

***Flora-Fauna Study of Pohoiki PONC Property
TMK 1-3-08:97 (26.762 acres)
Pohoiki, Puna, Island of Hawai‘i***

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Introduction

This flora-fauna study was prepared to assist the County of Hawai‘i in ensuring the appropriate and responsible use and stewardship of lands such as those at Pohoiki acquired with funds from the Public Access, Open Space and Natural Resources Preservation Fund (PONC). The land in question (“the property”) consists of a 26.762-acre property situated south of Isaac Hale County Beach Park makai of the Kalapana-Kapoho Road (County Road 137) at Pohoiki in the Puna District of the Island of Hawai‘i (see Figures 1a & 1b for location). The County has determined that it is important to ascertain the presence and location of any special status flora and fauna (termed herein rare, threatened and/or endangered, or RTE) terrestrial plants and animals on the property. This information is a critical prerequisite to the implementation of maintenance/development actions on this property, whether by the County or approved community-based groups and volunteers. It will also assist in establishing a responsible management policy for public use.

The specific scope of work for the project involved the following:

1. Examine background information, including land records for the property provided by the CLIENT and botanical and archaeological studies in previous EAs and EISs accessible on the OEQC database or provided by the CLIENT, with the goal of determining which RTE species have a reasonable probability of inhabiting the property prior to performing any fieldwork.
2. Conduct fieldwork and systematically inventory all plant species present. GEO will GPS coordinates of any RTE plants/patches identified and take a minimum of one photograph of each such plant/patch to permanently document its condition. GEO will also assess the habitat for birds and Hawaiian hoary bats. Any Hawaiian hoary bats, birds, shorebirds, reptiles, amphibians and non-native mammals observed during our surveys will also be documented.
3. Provide a comprehensive report of survey results, observations, and recommendations pertaining to the biota specified above. The report will include text, photographs, illustrations, figures, maps, tables, exhibits, references, etc., necessary to effectively communicate the survey’s purpose, methodology, surveyor’s credentials, educated assumptions, findings, and recommendations. This will provide the County and the interested public with a full and complete understanding of the RTE flora and fauna that exist or are likely to exist at the site, as well as the impact their presence has/have on the County’s management of the site and the public’s use of the land.

Background Information

The geologic substrate on the property consists of very recent lava flows from Kilauea Volcano dated between 200 and 1,500 years before the present (Wolfe and Morris 1996). The soil here is classified as Malama extremely cobbly highly decomposed plant material, dry, 2 to 40 percent slopes. It is a shallow, rocky, and mucky but well-drained soil formed from organic material on 'a'a flows (Sato et al 1973). The property is situated just above sea level and receives an average annual rainfall of about 84 inches (Giambelluca et al 2013).

Prior to its use for agriculture, ranching, and recreation, and before the introduction of noxious weeds, the natural vegetation of this part of the Puna shoreline was mostly coastal forest and strand vegetation, dominated by naupaka (*Scaevola taccada*), hala (*Pandanus tectorius*), milo (*Thespesia populnea* – possibly a native), 'ōhi'a (*Metrosideros polymorpha*), lama (*Diospyros sandwicensis*), alahe'e (*Psydrax odoratum*), nanea (*Vigna marina*) and various ferns, sedges and grasses (Gagne and Cuddihy 1990). Even on properties in the region that experienced no development, introduced plants, animals and pests profoundly altered the biota. According to an archaeological investigation of this and an adjacent property, the Pohoiki property has remnants of agriculture, transportation (trails and unpaved roadways), habitation, and other uses. The dense collection of sites strongly suggests that the natural vegetation was first altered in the pre-Western contact era and then throughout the Historic era.

Geometrician has conducted overview biological surveys as part of environmental assessments for a number of properties with similar vegetation characteristics, with distances varying from directly adjacent to seven miles away. These include County Department of Parks and Recreation projects at Isaac Hale Beach Park and Ahalanui Beach Park; a waterline corridor right-of-way for the County Department of Water Supply at Oneloa; proposed communication towers in Malama Ki and Keauohana for the County Department of Public Works; a private cinder quarry in Kauaea; and two single-family residences in Keauohana and Kaueleau. Most of these surveys found no RTE plant species because of a history of disturbance and/or unsuitable topography.

These surveys by Geometrician did detect two RTE plant species on two different properties. One coastal property hosted *Ischaemum byrone*, an endangered, stout grass known to grow on pahoehoe close the edge of sea cliffs, where salt spray may limit other plants. Another inland property had numerous individuals of *Cyrtandra nanawaleensis*, or haiwale, at about 800 feet in elevation. This inconspicuous low shrub in the African violet family (Gesneriaceae) plant was listed as endangered in 2015. Two RTE animal species are known to be present in the area. One is the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), which is widely distributed throughout the island of Hawai'i but rarely seen because of its cryptic nature. The endangered Hawaiian hawk (*Buteo solitarius*) is a raptor that is frequently seen throughout forested areas of the island.

Given the elevation, rainfall, geology, soil, land use history, and evidence of previous surveys, the property was considered very likely to have Hawaiian hoary bats and Hawaiian hawks. There was at least some likelihood of finding *Ischaemum byrone*, but almost none of finding the haiwale plant. Other more common native flora and fauna

were known or considered likely to be present. It is important to note that no designated non-marine plant or animal critical habitat for threatened or endangered species is located within 15 miles of the property (USFWS: <http://www.arcgis.com/home/item.html?id=e50d16a6823f499ab63bd35a4f15f369>).

Survey Methods and Findings

The area was surveyed on several occasions by Ron Terry and Jen Johansen¹ in September and October 2017. Plant species were identified in the field and, as necessary, collected and keyed out in the laboratory. Special attention was given to the possible presence of any federally listed (USFWS 2017) threatened or endangered plant species.

The work also included a faunal survey restricted to a tally of birds and introduced mammals, reptiles, or amphibians observed during the botanical survey and ecological fieldwork, as well as two additional one-hour bird observations. The field survey also assessed the general value of the habitat areas for native birds. Although there were no radar or ultrasound observations conducted that might have detected the endangered Hawaiian hoary bat, the general value of the habitat for the Hawaiian hoary bat was evaluated.

Not included in the survey was any systematic assessment of invertebrates; there is little likelihood of RTE invertebrates utilizing the property.

Vegetation, Flora and Rare, Threatened or Endangered Plants

The vegetation of the property is illustrated in the photos in Figure 2. The shoreline fringe of the property contains some littoral species typical of windward Hawai‘i, but because of the dense tree cover and extremely high wave action, the shoreline flora is somewhat reduced.

Several different types of plants, primarily natives or Polynesian introductions, dominate the tree canopy near the shoreline. These include primarily coconut (*Cocos nucifera*), hala, kamani (*Calophyllum inophyllum*), and milo, although there is also some naupaka and tree heliotrope (*Tournefortia argentea*). Very few herbs, vines or grasses are present in this rocky, high-energy environment affected by frequent storm surge waves, although a large patch of the non-native vine moonflower (*Ipomoea alba*) is present near the surf site “Second Bay”. Maile-scented fern (*Phymatosorus grossus*) is prominent in the backshore understory, along with tree seedlings and vines of pothos (*Epipremnum aureum*).

The shoreline area consists of both elevated solid rock outcrops and wave-deposited stones that connect the outcrops and form a slightly elevated berm in the lower areas. Behind this are both rock outcrops and depressed areas, some of which are low enough to

¹ Ron Terry, Ph.D., Principal of Geometrician Associates, is a biogeographer with 25 years of professional experience in preparing biological surveys and assessing environmental impacts. As discussed above, Dr. Terry has extensive experience in the biological survey in Puna. Jen Johansen, B.A., is an experienced botanist who resides and works in Puna, specializing in native forest habitats.

extend below sea level and contain anchialine ponds, which have tidal, brackish water with no overland outlet to the sea. Some of the low areas behind the shore are so densely covered with fallen coconut leaves and vines, primarily maile pilau (*Paederia foetida*), and also sea bean (*Mucuna gigantea*, as to be virtually impassable without cutting one's way through. This area is infested with little fire ants (*Wasmannia auropunctata*). But this extremely dense area soon gives way in the mauka direction to a somewhat more open forest less dominated by vines, composed of coconut, hala, strawberry guava (*Psidium cattleianum*), and many other trees, including the native alahe'e, and without milo or kamani.

As the elevation rises towards the Kalapana-Kapoho Road, the forest becomes extremely diverse, with alahe'e and hala but primarily non-native trees, including mango (*Mangifera indica*), shoebuttan ardisia (*Ardisia elliptica*), gunpowder tree (*Trema orientalis*), *Melochia umbellata*, octopus tree (*Schefflera actinophylla*), cecropia (*Cecropia obtusifolia*), guava (*Psidium guajava*), and strawberry guava. Vines including pothos, maile pilau, rosary pea (*Abrus precatorius*) and white Thunbergia (*Thunbergia fragrans*) festoon the trees. The ground is densely covered with tree seedlings and ferns, including maile-scented fern, sword ferns (*Nephrolepis* spp.) and bird's nest fern or 'ekaha (*Asplenium nidus*).

Despite the absolute dominance of non-native trees in this area, a few 'ōhi'a persist, and this is the densest zone for alahe'e. Although we did not observe any, it is possible that a few lama (*Diospyros sandwicensis*) trees are also present.

All plant species observed, with the exception of roadside weeds not found in the property itself, are listed in Table 1. A total of seven native plants were present, all of them relatively common in the region and on the island. No individuals of the endangered plants *Ischaemum byrone* or *Cyrtandra nanawaleensis* were observed, and there were no other RTE species present.

Aquatic and Wetlands Vegetation

As noted above, several anchialine ponds are present in the backshore. One well-known bathing pond with geothermally heated ground waters is present near the coast on the northeast end of the property. Systematic investigation of the soil in the lowest areas might also reveal wetlands with groundwater saturated soil. Most of the surface in these low areas is heavily covered with plant litter and there is little rooted vegetation other than the same species of trees found elsewhere. No unique vegetation appears to be associated with the anchialine ponds or wetlands in the area.

Birds

Very few species of birds were detected during the survey, most of them non-natives typical of those found in similar areas of lowland disturbed habitat. The Japanese white-eye (*Zosterops japonicus*) was by far the most common bird observed, with flocks of them present in the forests in the inland parts of the property. We also observed common myna (*Acridotheres tristis*), zebra dove (*Geopelia striata*), spotted dove (*Streptopelia chinensis*) and northern cardinal (*Cardinalis cardinalis*). Additional survey times may

have yielded other bird species, which almost certainly would have been non-native.

The site is visited by the endangered Hawaiian hawk (*Buteo solitarius*), which likely forages over the property. Hawk vocalizations were heard during the bird survey. This wide-ranging raptor nests in large trees and can be vulnerable to disturbance during the nesting season from March through September. There may be trees present on the property that are suitable for nesting, although the habitat does not appear ideal. Aside from the hawk, it is unlikely that native forest birds frequent the area. Nevertheless, it is possible that Hawai'i 'amakihi (*Hemignathus virens*) could sometimes be present, as some populations of this native honeycreeper appear to have adapted to the mosquito borne diseases of the Hawaiian lowlands.

The rocky shoreline and tidepools of the property are also habitat for several migratory shorebirds that were observed during site reconnaissance: ruddy turnstone or 'akekeke (*Arenaria interpres*), wandering tattler or 'ulili (*Heteroscelus incanus*), and Pacific golden-plover or kolea (*Pluvialis fulva*). Additional shorebirds such as the bristle-thighed curlew or kioea (*Numenius tahitiensis*) may also be occasionally present. The seabird black noddy (*Anous minutus melanogenys*), which nests in crevices and caves in lava (especially pahoehoe) seacliffs, has been observed nearby, but the low shoreline does not accommodate nests for these seabirds. All these birds are reasonably common in Hawai'i.

Although undetected during this survey, some endangered Hawaiian petrels (*Pterodroma sandwichensis* or 'ua'u) and band-rumped storm-petrels (*Oceanodroma castro*), as well as threatened Newell's shearwaters (*Puffinus auricularis newelli*), may overfly the area between the months of June and October. All three of these pelagic seabird species nest high in the mountains in burrows. There is no suitable nesting habitat for any of these seabird species within or near the property. The Hawaiian petrel was formerly common on the Island of Hawai'i. This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea, as well as at the mid-to-high elevations of Hualālai. It has within recent historic times been reduced to relict breeding colonies located at high elevations on Mauna Loa and, possibly, Hualālai. The primary cause of mortality in all these seabird species in Hawai'i is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds may collide with manmade structures. If they are not killed outright, the dazed or injured birds are easy targets for feral mammals.

Hawaiian Hoary Bat

The Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), the only native Hawaiian land mammal, may also utilize the property, as it is found in most areas on the island of Hawai'i and has been observed in nearly all varieties of tall shrubs and tree vegetation (Hawai'i DLNR-DOFAW 2005; Bonaccorso 2010). It was not observed in our survey, which took place in daylight and did not use any detection equipment, but it should be presumed present. Bats may forage for flying insects over the property on a seasonal basis, and they may find some of the larger shrubs and trees suitable nesting habitat. Hawaiian hoary bats are vulnerable to disturbance during the summer pupping season.

Introduced Mammals, Reptiles, and Amphibians

No live mammals other than small Indian mongooses (*Herpestes a. auropunctatus*) were seen during the survey. It is likely that the property is occasionally used by feral pigs (*Sus scrofa*), feral cats (*Felis catus*), mice (*Mus* spp.), and rats (*Rattus* spp.). There are no native terrestrial reptiles or amphibians in Hawai'i. The only reptile species observed during the survey was one anole individual; various geckoes and skinks could occupy the property. The endangered Pacific green sea turtle (*Chelonia mydas*) may also haul up on the shoreline rocks to bask. This turtle is frequently observed in the nearshore waters off the property. As for amphibians, the highly invasive coqui frogs (*Eleutherodactylus coqui*) is known from this area. It is also likely that bufo toads (*Bufo marinus*) are present. None of these alien species have conservation value and all are deleterious to native flora and fauna.

Impacts and Mitigation Measures

As discussed above, no rare plants or plants listed by the U.S. Fish and Wildlife Service as threatened or endangered plant species appear to be present on the property, nor are there uniquely valuable habitats. No existing or proposed federally designated critical plant (or animal) habitat is present on the property. There appears to be no potential to adversely affect RTE plant species.

Several wide-ranging RTE animal species are present or potentially present – which is true for virtually every location on the Big Island. If future activities at the property involve outdoor lighting, they may attract threatened and endangered Hawaiian seabirds, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of these threatened and endangered seabirds due to interaction with outdoor lighting, no construction using unshielded equipment maintenance lighting should be permitted after dark between the months of April and October. All additional permanent lighting should conform to the Hawai'i County Outdoor Lighting Ordinance (Hawai'i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

The endangered Hawaiian hoary bat is vulnerable to disturbance while roosting with its juveniles in the pupping season. If removal or trimming of woody vegetation is required as part of property management and development, it is recommended that woody plants taller than 15 feet not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15).

Although beyond the scope of this report, which focuses on the terrestrial environment, it should be noted that the coastal and marine fauna and flora found offshore are typical of the high-energy coasts of Puna. These are young ecosystems with limited coral growth but a variety of algae, fish and invertebrates. Marine mammals and reptiles, some of them endangered, also visit the Puna coastal waters. Reducing land-derived pollution is critical for the health of marine and nearshore ecosystems and the species they support.

Report Limitations

No biological survey of a large area can claim to have detected every species present. Some plant species are cryptic in juvenile or even mature stages of their life cycle. Dry conditions can render almost undetectable plants that extended rainfall may later invigorate and make obvious. Thick brush can obscure even large, healthy specimens. Birds utilize different patches of habitat during different times of the day and seasons, and only long-term study can determine the exact species composition. The findings of this survey must therefore be interpreted with proper caution; in particular, there is no warranty as to the absence of any particular species.

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Figure 1a. Property Location

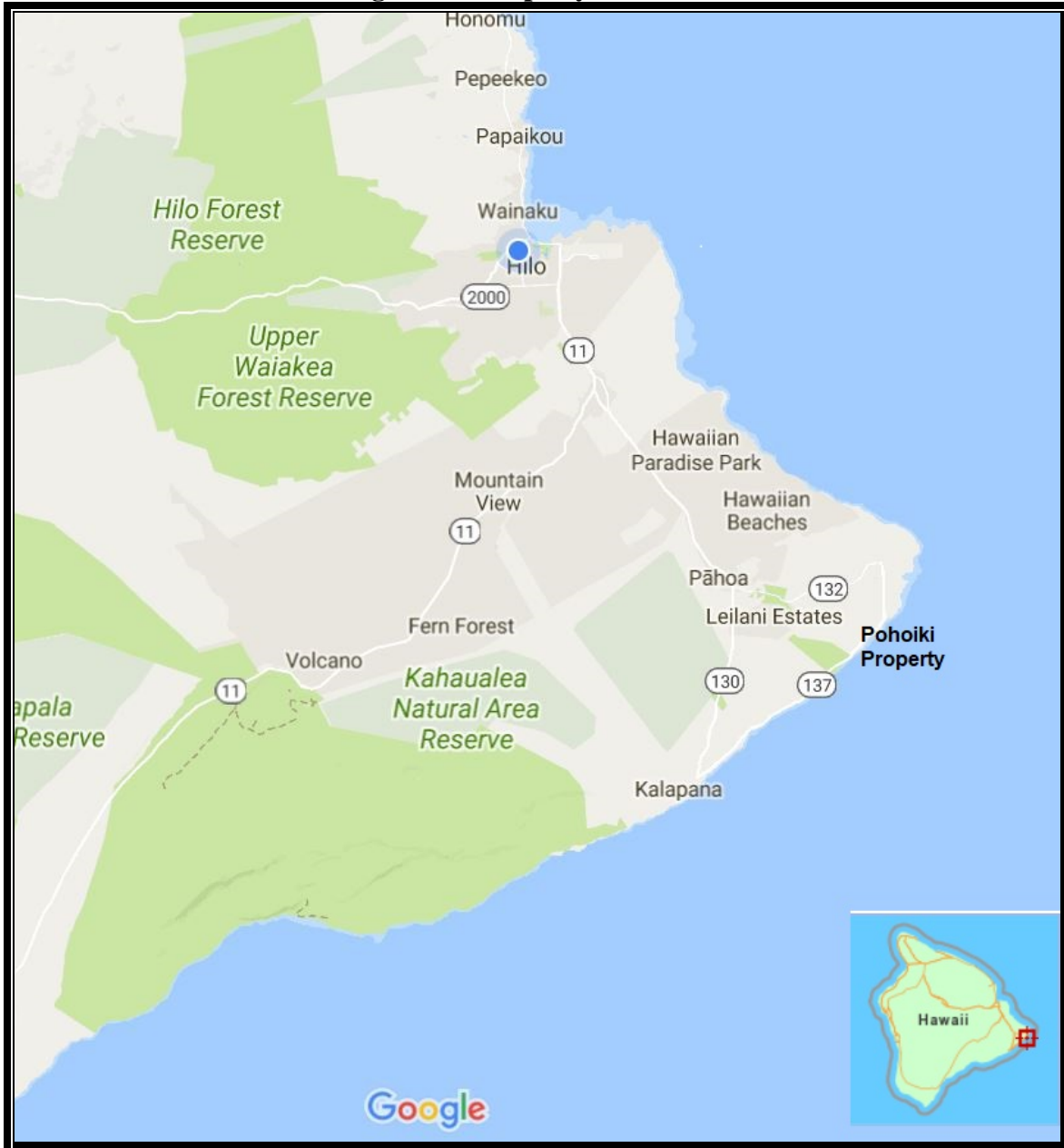


Figure 1b. Google Earth Close-up



Figure 2. Property Photos



2a. Shoreline section dominated by coconut palms ▲ ▼ 2b. Backshore with kamani and hala



Figure 2. Property Photos



2c. Anchialine pond ▲ ▼ 2d. Canopy in middle of property



Figure 2. Property Photos



2e. Canopy in most inland section ▲ ▼ 2f. Alahe'e, one of few native trees on property



Table 1. Plant Species Detected at Pohoiki Property

Scientific Name	Family	Common Name	Life Form	Status*
<i>Abrus precatorius</i>	Fabaceae	Rosary pea	Vine	X
<i>Acalypha wilkesiana</i>	Euphorbiaceae	Beefsteak plant	Shrub	A
<i>Ageratum conyzoides</i>	Asteraceae	Ageratum	Herb	A
<i>Aleurites moluccana</i>	Euphorbiaceae	Kukui	Tree	P
<i>Ardisia elliptica</i>	Myrsinaceae	Shoebuttan ardisia	Tree	X
<i>Asplenium nidus</i>	Aspleniaceae	Bird nest fern	Fern	X
<i>Begonia sp.</i>	Begoniaceae	Begonia	Herb	X
<i>Calophyllum inophyllum</i>	Clusiaceae	Kamani	Tree	P
<i>Carica papaya</i>	Caricaceae	Papaya	Tree	X
<i>Cecropia obtusifolia</i>	Cecropiaceae	Cecropia	Tree	X
<i>Cassytha filiformis</i>	Lauraceae	Kauanoa pehu	Vine	I
<i>Chamaecrista nictitans</i>	Fabaceae	Partridge pea	Herb	X
<i>Clusia rosea</i>	Clusiaceae	Autograph tree	Tree	X
<i>Cocos nucifera</i>	Arecaceae	Coconut	Tree	P
<i>Cordyline fruticosa</i>	Agavaceae	Ti	Shrub	P
<i>Cyperus polystachyos</i>	Cyperaceae	Pycreus	Sedge	I
<i>Digitaria setigera</i>	Poaceae	Crabgrass	Herb	X
<i>Emilia sonchifolia</i>	Asteraceae	Pualele	Herb	X
<i>Epipremnum aureum</i>	Araceae	Pothos vine	Vine	X
<i>Eragrostis tenella</i>	Poaceae	Lovegrass	Herb	X
<i>Ipomoea alba</i>	Convolvulaceae	Moon flower	Vine	A
<i>Ipomoea triloba</i>	Convolvulaceae	Little bell	Vine	X
<i>Kalanchoe pinnata</i>	Crassulaceae	Air plant	Shrub	X
<i>Leucaena leucocephala</i>	Fabaceae	Haole koa	Tree	X
<i>Lepisorus thunbergianus</i>	Polypodiaceae	Pakahakaha	Fern	I
<i>Mangifera indica</i>	Anacardiaceae	Mango	Tree	X
<i>Melochia umbellata</i>	Sterculiaceae	Melochia	Tree	X
<i>Metrosideros polymorpha</i>	Myrtaceae	'Ōhi'a	Tree	E
<i>Mimosa pudica</i>	Fabaceae	Sensitive plant	Herb	X
<i>Monstera deliciosa</i>	Araceae	Monstera	Vine	X
<i>Morinda citrifolia</i>	Rubiaceae	Noni	Shrub	P
<i>Mucuna gigantea</i>	Fabaceae	Sea bean	Vine	A
<i>Nephrolepis exaltata</i>	Nephrolepidaceae	Sword Fern	Fern	I
<i>Nephrolepis multiflora</i>	Nephrolepidaceae	Sword fern	Fern	X
<i>Oplismenus hirtellus</i>	Poaceae	Basket grass	Herb	X
<i>Paederia foetida</i>	Rubiaceae	Maile pilau	Vine	X
<i>Pandanus tectorius</i>	Pandanaceae	Hala	Tree	X
<i>Paspalum conjugatum</i>	Poaceae	Hilo grass	Grass	X
<i>Passiflora edulis</i>	Passifloraceae	Lilikoi	Vine	X
<i>Phymatosorus grossus</i>	Polypodiaceae	Maile-scented fern	Fern	X
<i>Pluchea carolinensis</i>	Asteraceae	Sourbush	Shrub	A
<i>Portulaca oleracea</i>	Portulacaceae	Pigweed	Herb	X
<i>Psidium cattleianum</i>	Myrtaceae	Strawberry guava	Tree	X
<i>Psidium guajava</i>	Myrtaceae	Guava	Tree	X
<i>Pterolepis glomerata</i>	Melastomataceae	Pterolepis	Herb	X

Scientific Name	Family	Common Name	Life Form	Status*
<i>Psydrax odorata</i>	Rubiaceae	Alahe'e	Shrub	I
<i>Samanea saman</i>	Fabaceae	Monkeypod	Tree	X
<i>Scaevola taccada</i>	Goodeniaceae	Naupaka kahakai	Shrub	I
<i>Schefflera actinophylla</i>	Araliaceae	Octopus tree	Tree	X
<i>Schizostachyum glaucifolium</i>	Poaceae	'Ohe	Grass	P
<i>Schinus terebinthifolius</i>	Anacardiaceae	Christmas-berry	Shrub	X
<i>Sida rhombifolia</i>	Malvaceae	Broom weed	Herb	A
<i>Spermacoce exilis</i>	Rubiaceae	Spermacoce	Herb	X
<i>Sphagneticola trilobata</i>	Asteraceae	Wedelia	Shrub	A
<i>Sporobolus elongatus</i>	Poaceae	Rat tail grass	Herb	X
<i>Synedrella nodiflora</i>	Asteraceae	Synedrella	Herb	X
<i>Syngonium sp.</i>	Araceae	Syngonium	Vine	X
<i>Terminalia catappa</i>	Combretaceae	False kamani	Tree	X
<i>Thunbergia fragrans</i>	Acanthaceae	White thunbergia	Vine	X
<i>Tournefortia argentea</i>	Boraginaceae	Tree heliotrope	Tree	X
<i>Trema orientalis</i>	Ulmaceae	Gunpowder tree	Tree	X
<i>Vigna luteola</i>	Fabaceae	Hairy pod cowpea	Vine	X

X = alien, P = Polynesian, E = endemic, I = indigenous, End = Fed