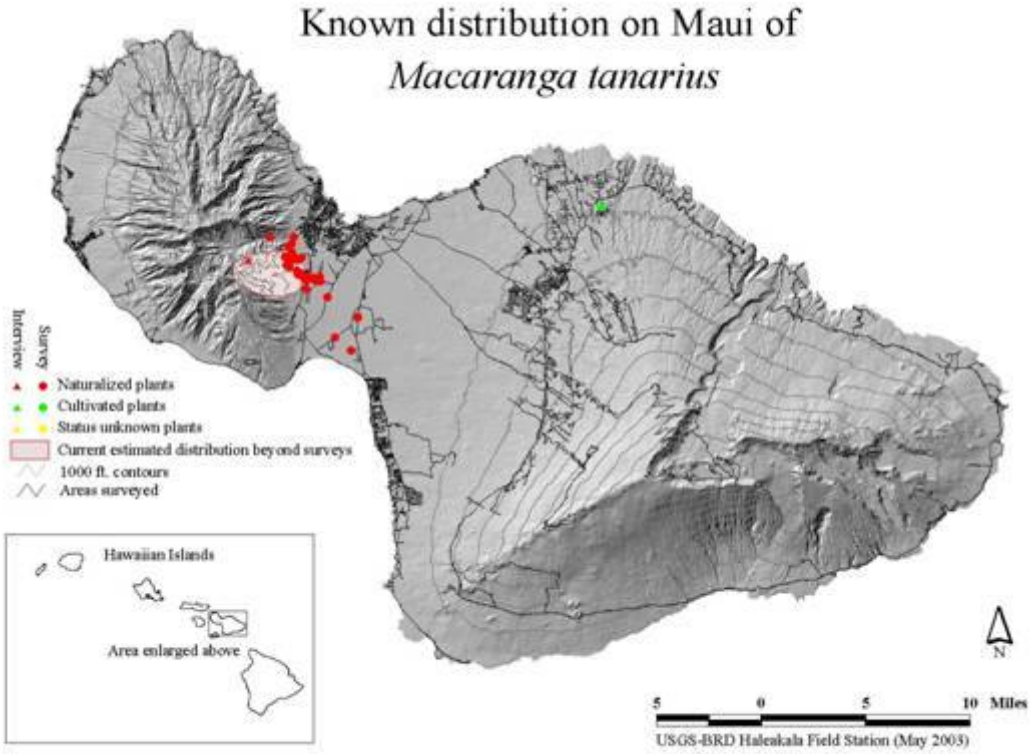

Known distribution on Maui of
Leptospermum spp.
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

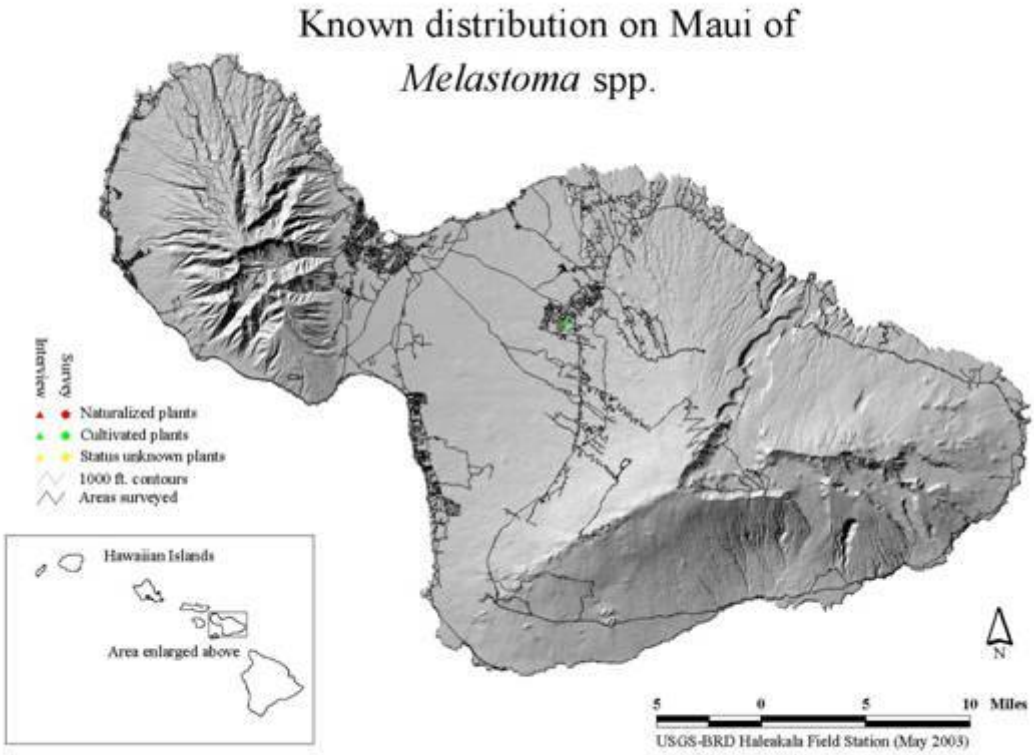

Known distribution on Maui of
Ligustrum sinense
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

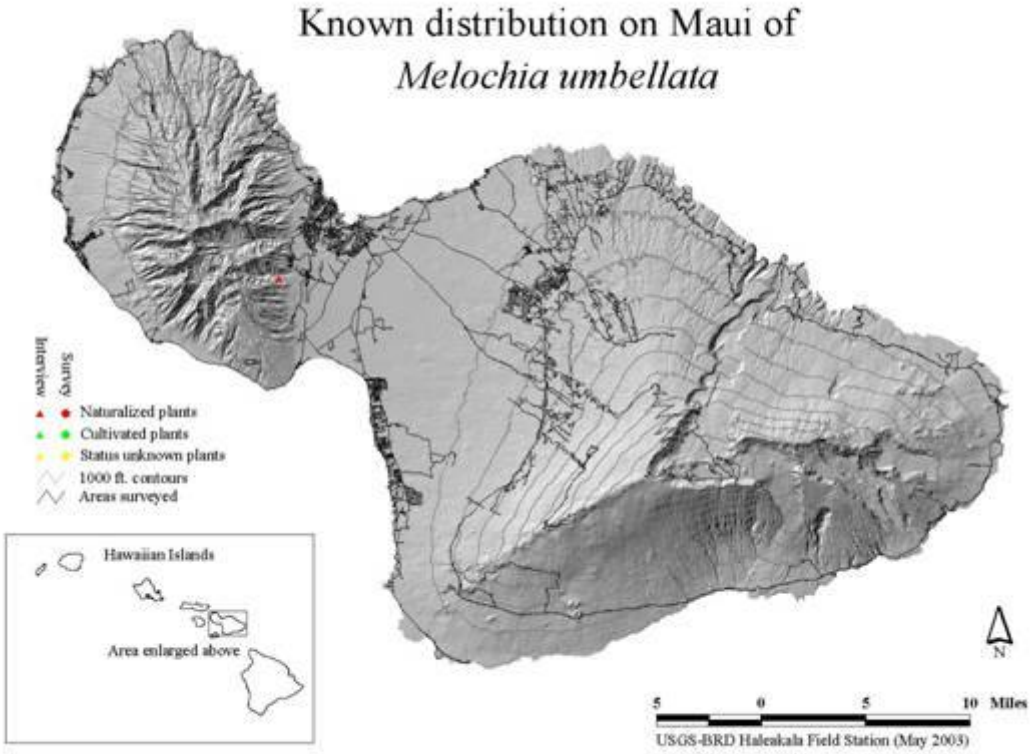

Known distribution on Maui of
Livistona chinensis
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

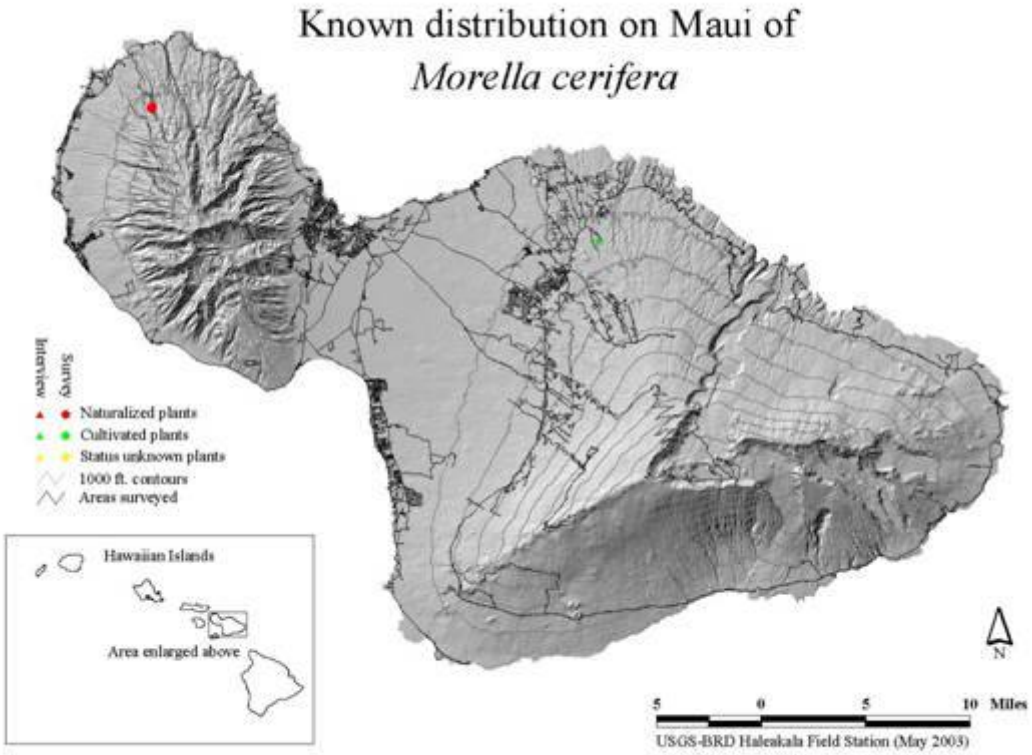

Known distribution on Maui of
Lonicera japonica
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

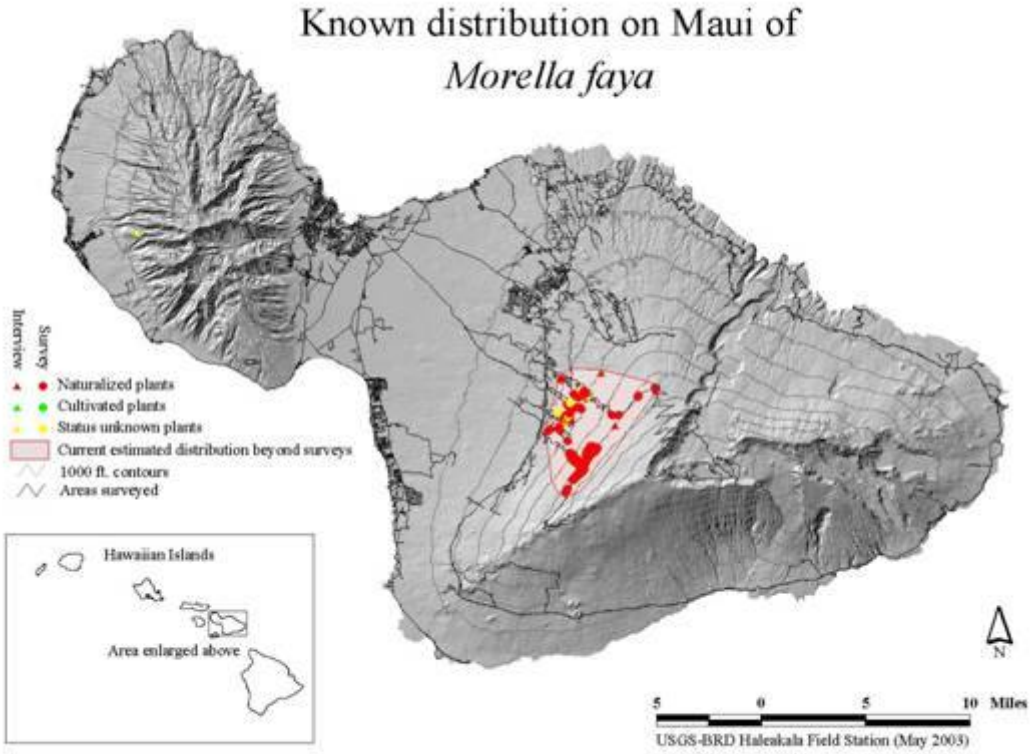

Known distribution on Maui of
Macaranga mappa
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

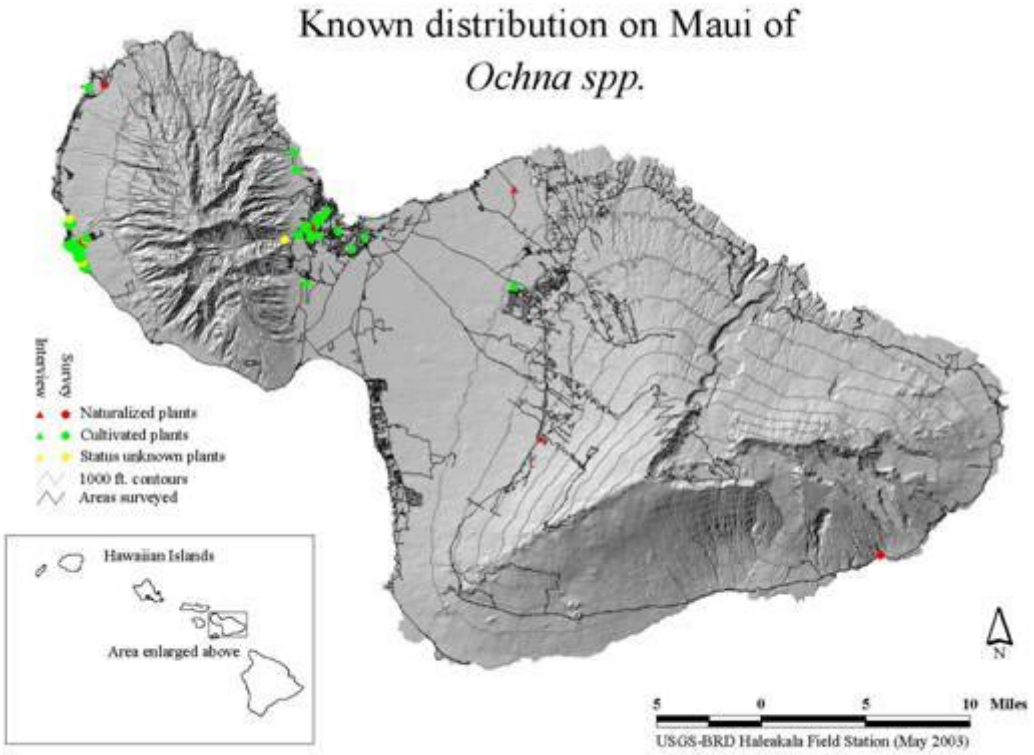

Known distribution on Maui of
Macaranga tanarius
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

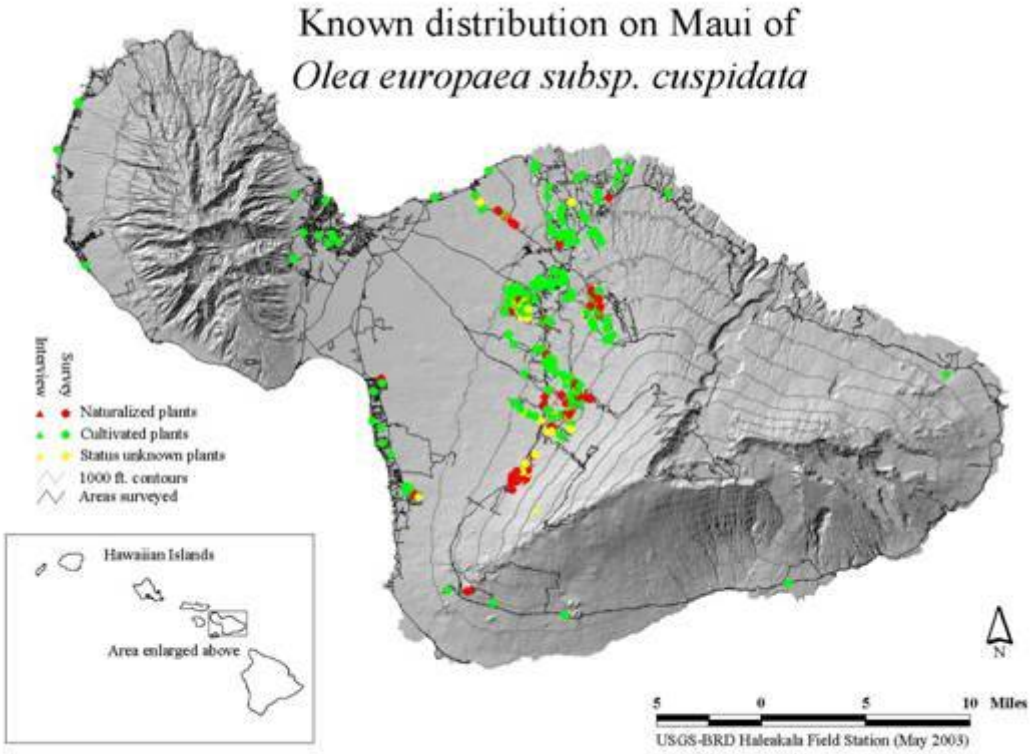

Known distribution on Maui of
Melastoma spp.
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

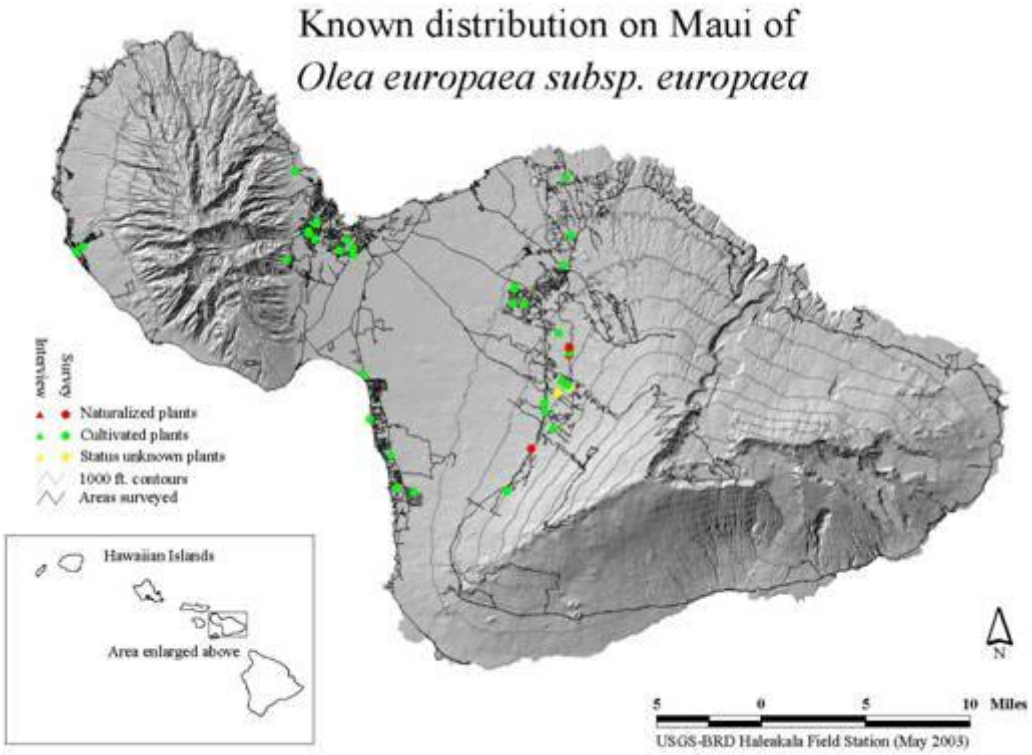

Known distribution on Maui of
Melochia umbellata
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

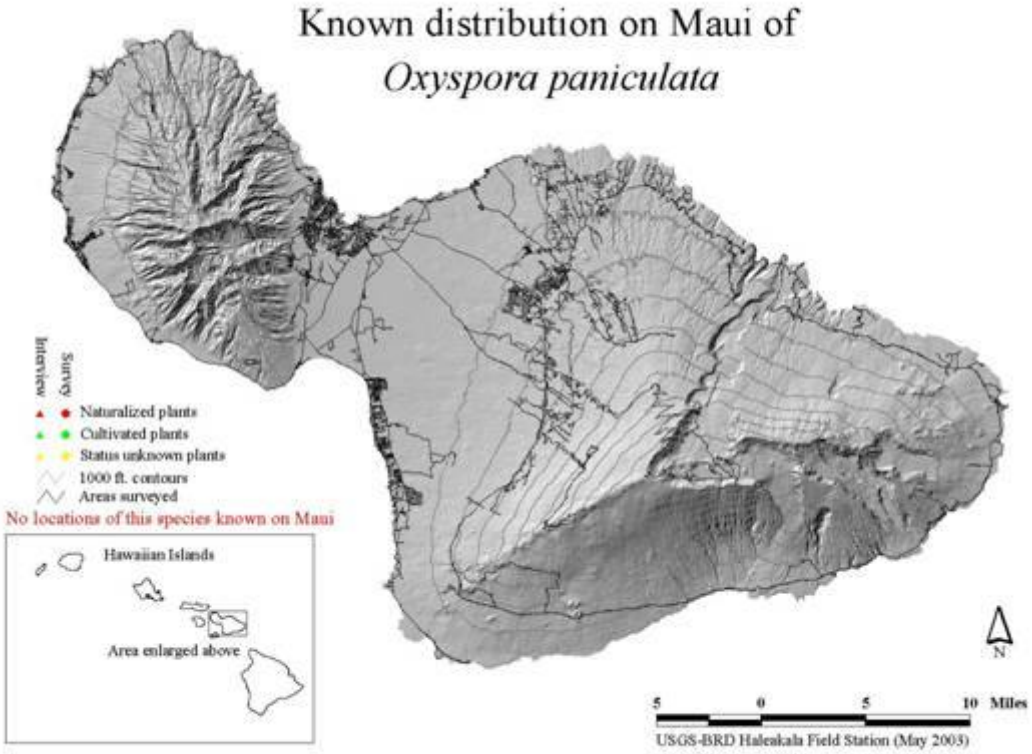

Known distribution on Maui of
Morella cerifera
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

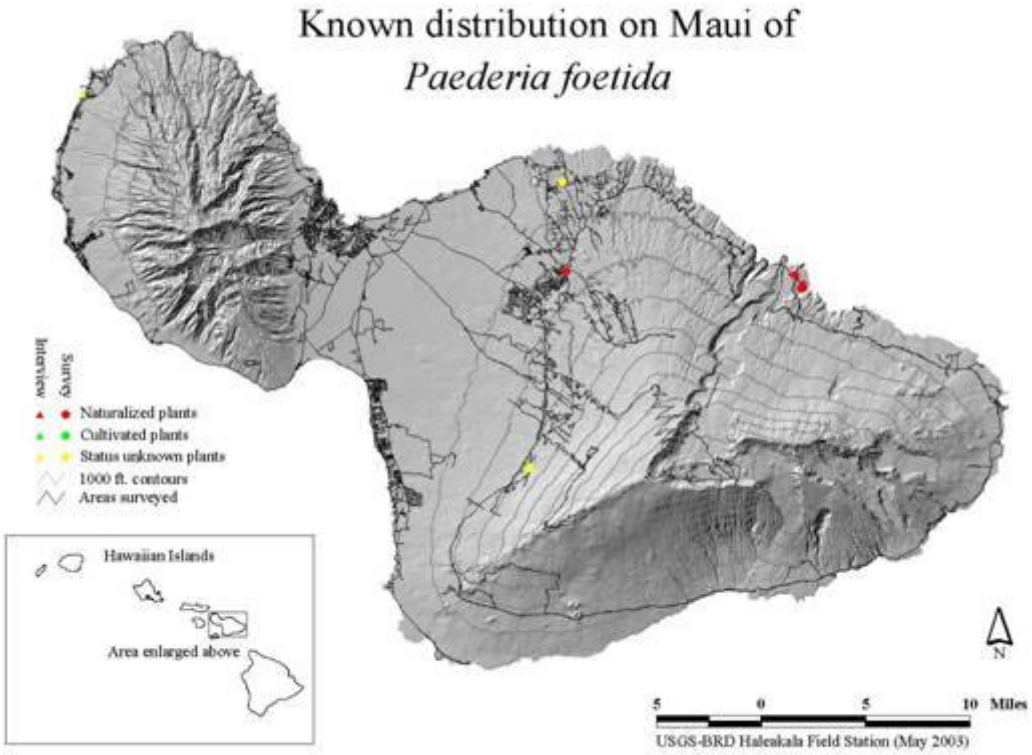

Known distribution on Maui of
Morella faya
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

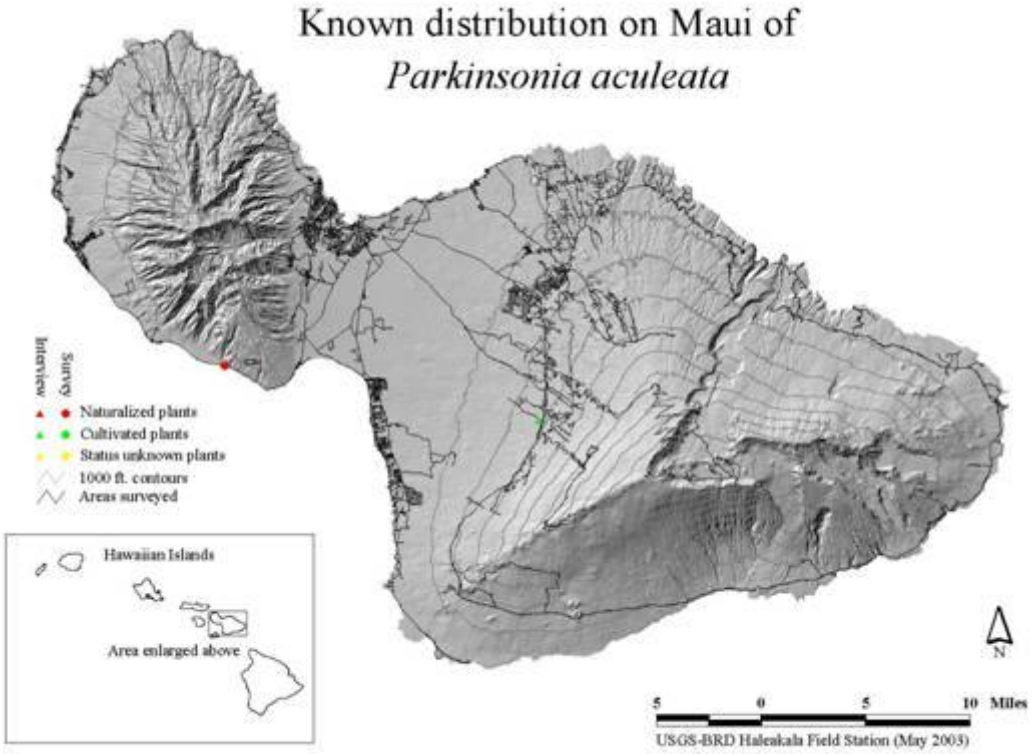

Known distribution on Maui of
Ochna spp.
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

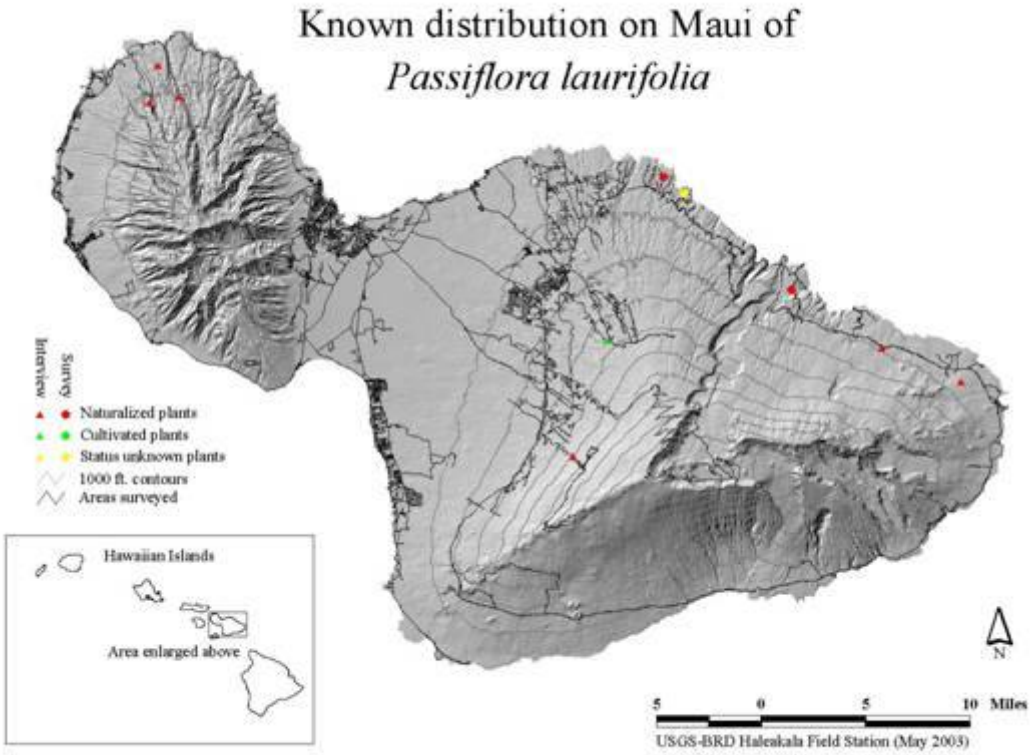

Known distribution on Maui of
Olea europaea subsp. cuspidata
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

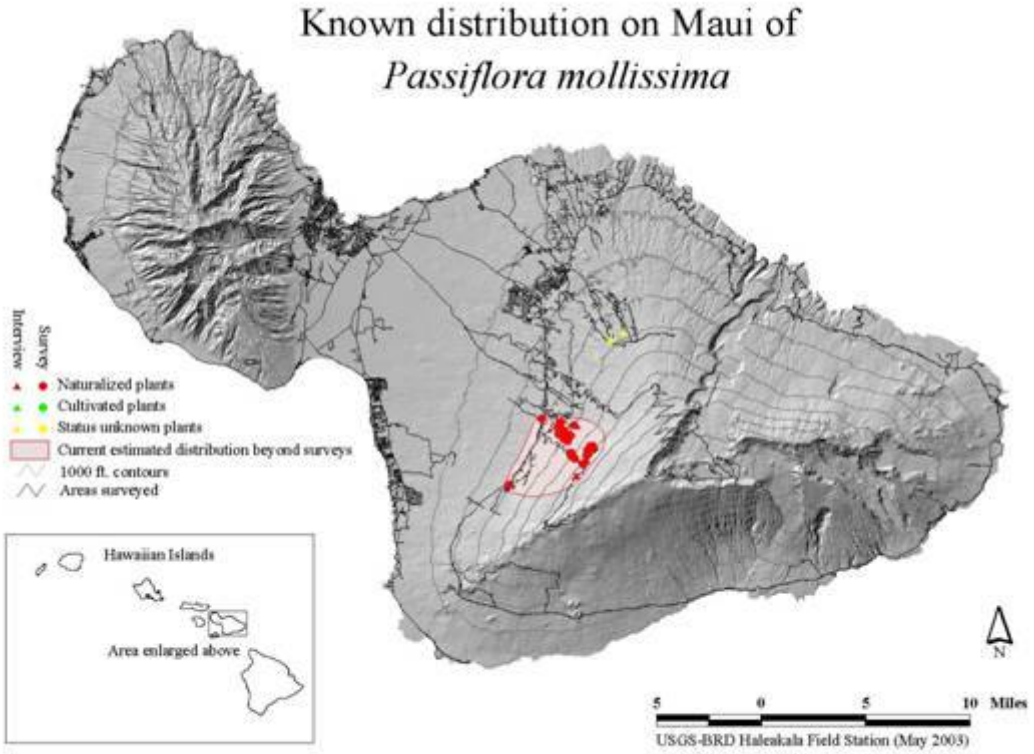

Known distribution on Maui of
Olea europaea subsp. europaea
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

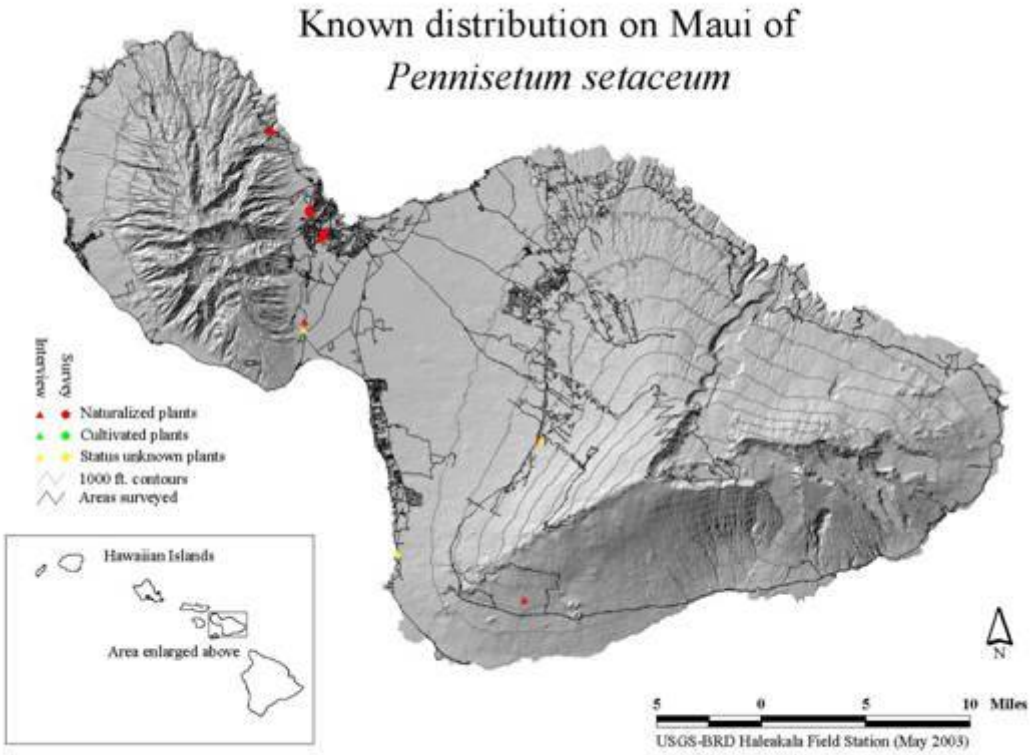

Known distribution on Maui of
Oxyspora paniculata
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
No locations of this species known on Maui
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

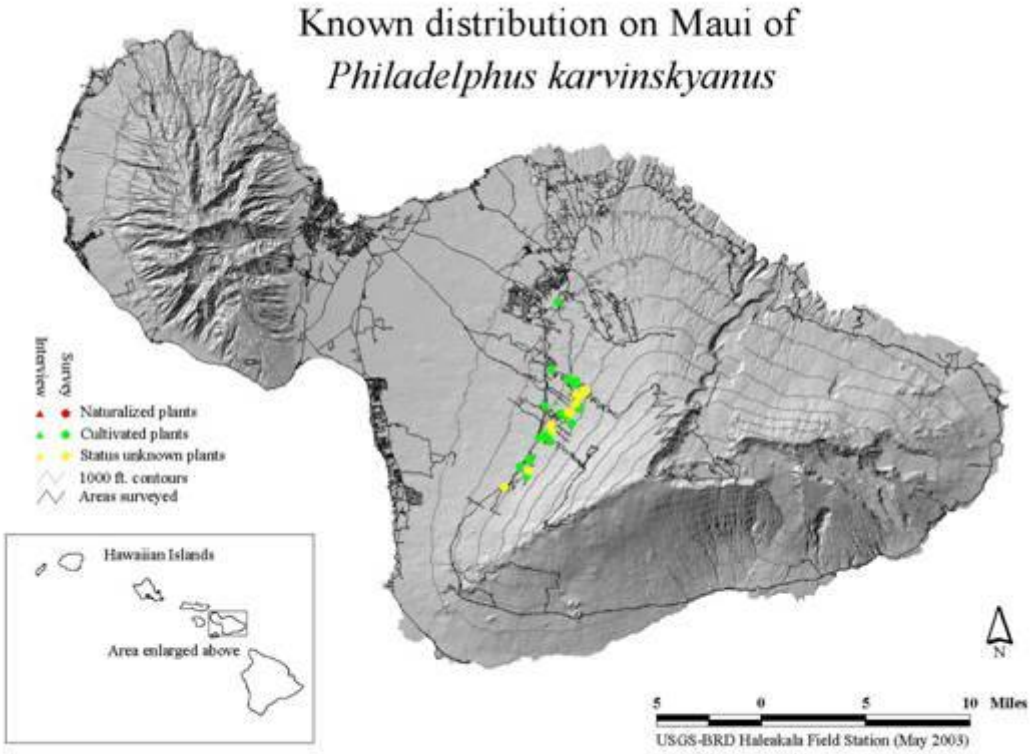

Known distribution on Maui of
Paederia foetida
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

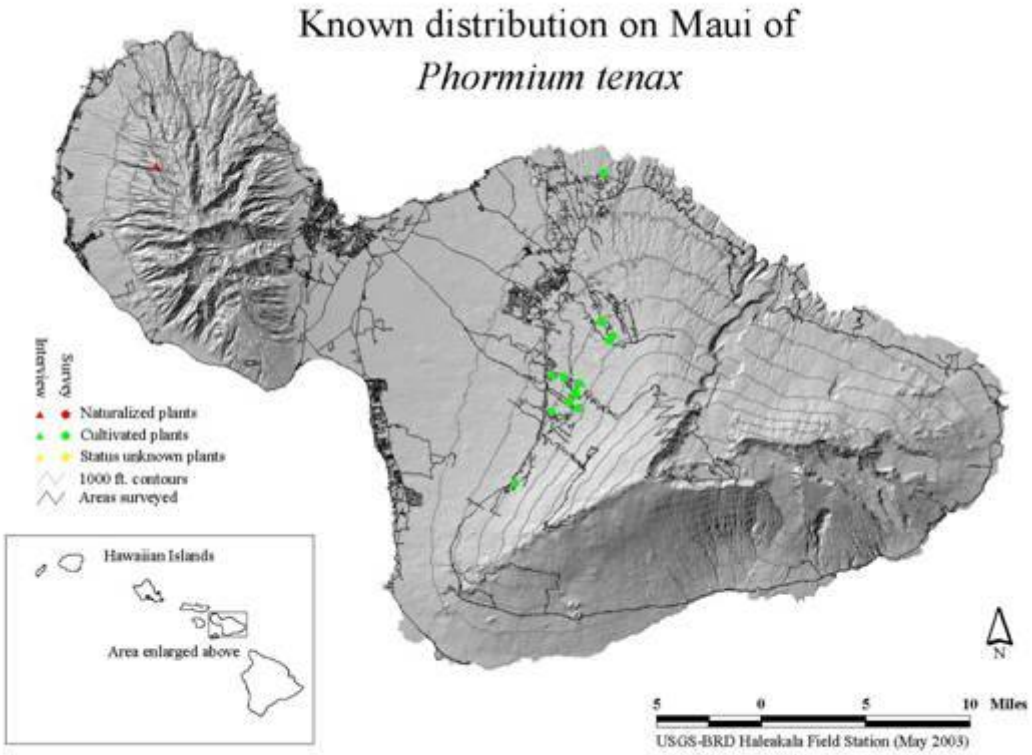

Known distribution on Maui of
Parkinsonia aculeata
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

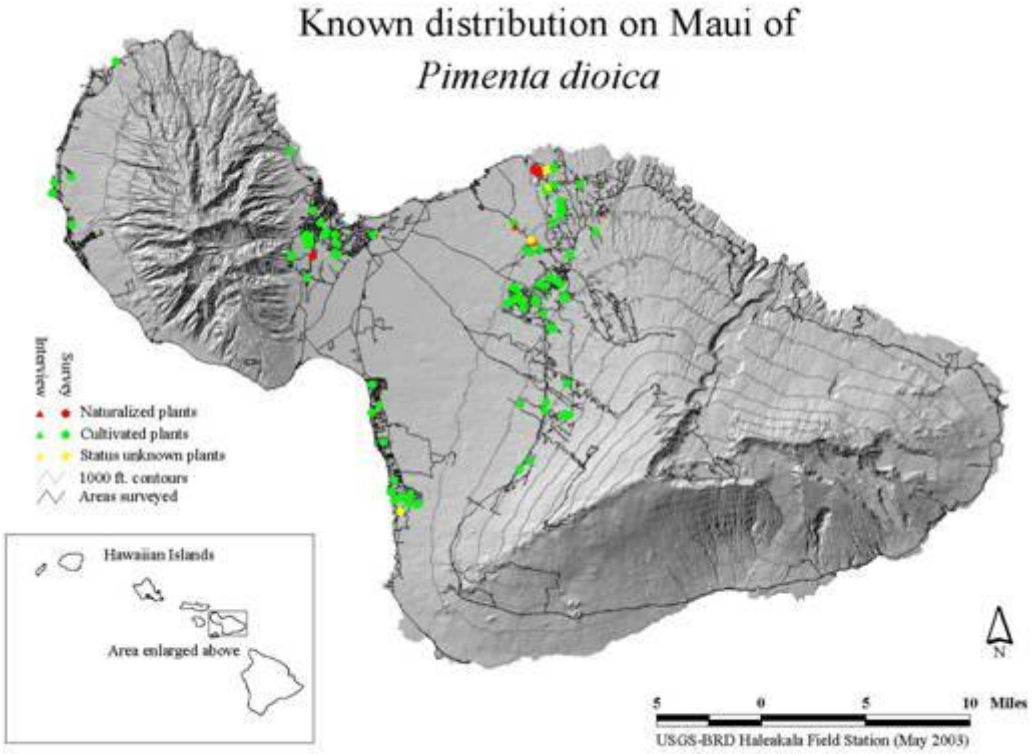

Known distribution on Maui of
Passiflora laurifolia
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

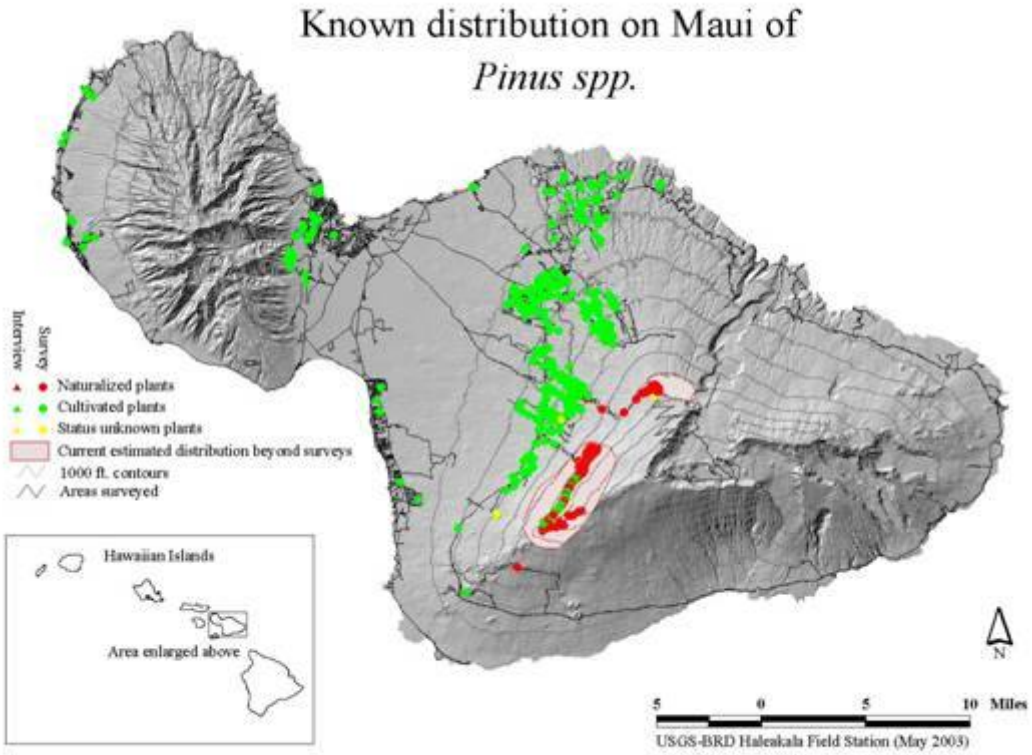

Known distribution on Maui of
Passiflora mollissima
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

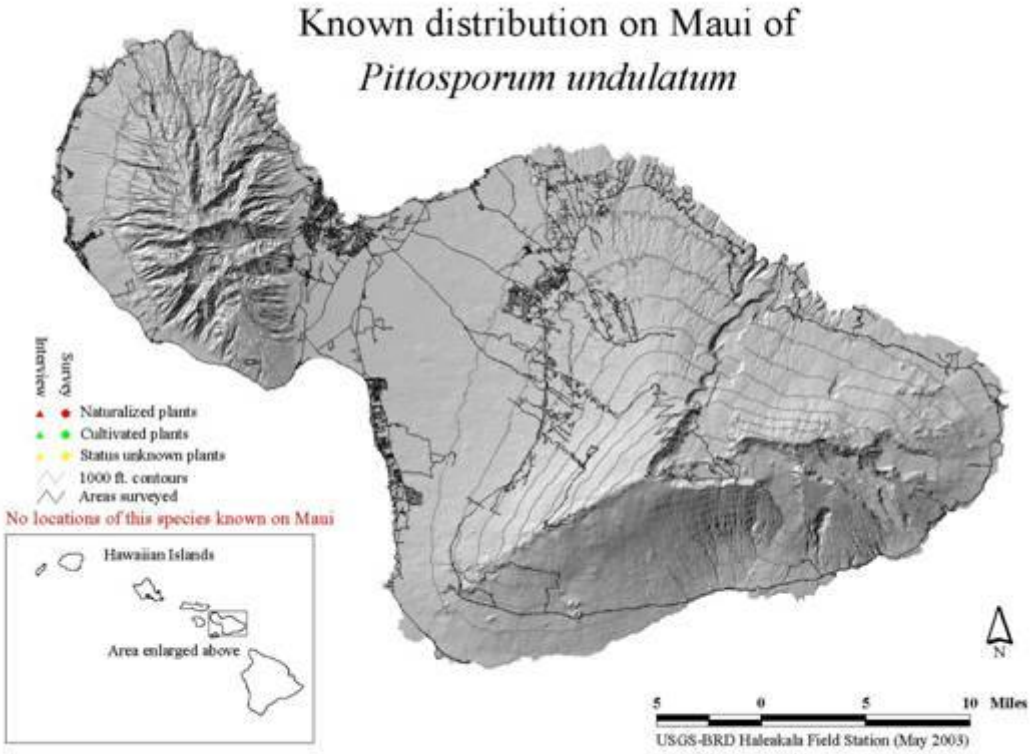

Known distribution on Maui of
Pennisetum setaceum
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

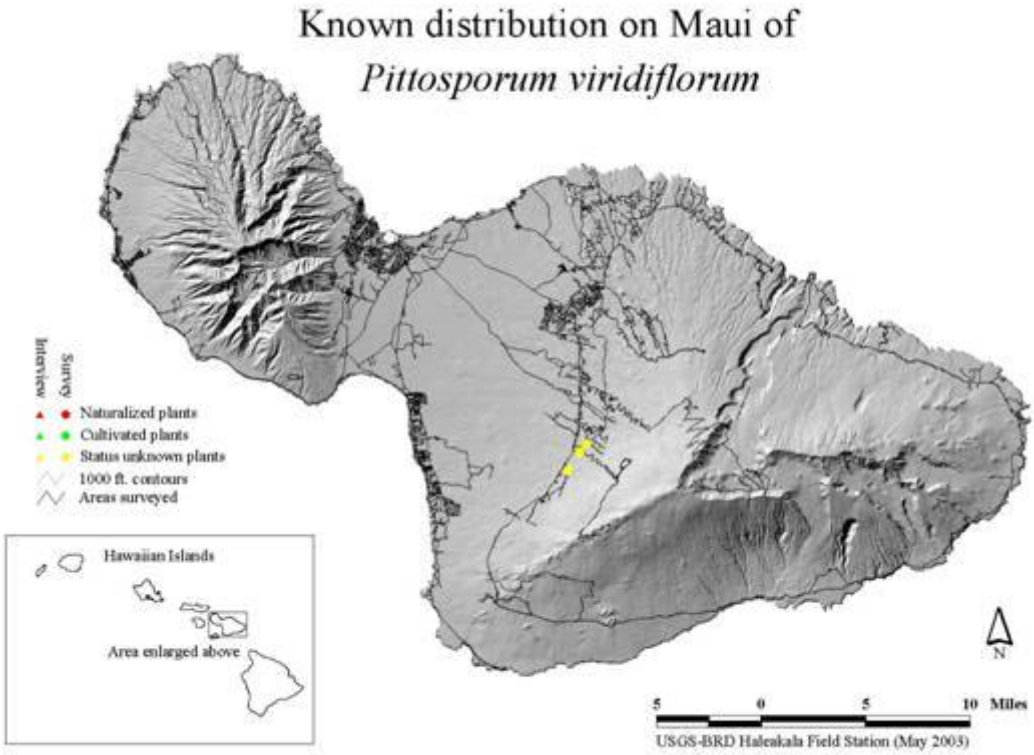

Known distribution on Maui of
Philadelphus karvinskyanus
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

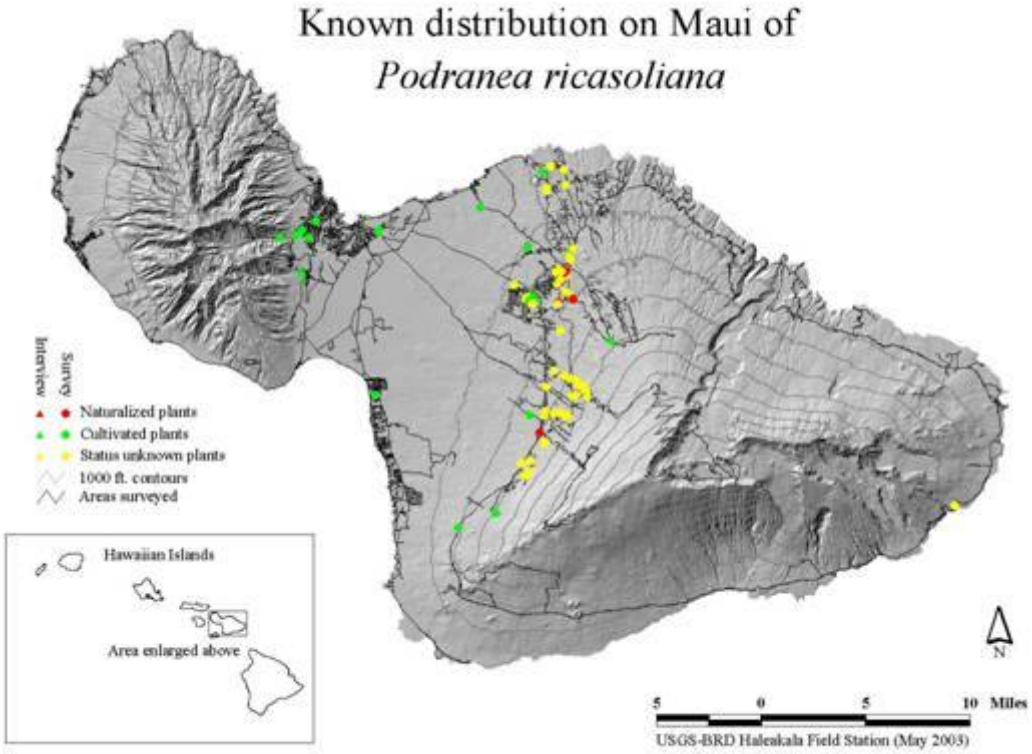

Known distribution on Maui of
Phormium tenax
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

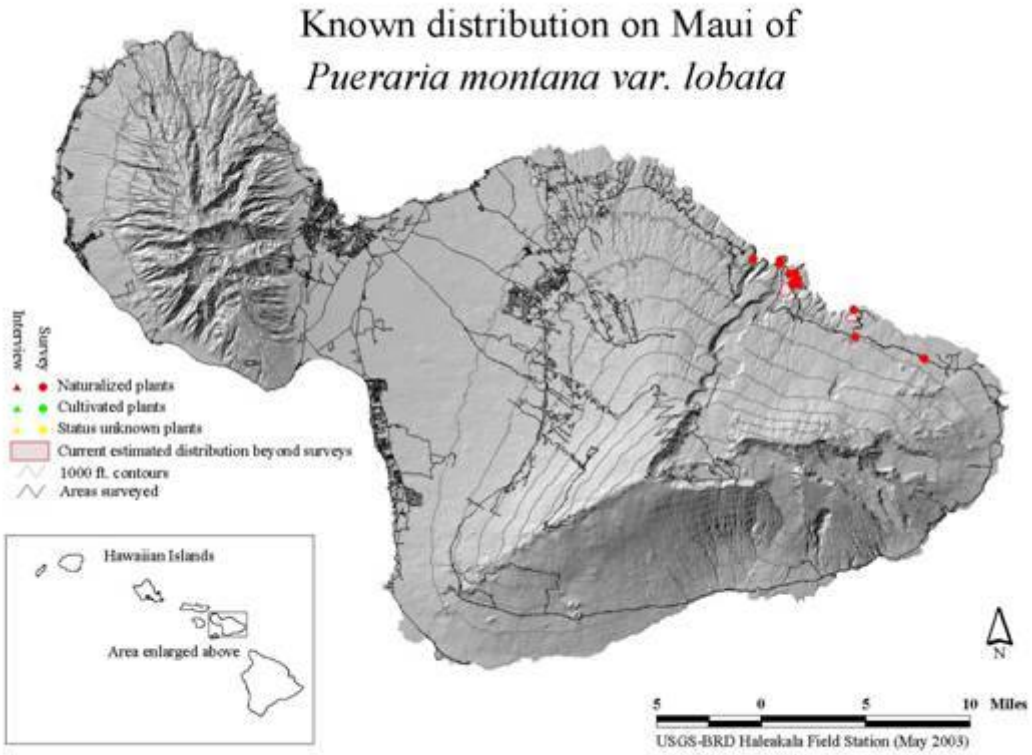

Known distribution on Maui of
Pimenta dioica
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

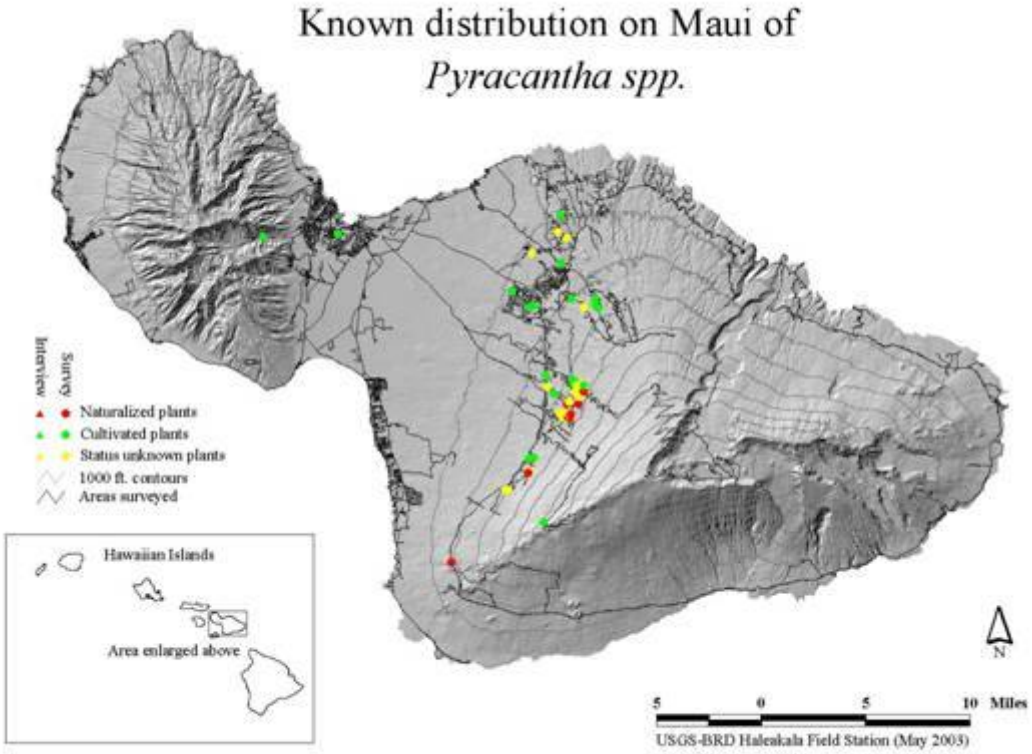

Known distribution on Maui of
Pinus spp.
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

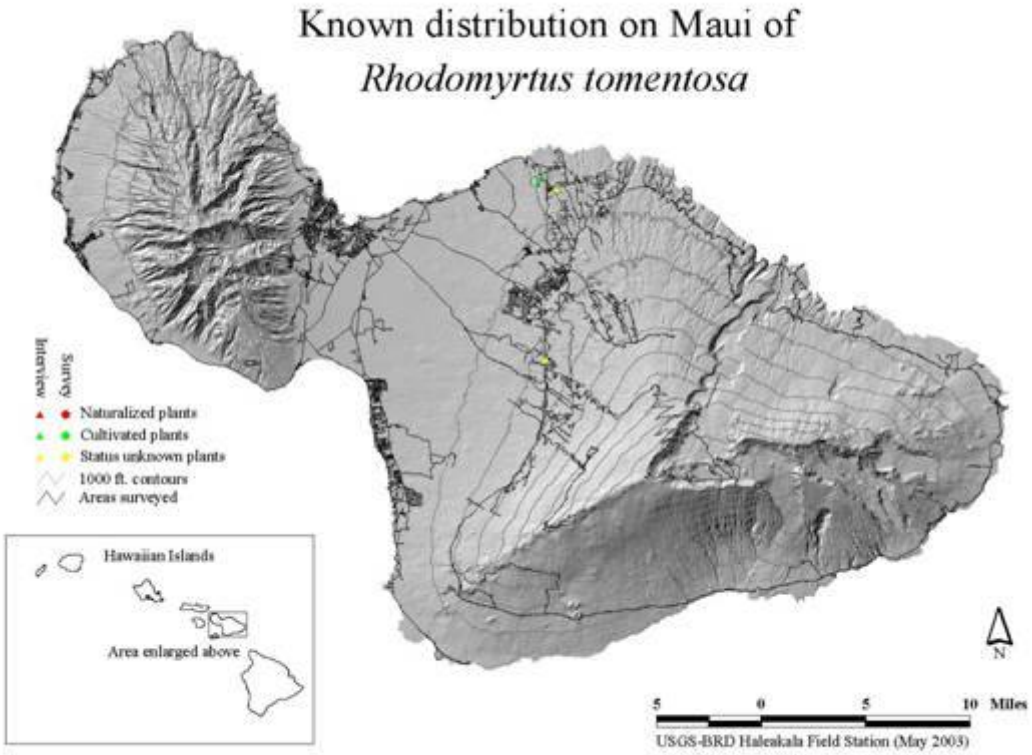

Known distribution on Maui of
Pittosporum undulatum
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
No locations of this species known on Maui
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

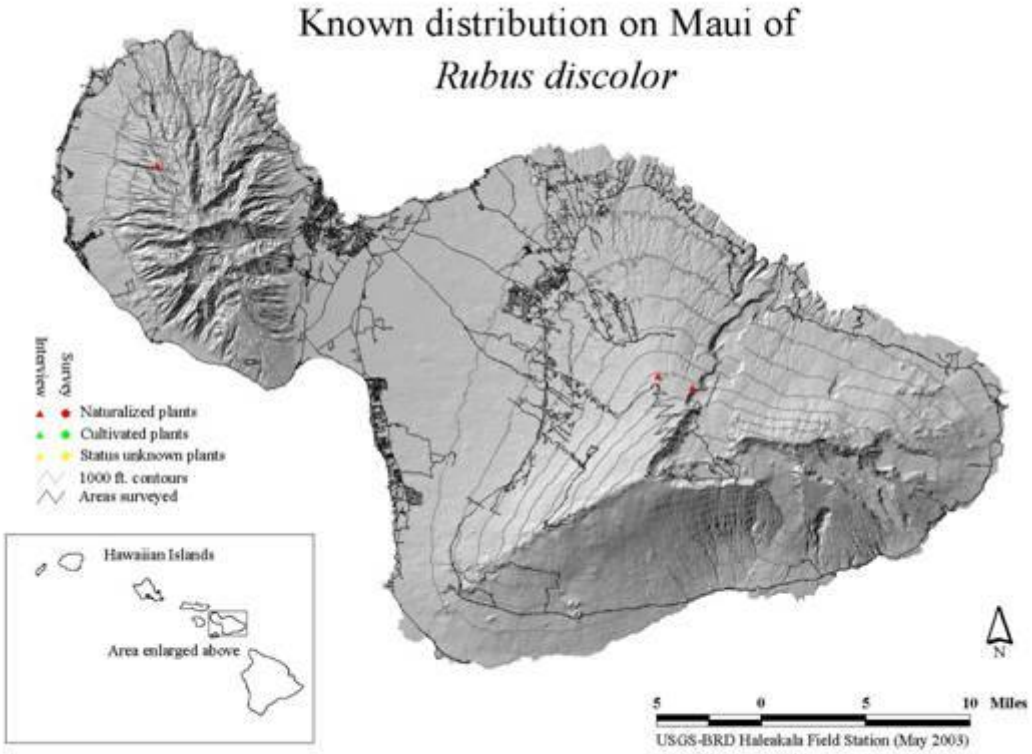

Known distribution on Maui of
Pittosporum viridiflorum
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

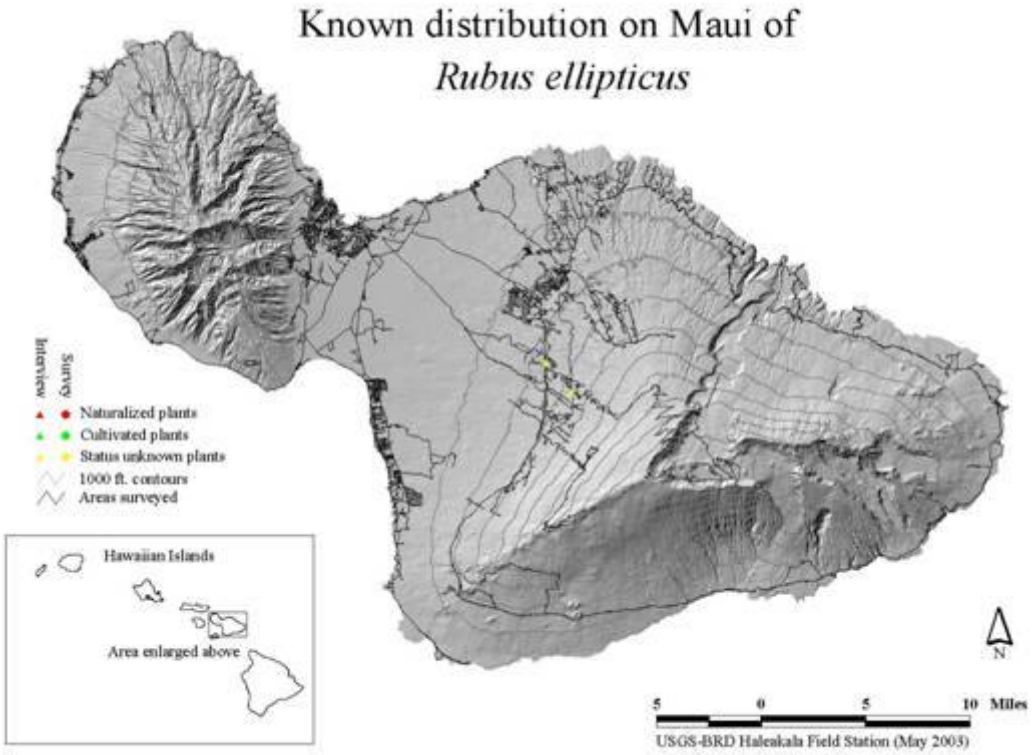

Known distribution on Maui of
Podranea ricasoliana
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

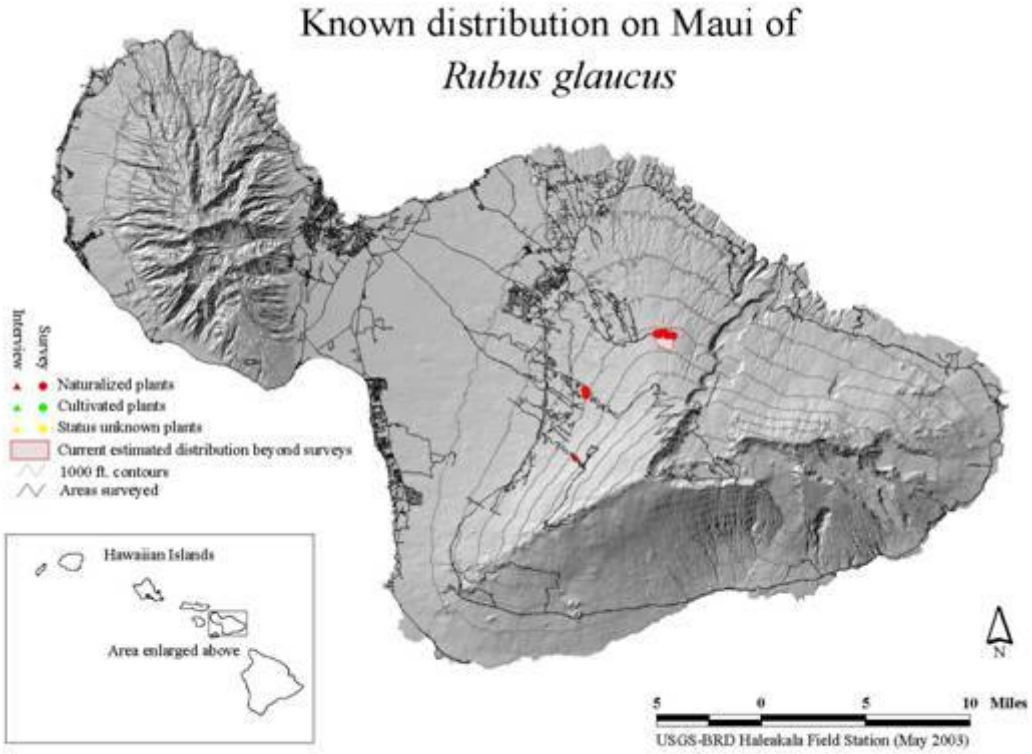

Known distribution on Maui of
Pueraria montana var. lobata
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

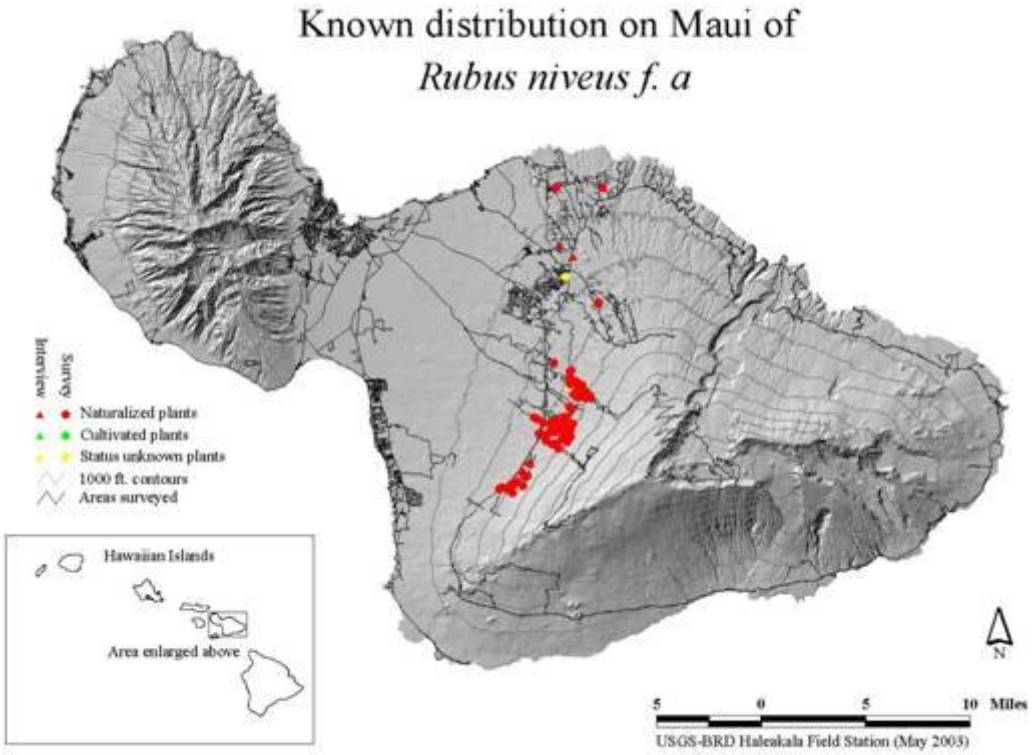

Known distribution on Maui of
Pyracantha spp.
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

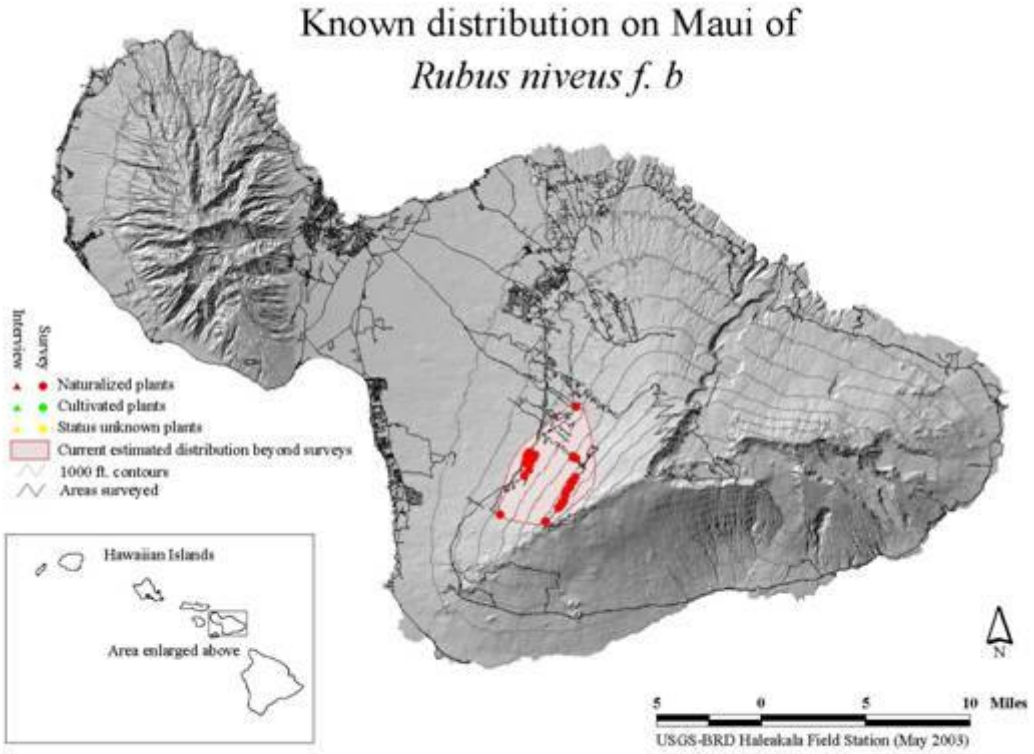

Known distribution on Maui of
Rhodomyrtus tomentosa
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

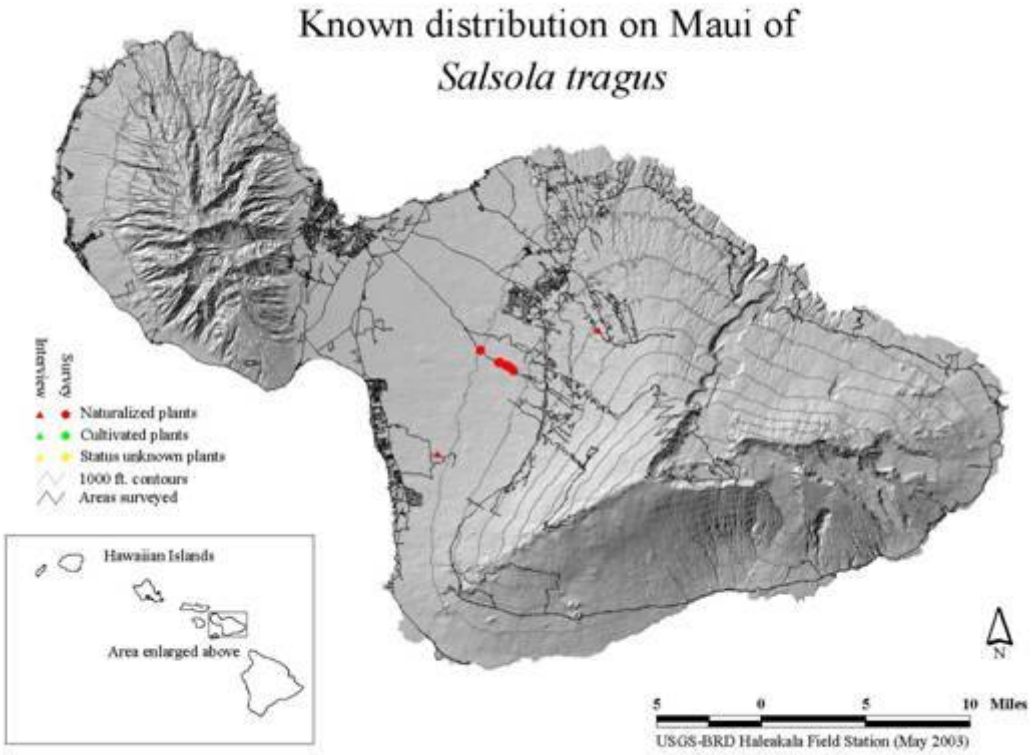

Known distribution on Maui of
Rubus discolor
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

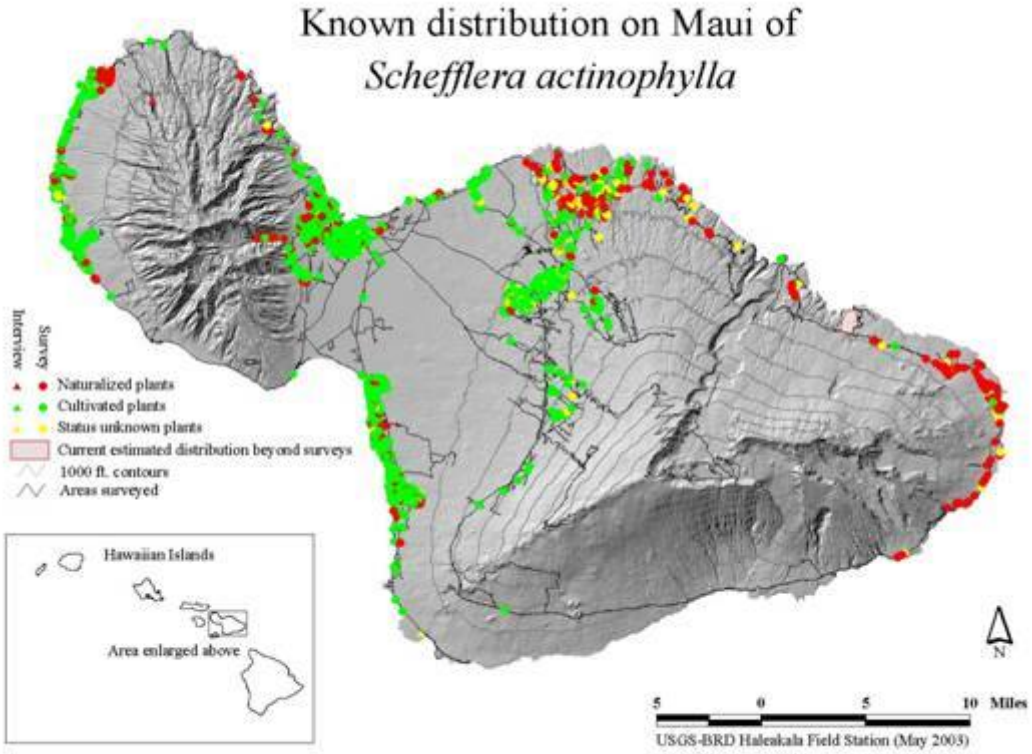

Known distribution on Maui of
Rubus ellipticus
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

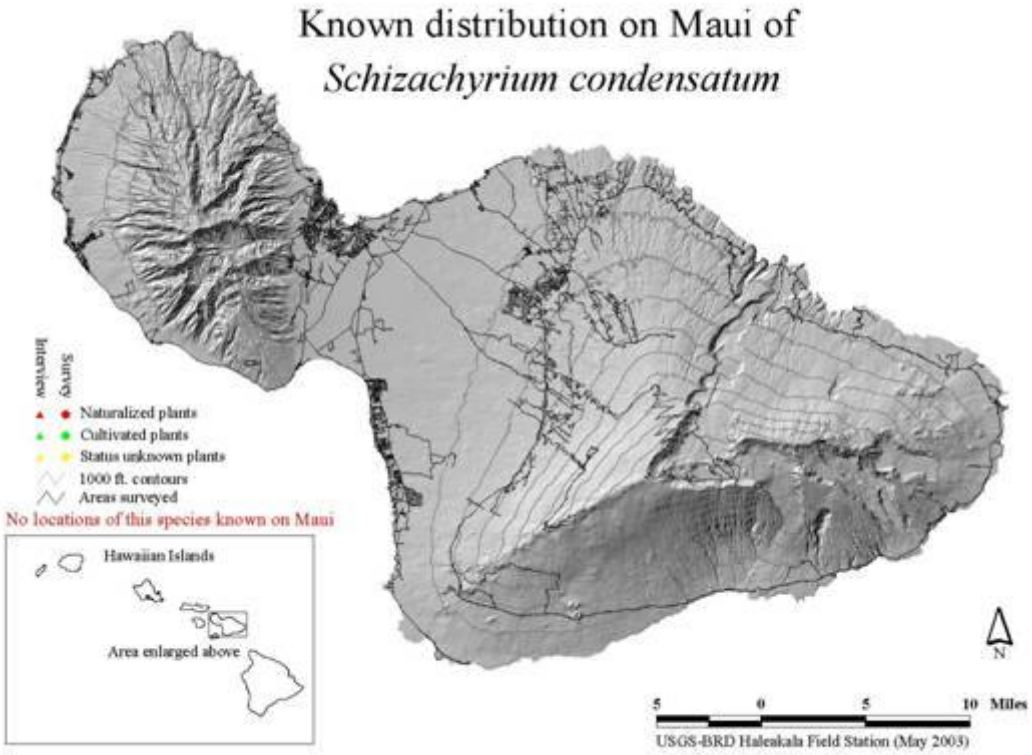

Known distribution on Maui of
Rubus glaucus
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

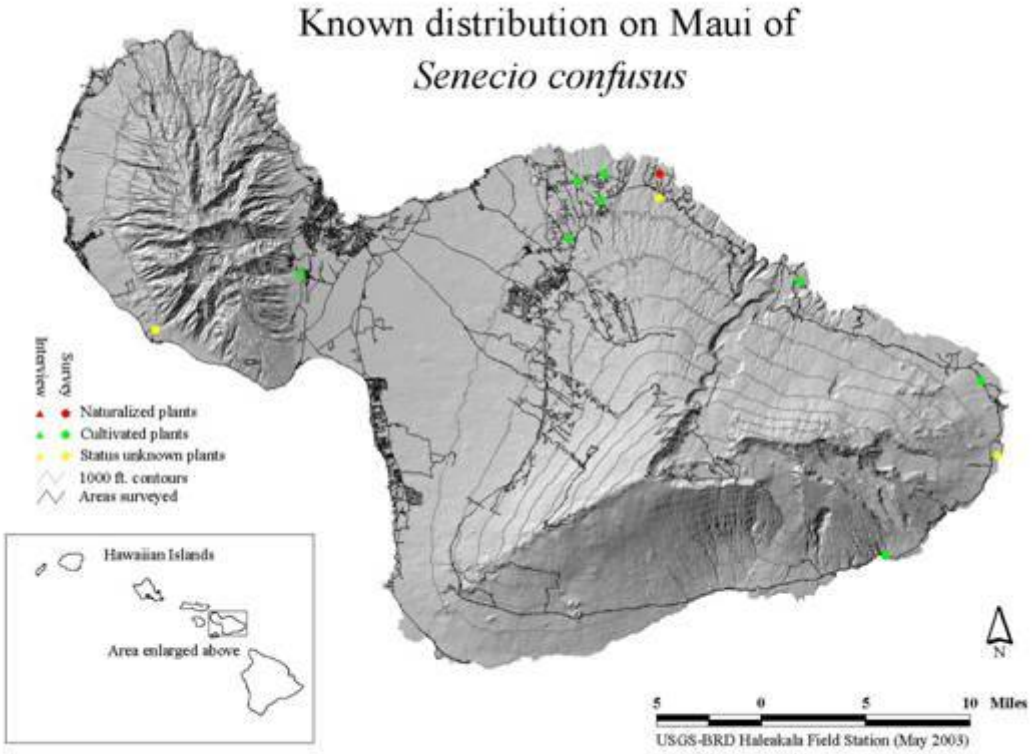

Known distribution on Maui of
Rubus niveus f. a
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

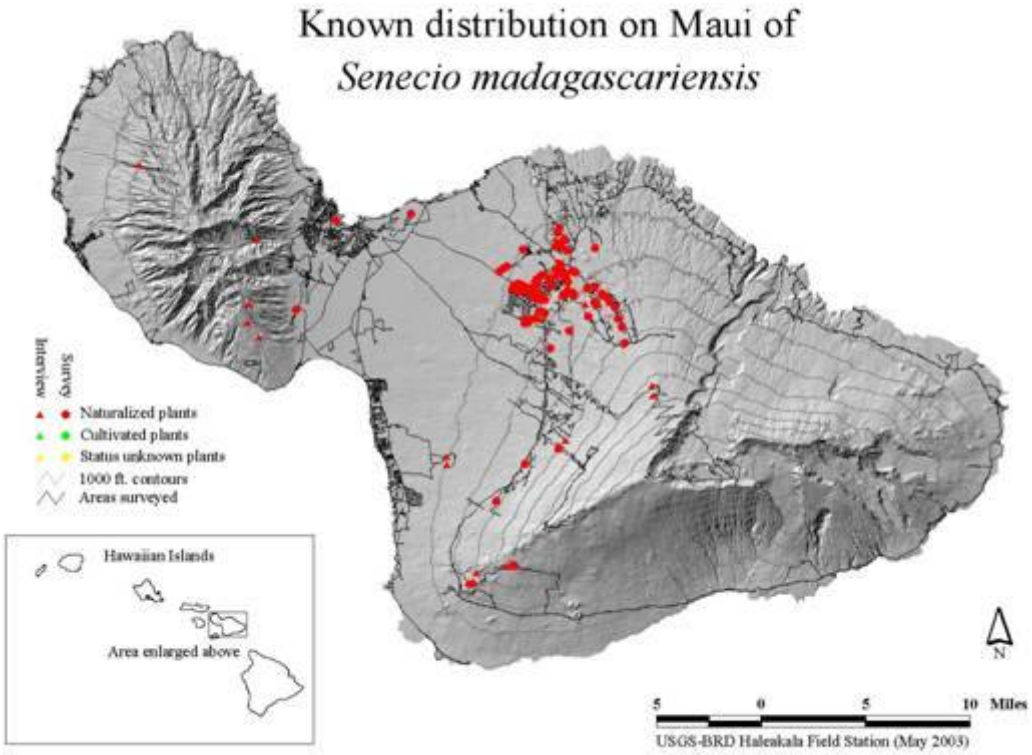

Known distribution on Maui of
Rubus niveus f. b
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

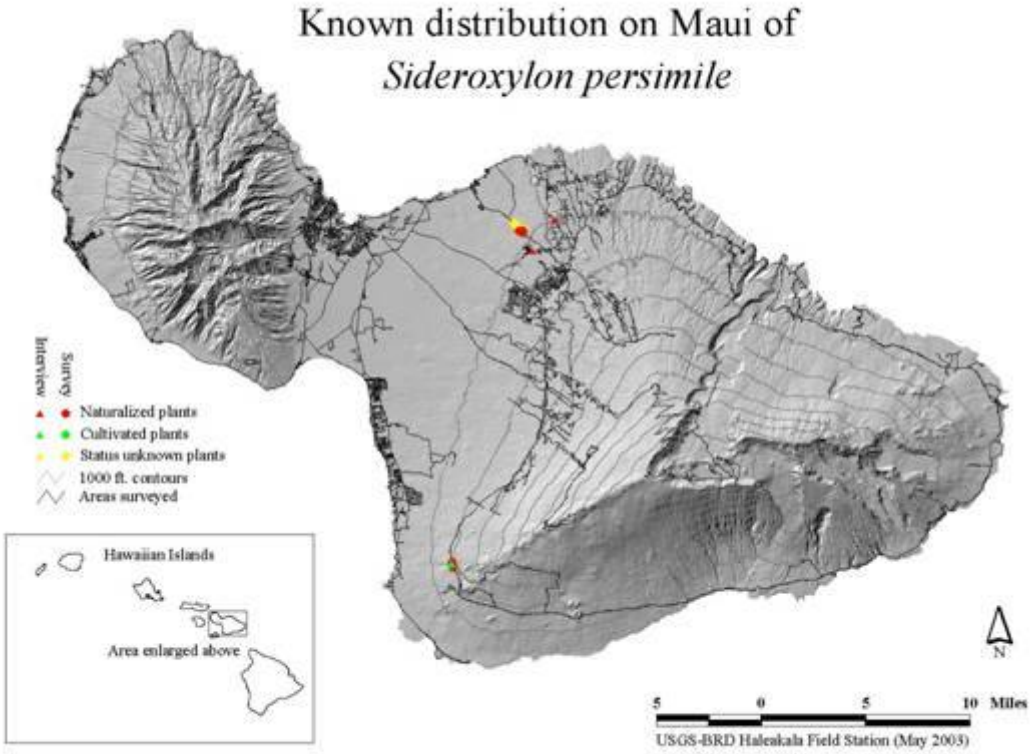

Known distribution on Maui of
Salsola tragus
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

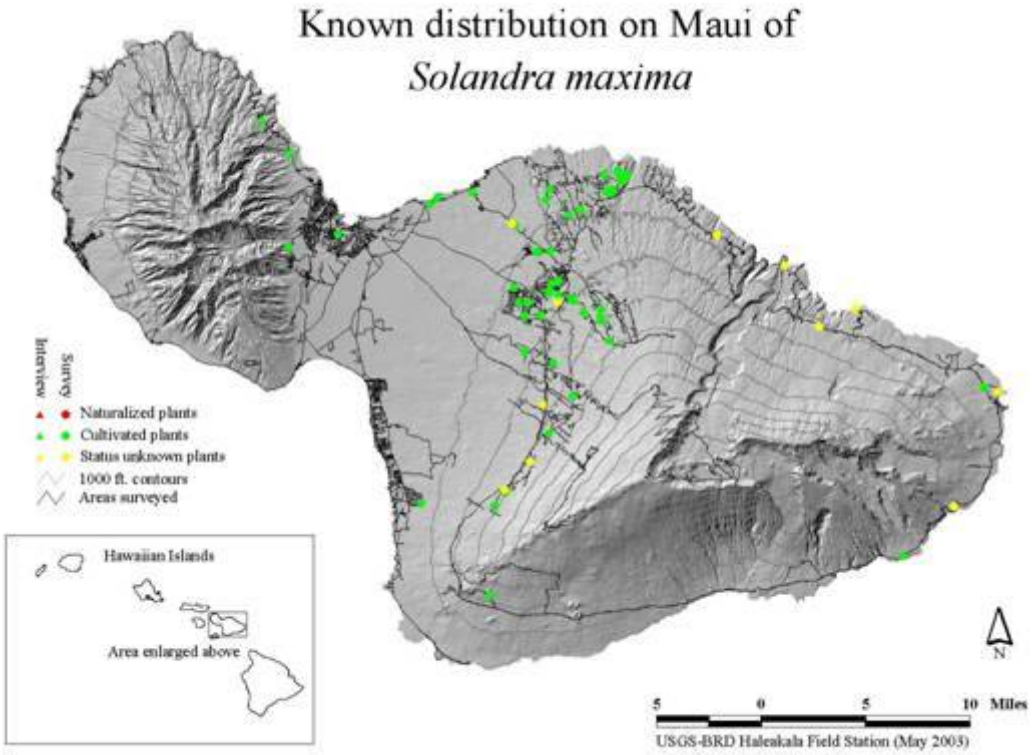

Known distribution on Maui of
Schefflera actinophylla
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
Current estimated distribution beyond surveys
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

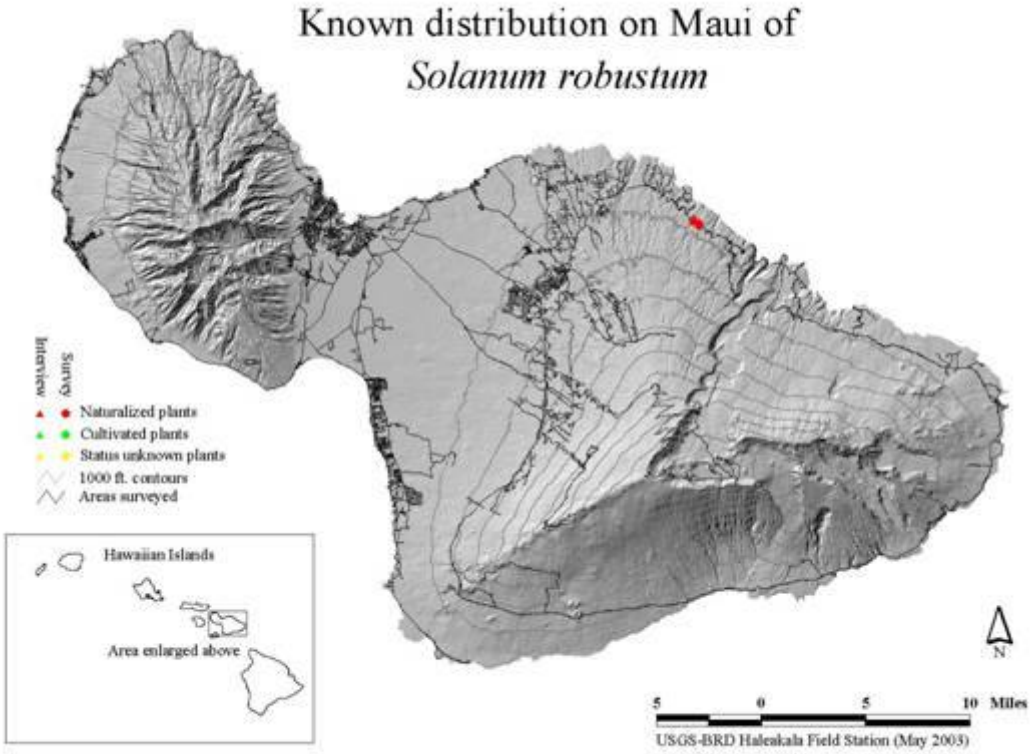

Known distribution on Maui of
Schizachyrium condensatum
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
No locations of this species known on Maui
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

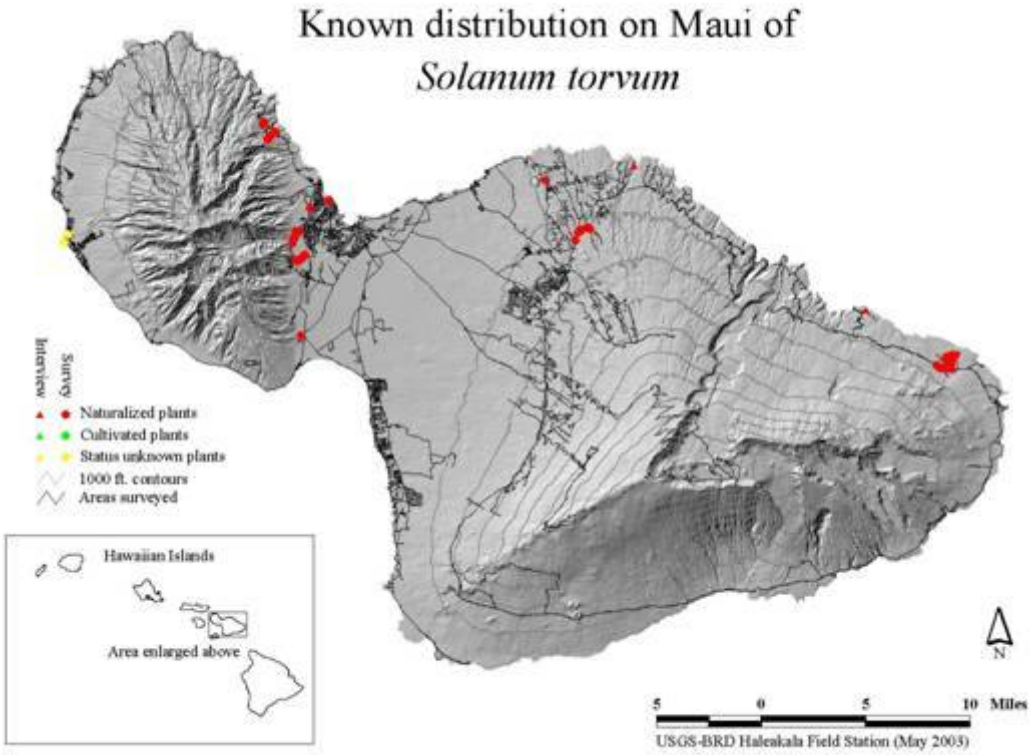

Known distribution on Maui of
Senecio confusus
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

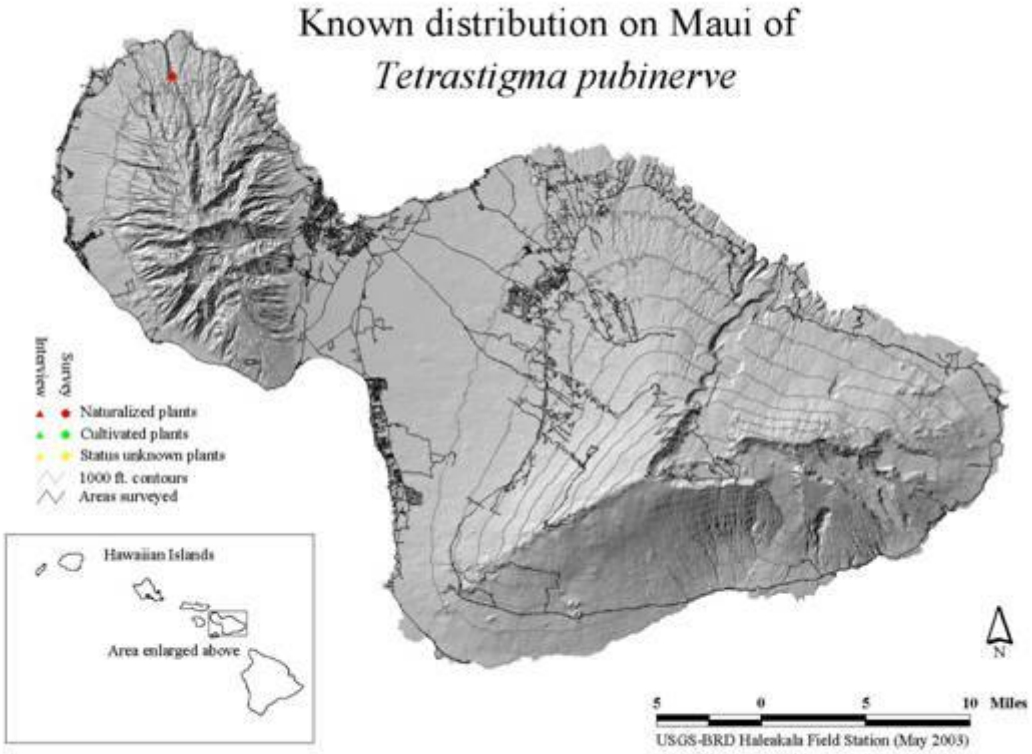

Known distribution on Maui of
Senecio madagascariensis
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

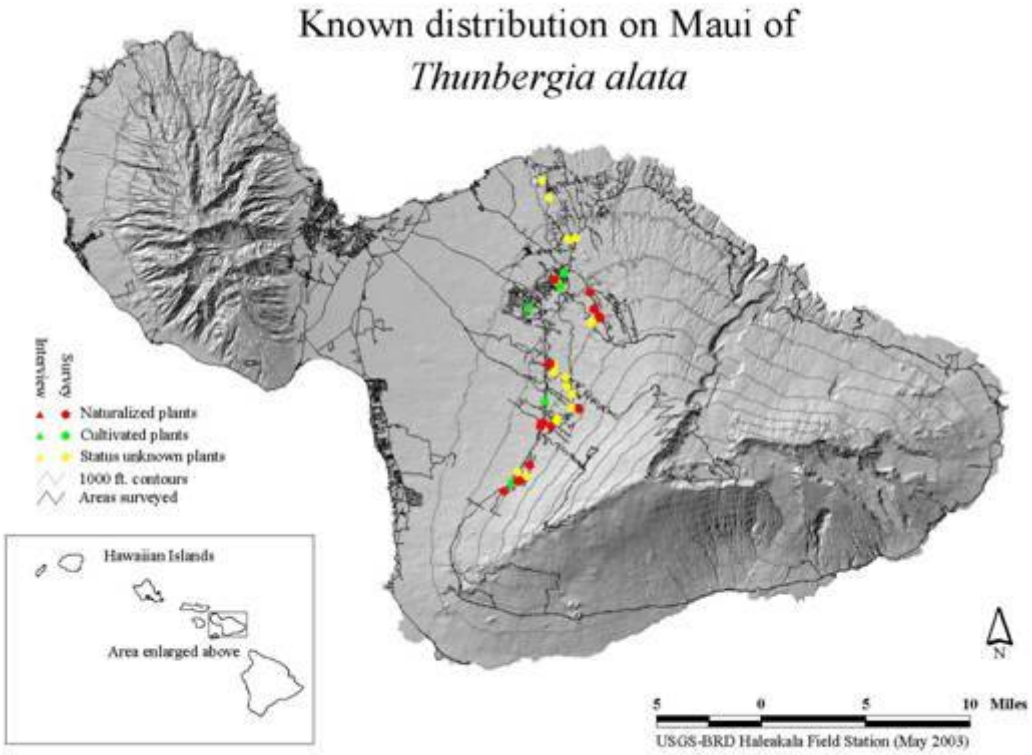

Known distribution on Maui of
Sideroxylon persimile
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)


Known distribution on Maui of
Solandra maxima
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)


Known distribution on Maui of
Solanum robustum
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)


Known distribution on Maui of
Solanum torvum
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)


Known distribution on Maui of
Tetrastigma pubinerve
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)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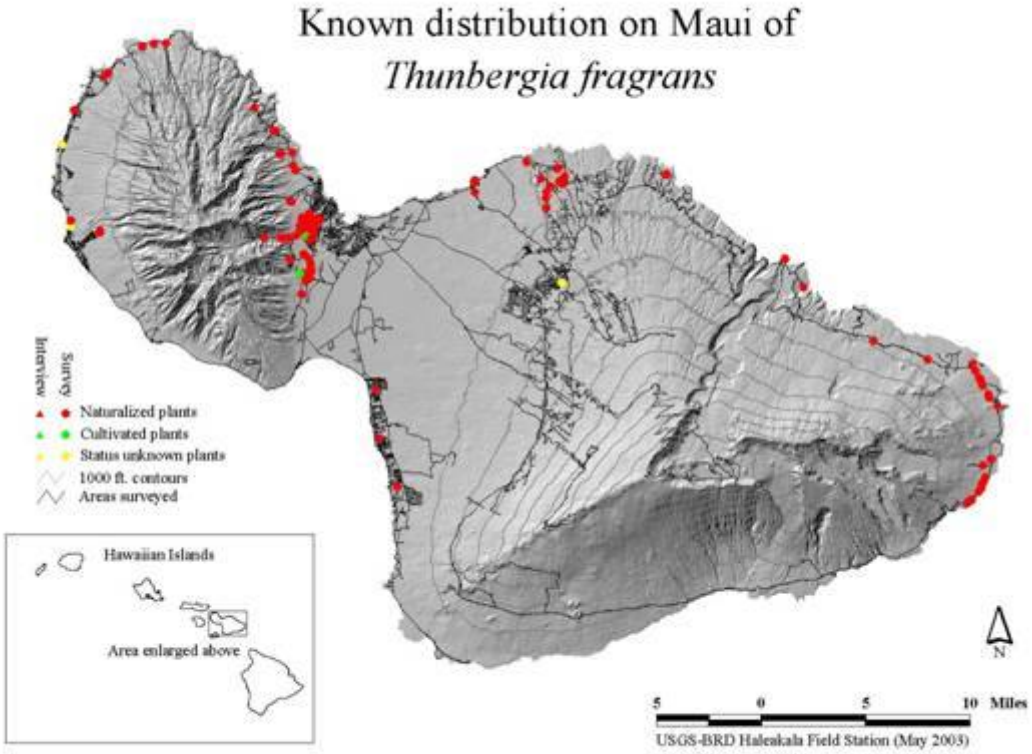
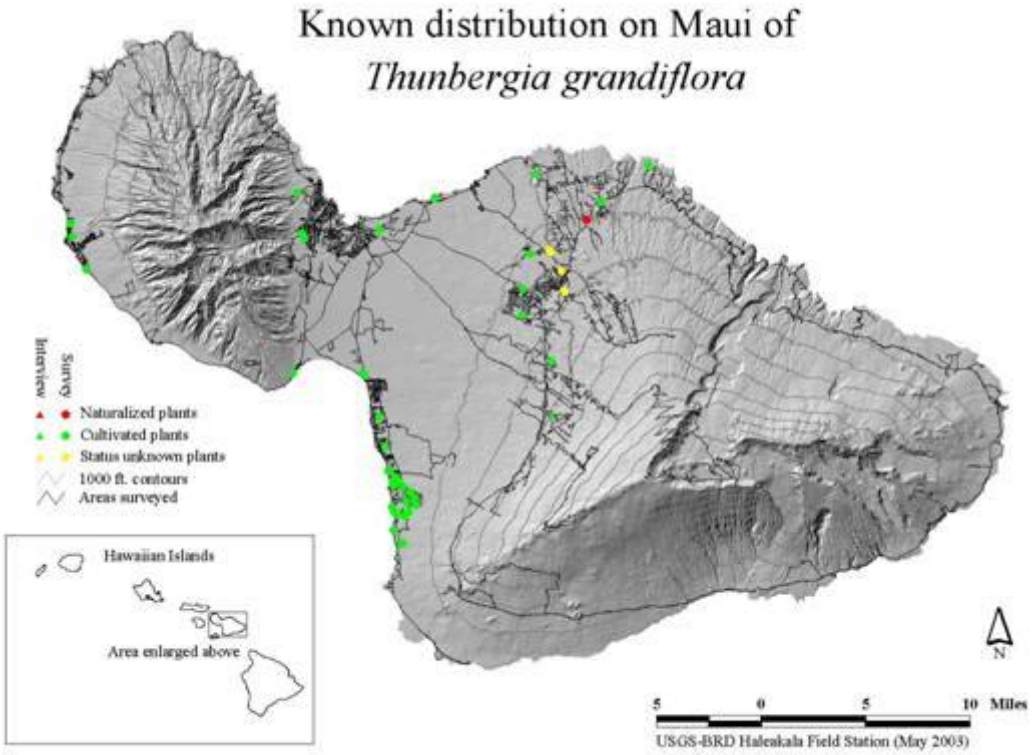
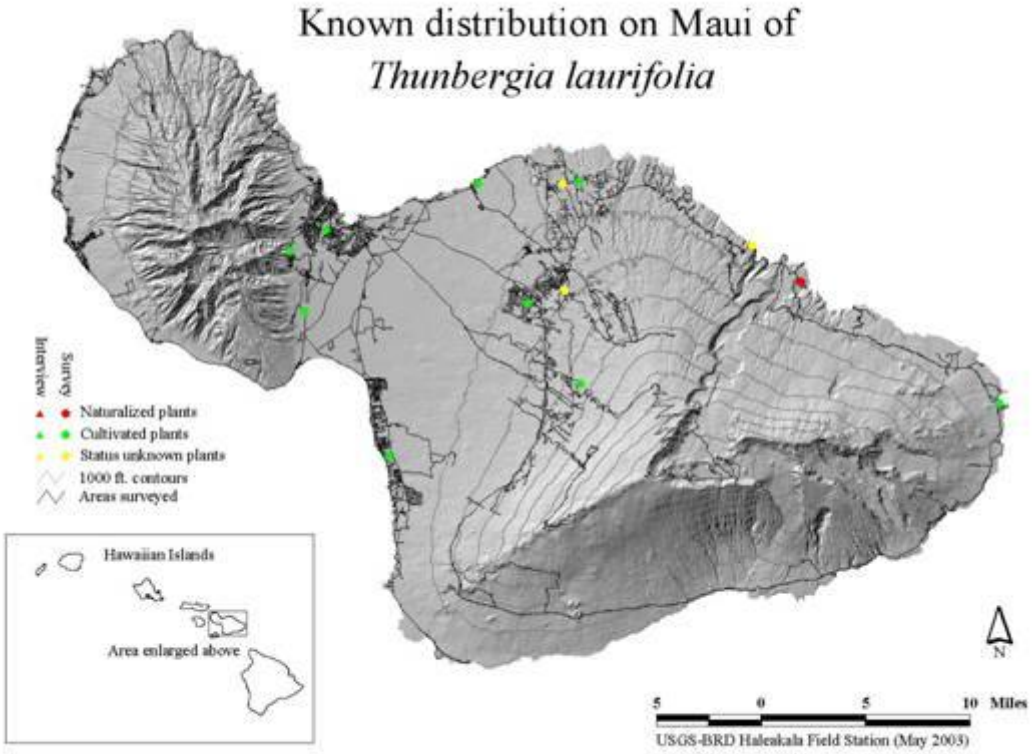
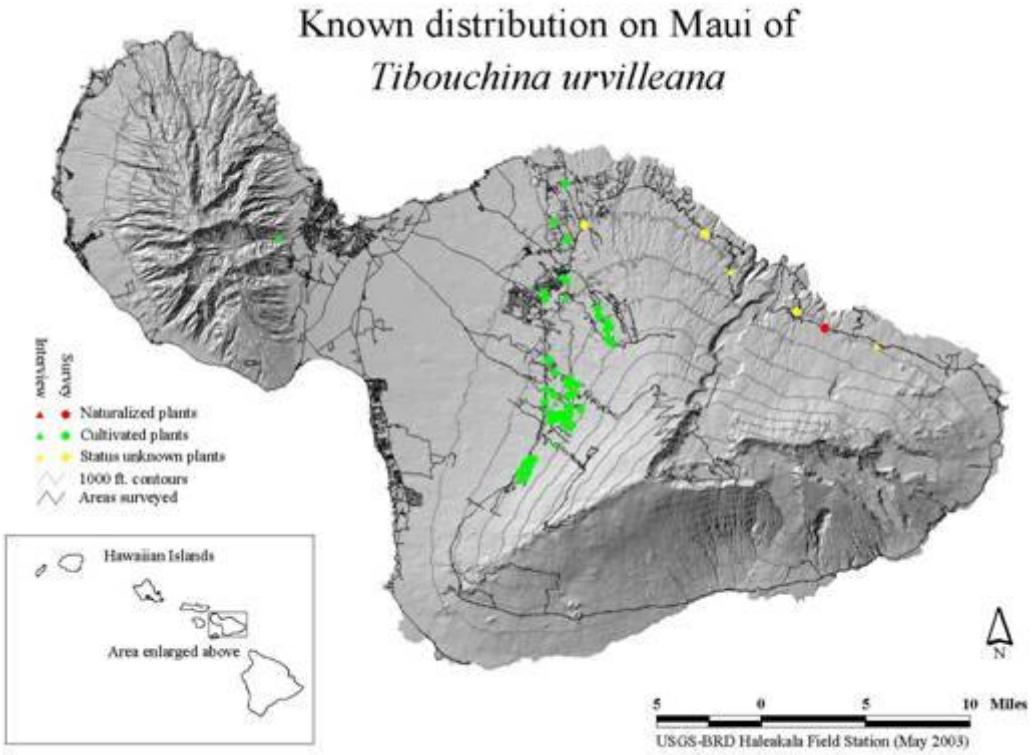
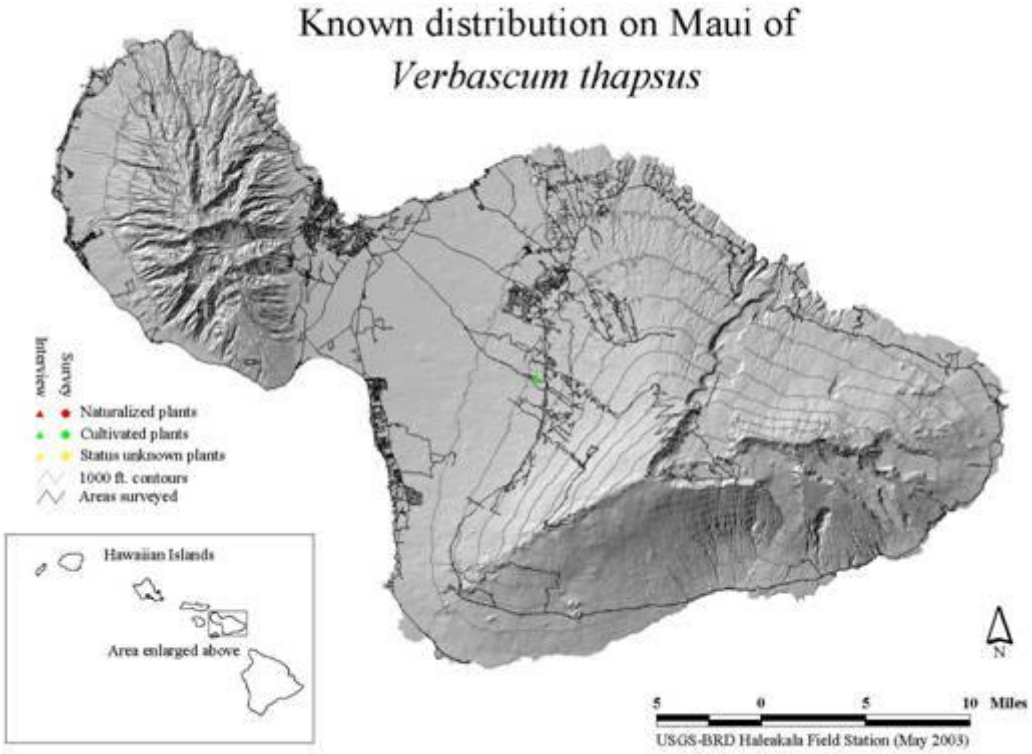
Thunbergia alata
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

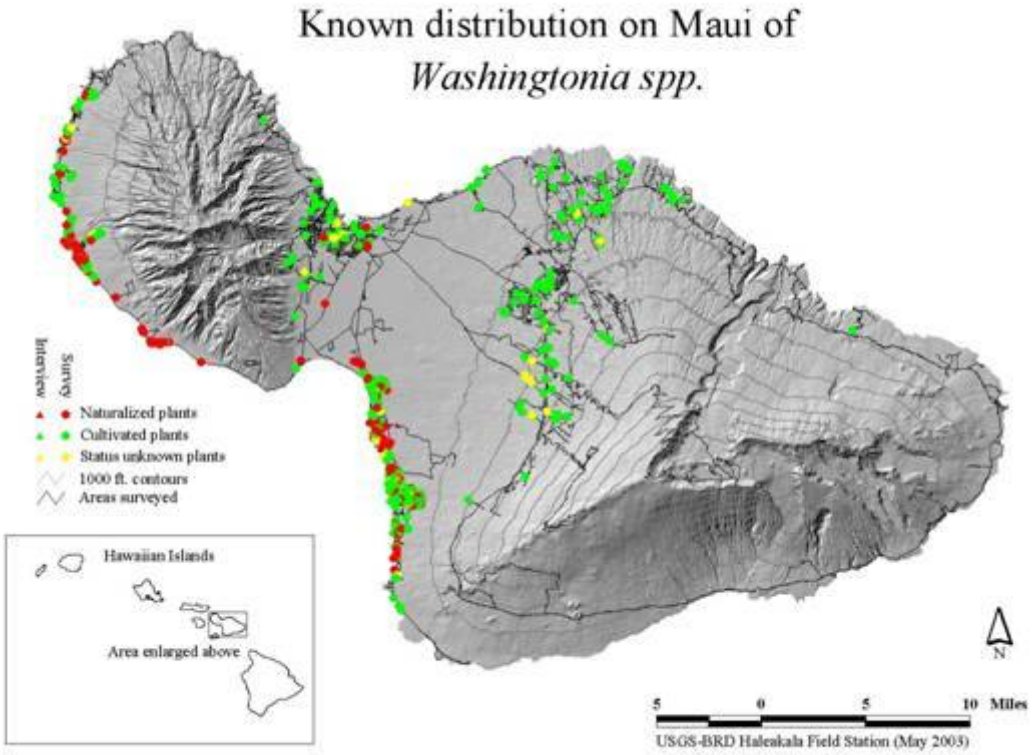

Known distribution on Maui of
Thunbergia fragrans
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)


Known distribution on Maui of
Thunbergia grandiflora
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)


Known distribution on Maui of
Thunbergia laurifolia
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)


Known distribution on Maui of
Tibouchina urvilleana
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)


Known distribution on Maui of
Verbascum thapsus
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)


Known distribution on Maui of
Washingtonia spp.
Interview
Survey
Naturalized plants
Cultivated plants
Status unknown plants
1000 ft. contours
Areas surveyed
Hawaiian Islands
Area enlarged above
N
5 0 5 10 Miles
USGS-BRD Haleakala Field Station (May 2003)

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