



**Botanical Inventory of O'ahu  
Forest National Wildlife Refuge  
Uplands, Waipi'o, O'ahu**

**Hawaii  
Biological  
Survey**

**Final Report**

**May 2006**



**Botanical Inventory of O'ahu Forest National Wildlife Refuge, Waipi'o, O'ahu**

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**Final Report**

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## EXECUTIVE SUMMARY

The Hawaii Biological Survey of Bishop Museum (BISH) conducted a vegetation reconnaissance of 190 hectares of O'ahu Forest National Wildlife Refuge (OFNWR) land for landowner U.S. Fish and Wildlife Service (USFWS), in cooperation with the Ko'olau Mountains Watershed Partnership (KMWP). The project area lies in the wet central Ko'olau summit area, and is characterized by a series of steep-sided ridges dissected by gulches formed by the headwaters of Waikakalaua and Kīpapa Streams, and a portion of Waiawa Stream to the south.

The survey took place between May 2005 and May 2006, with the primary goals of documenting locations of rare and endangered vascular plants, providing an inventory of all vascular plants, noting major resource concerns, creating general plant community maps, and providing recommendations for conservation practices.

A total of 175 taxa were noted during the survey, including 136 native and 39 naturalized taxa. Thus, about 78% of all plant taxa seen were native, a remarkably high percentage by current standards, attesting to the relatively undisturbed nature of the vegetation. On top of the high percentage of native species, we estimate the total land cover of native plants to be in the range of 90%. Five vegetation types were observed in OFNWR, all native-dominated structural variants of Lowland Wet communities, differing by a combination of elevation, wind exposure, slope, and substrate, and generally dominated by various forms of *Metrosideros polymorpha* ('ōhi'a), often with the presence of tangled mats of the fern *Dicranopteris linearis* (uluhe).

In addition to rare and endangered species of vascular plants noted in a 2003 survey (Hawaii Natural Heritage Program 2003), this report documents additional populations of *Chamaesyce rockii* (Endangered); the rare grass *Dichanthelium koolauense*; an endemic fern, *Doodia lyonii* (Species of Concern); *Gardenia mannii* (Endangered); *Joinvillea ascendens* subsp. *ascendens* (Species of Concern); *Labordia hosakana* (Species of Concern); *Lobelia gaudichaudii* subsp. *gaudichaudii* (Species of Concern); *L. gaudichaudii* subsp. *koolauensis* (Endangered); and *Zanthoxylum oahuense* (Candidate).

The main current biological threat to the native vegetation of the OFNWR parcel is the spread of invasive alien plant species. Within the upper sections of the valley, the ubiquitous *Clidemia hirta* (Koster's curse) is the main non-native shrub component on open, disturbed slopes, and *Psidium guajava* (common guava) is a common element in disturbed gulch bottoms. Most of the herbaceous and grassy weeds are concentrated along trails and on disturbed hilltops. The focus of eradication efforts should concentrate on weedy tree species that are just starting to become established, such as *Heliocarpus popayanensis* (white moho, occasionally noted), and the rarely noted *Falcataria moluccana* (albizia), *Spathodea campanulata* (tulip tree), *Citharexylum caudatum* (fiddlewood), and *Psidium cattleianum* (strawberry guava). A grove of *Cryptomeria japonica* (sugi pine) along the Ko'olau summit should be cut down. *Hedychium gardnerianum* (kāhili ginger) is uncommon and should also be eliminated from the refuge. Future surveillance efforts in the refuge should also be vigilantly on the lookout for invasives not noted on the survey, such as *Schefflera actinophylla* (octopus tree) and *Angiopteris evecta* (mule's-foot fern).



**Botanical Inventory of O'ahu Forest National Wildlife Refuge, Waipi'o, O'ahu  
Hawaii Biological Survey, Bishop Museum  
May 2006**

**I. INTRODUCTION**

A vegetation reconnaissance of 190 hectares of O'ahu Forest National Wildlife Refuge (OFNWR) land was conducted by Bishop Museum (BISH) for landowner U.S. Fish and Wildlife Service (USFWS), in cooperation with the Ko'olau Mountains Watershed Partnership (KMWP). Six days of fieldwork (28 person-days) took place between May 2005 and May 2006. The primary purposes of the survey were to document locations of rare and endangered vascular plants, provide an inventory of all vascular plants, note major resource concerns, create general plant community maps, and provide recommendations for conservation practices.

**Ia. Setting**

The project area lies in the central leeward Ko'olau summit area, mauka of Mililani town, and comprises the upper-elevation, northeastern portion of OFNWR, ranging in elevation from 817 m at Pu'u Ka'aumakua (northeast corner of the refuge) down to less than 520 m in Waikakalaua and Kīpapa Gulches. The survey area is characterized by a series of steep-sided ridges dissected by gulches formed by the headwaters of Waikakalaua and Kīpapa Streams, and a portion of Waiawa Stream to the south. The parcel is located within a zone that generally receives 5000 or more millimeters of rainfall per year; thus, all of the vegetation types are in the "wet" moisture category.

All of the land in the survey area is classified as Rough Mountainous Land (rRT) by Foote et al. (1972). This is the dominant land formation in the upper, wetter leeward Ko'olau Range. These lands are very steep and are dissected by numerous intermittent drainages. Deep, V-shaped valleys with steep side slopes and narrow ridgelines are the norm. The soil is very thin, ranging from 2.5–25 cm in thickness over saprolite (thoroughly decomposed, earthy, untransported rock), and not stony. The saprolite is relatively soft and permeable to roots and water. Soil on the ridges is similar to the Amalu (Maui and Moloka'i) and Olokui (Moloka'i) series, both poorly drained, wet upland soils. About 20–40% of the land consists of rockland, rock outcrops, soil slips, and eroded spots. In the Hawaiian Islands, rRT lands occur from sea level up to 1830 m elevation, with rainfall ranging from 180 to more than 1000 cm per year. Uses for rRT lands include water supply, wildlife habitat, and recreation. These lands are classified as capability group VIIIe soils, which are subject to severe erosion if the existing vegetation cover is removed. Natural vegetation in the rRT association include *Metrosideros polymorpha* ('ōhi'a), *Dicranopteris linearis* (uluhe), *Cibotium* spp. (hāpuu), *Setaria parviflora* (yellow foxtail), *Lantana camara* (lantana), *Aleurites moluccana* (kukui), and *Leptecophylla tameiameia* (pūkiawe).

Edward Y. Hosaka, in conducting ecological and floristic studies in Kīpapa Gulch to partially fulfill requirements for a Master of Science degree at the University of Hawai'i in the early 1930s, divided the gulch into six broad plant zones (Hosaka 1937). At the extreme seaward end is the Maritime Zone with salt-loving coastal herbs, followed upland by the Haole Koa (*Leucaena leucocephala*), Guava (*Psidium guajava*), and Koa (*Acacia koa*) Zones. Hosaka's 'Ōhi'a Zone, which he describes as dominated by tall *Metrosideros polymorpha* trees (reaching maximum height around 550 m

elevation), matches large portions of the survey area on lower, protected slopes. He describes associated canopy trees as including 'ōhi'a hā (*Syzygium sandwicensis*) and 'ahakea (*Bobea elatior*); second-layer trees including hame (*Antidesma platyphylla*) and kōpiko (*Psychotria mariniana*); shrubs including *Cyrtandra paludosa* and *Cyanea crispa*; the ground layer covered with mosses and ferns; and tree trunks clothed with epiphytic bryophytes and ferns. Finally, Hosaka calls the area above 600 m elevation the Cloud Zone. This very wet zone consists of low, scrubby vegetation in which there are no dominant species. Tree species are dwarfed. Characteristic species include *Metrosideros polymorpha*, 'ōlapa (*Cheirodendron platyphyllum*), loulu (*Pritchardia martii*), kāmakahala (*Labordia* spp.), na'ena'e (*Dubautia laxa*), and 'uki (*Machaerina angustifolia*).

### **Ib. Historical plant collections of upper Waikakalaua and Kīpapa drainages**

Many botanists have collected in the upper Waikakalaua–Kīpapa drainage during the past century. A search of the Herbarium Pacificum specimen database for Hawaiian plant vouchers at Bishop Museum pulled up numerous botanical collections in the area. A concentrated period of botanical exploration took place during the early 1930s, when Hosaka was spending much field time in the area. BISH holdings include almost 1500 vouchers from the area, including close to 600 Hosaka vouchers from the Kīpapa drainage. Other prominent collections in the 1930s in the Waikakalaua–Kīpapa area include those by Edwin H. Bryan, Jr., a Bishop Museum entomologist; F. Raymond Fosberg, then a graduate student at the University of Hawai'i, later a prominent Pacific botanist at the Smithsonian Institution; Martin L. Grant, a Yale–Bishop Museum fellow; and Harold St. John, prominent Hawaiian botanist. Subsequent botanical vouchers from the region have been spotty, in part due to remoteness and difficulty of access.

Among vascular plant taxa vouchered during historical collecting trips are the following currently Federally endangered taxa: *Alectryon macrococcus* (māhoe, Sapindaceae); *Cyanea acuminata*, *C. crispa*, *C. grimesiana* ssp. *grimesiana*, *C. humboldtiana*, *C. koolauensis*, *C. longiflora*, and *C. st.-johnii* (hāhā, Campanulaceae); *Cyrtandra viridiflora* (ha'iwale, Gesneriaceae); *Gardenia mannii* (nā'ū, Rubiaceae); *Hesperomannia arborescens* (Asteraceae); *Labordia cyrtandrae* (kāmakahala, Loganiaceae); *Lobelia oahuensis* (Campanulaceae); *Melicope lydgatei* (alani, Rutaceae); *Phyllostegia hirsuta* and *P. parviflora* (Lamiaceae); *Platanthera holochila* (Orchidaceae); *Sanicula purpurea* (Apiaceae); *Tetraplasandra gymnocarpa* ('ohe'ohe, Araliaceae); and *Viola oahuensis* (Violaceae), as well as the rare but unprotected *Anoectochilus sandwicensis* (Orchidaceae); *Cryptocarya mannii* (hōlio, Lauraceae); *Cyanea calycina* and *C. lanceolata* (hāhā, Campanulaceae); *Cyrtandra kalihii* (ha'iwale, Gesneriaceae); *Dichantherium koolauense* (Poaceae); *Doodia lyonii* (Blechnaceae); *Eurya sandwicensis* (ānini, Theaceae); *Exocarpos gaudichaudii* (hulumoa, Santalaceae); *Hedyotis fluviatilis* (kamapua'a, Rubiaceae); *Joinvillea ascendens* ('ohe, Joinvilleaceae); *Labordia hosakana* (kāmakahala, Loganiaceae); *Liparis hawaiiensis* ('awapuhiakanaloa, Orchidaceae); *Lobelia gaudichaudii* ssp. *gaudichaudii* (Campanulaceae); *Melicope hiiakae* (alani, Rutaceae); *Platydesma cornuta* (Rutaceae); *Psychotria hexandra* var. *oahuensis* (kōpiko, Rubiaceae); and *Zanthoxylum oahuense* (a'e, Rutaceae). Appendix B (p. 27) provides a list of representative vouchers of the above taxa stored at BISH.

### **Ic. Past surveys of O'ahu Forest National Wildlife Refuge**

In September 2003 the Hawaii Natural Heritage Program (now called the Hawai'i Biodiversity and Mapping Program) conducted a 3-day rare plant survey in the same 190 hectare parcel studied in the current report. Due to limited field time, the team concentrated on habitats with the best potential for harboring rare taxa. Six rare plant taxa were documented: 1) *Chamaesyce rockii* (15 plants in 2 populations); 2) *Cyanea calycina* (5 plants just outside of OFNWR on windward summit slope); 3) *Cyanea humboldtiana* (4 immatures); 4) *Doodia lyonii* (ca. 560 plants); 5) *Lobelia oahuensis* (4 plants just outside of OFNWR on windward summit slope); and 6) *Tetraplasandra gymnocarpa* (7 individual sightings). We attempted to relocate these populations if we were surveying transects previously walked on the 2003 survey; otherwise, we made no special effort to relocate these records, preferring to explore new areas of the refuge.

### **Id. Critical habitat designations**

In June 2003, the U.S. Fish and Wildlife Service (USFWS) published final designations of critical habitat for 101 endangered O'ahu plant taxa (U.S. Fish and Wildlife Service 2003). The USFWS created 36 critical habitat units for O'ahu, many of them created for multiple endangered species. O'ahu Forest National Wildlife Refuge (OFNWR) is contained within Unit 20, the largest of the units, encompassing the central and northern Ko'olau Mountains. Designation as critical habitat does not imply that the endangered species is already present in the area; in many cases an area is designated, although currently unoccupied, because it provides a landbank of environmental conditions suitable for the recovery of the species. The goal of the U.S. Fish and Wildlife Service is to designate critical habitat for 8–10 discrete, viable, reproducing populations of each endangered taxon in their historically known ranges. Study of the critical habitat maps indicates that parts of the OFNWR tract are included as critical habitat for eighteen endangered species. The taxa and their critical habitats in the OFNWR tract are as follows:

- **Chamaesyce rockii** ('akoko, Euphorbiaceae), gulch slopes and bottoms, ridge crests in wet 'ōhi'a-uluhe forest and shrubland in vicinity of Pu'u Ka'aumakua, currently unoccupied (USFWS Critical Habitat Oahu 20—*Chamaesyce rockii*—b; habitat mostly within OFNWR).
- **Cyanea acuminata** (hāhā, Campanulaceae), north to central Ko'olau summit, slopes, ridges, streambanks in 'ōhi'a-uluhe or 'ōhi'a-koa wet or mesic forest or shrubland, or lama-'ōhi'a lowland mesic forest, including Pu'u Ka'aumakua and Kīpapa Trail, currently 30 individuals (Oahu 20—*Cyanea acuminata*—b; most of OFNWR included in designation)
- **Cyanea st.-johnii** (hāhā, Campanulaceae), central Ko'olau summit ridge designated, wet windswept slopes and ridges in 'ōhi'a mixed lowland shrubland or 'ōhi'a-uluhe lowland shrubland, currently 44 individuals (Oahu 20—*Cyanea st.-johnii*—a; all of OFNWR summit ridge included)
- **Cyrtandra viridiflora** (ha'iwale, Gesneriaceae), north to central Ko'olau summit, moist slopes and gulch bottoms in 'ōhi'a wet forest or mixed with uluhe and koa, currently 33 individuals (Oahu 20—*Cyrtandra viridiflora*—a; including northern summit portion of OFNWR)



- ***Gardenia mannii*** (nā'ū, Rubiaceae), leeward drainage encompassing Pu'u Kamana, Waikakalaua and Kīpapa, gulch slopes and bottoms, streambanks, and ridge crests, currently unoccupied (Oahu 20—*Gardenia mannii*—c; upper end includes lower-elevation portion of OFNWR)
- ***Isodendrion longifolium*** (aupaka, Violaceae), steep slopes or streambanks in mixed mesic or lowland wet 'ōhi'a-uluhe forest, currently unoccupied (Oahu 20—*Isodendrion longifolium*—b; habitat entirely within OFNWR)
- ***Lobelia gaudichaudii* ssp. *koolauensis*** (Campanulaceae), north to central Ko'olau summit, moderate to steep slopes in 'ōhi'a lowland wet shrubland or bog, currently 247 individuals (Oahu 20—*Lobelia gaudichaudii* ssp. *koolauensis*—a; includes all of OFNWR summit ridge)
- ***Lobelia oahuensis*** (Campanulaceae), central Ko'olau summit ridge, steep slopes or summit cliffs in cloudswept wet forest or lowland wet shrubland frequently exposed to heavy wind and rain, currently 13 individuals (Oahu 20—*Lobelia oahuensis*—a; includes all of OFNWR summit ridge)
- ***Melicope lydgatei*** (alani, Rutaceae), designated range includes ridges in mesic to wet forest in the central Ko'olau Mountains, currently 2 individuals (Oahu 20—*Melicope lydgatei*—a; includes lower portion of OFNWR)
- ***Myrsine juddii*** (kōlea, Myrsinaceae), north to central Ko'olau summit, ridge crests or gulch slopes in wet forest dominated by 'ōhi'a or 'ōhi'a-uluhe mixture, currently 5,000 individuals (Oahu 20—*Myrsine juddii*—a; designation includes a portion of OFNWR)
- ***Phlegmariurus (Huperzia) nutans*** (no common name, Lycopodiaceae), north to central Ko'olau summit, tree trunks on open ridges, forested slopes, or cliffs in 'ōhi'a-dominated wet forest or shrubland, or mesic forest, currently 5 individuals (Oahu 20—*Phlegmariurus nutans*—a; much of OFNWR included)
- ***Phyllostegia parviflora*** (no common name, Lamiaceae), north to central Ko'olau summit, 'ōhi'a mixed lowland wet forest, currently 30 individuals (Oahu 20—*Phyllostegia parviflora*—d; portion of OFNWR included)
- ***Plantago princeps*** (laukahi kuahiwi, Plantaginaceae), upper portions of leeward central Ko'olau Mountains, slopes or ledges in 'ōhi'a lowland mesic forest or shrubland, currently 2 individuals (Oahu 20—*Plantago princeps*—d; includes portion of southern end of OFNWR)
- ***Platanthera holochila*** (no common name, Orchidaceae), central Ko'olau, 'ōhi'a-uluhe wet forest or 'ōhi'a mixed shrubland, currently unoccupied (Oahu 20—*Platanthera holochila*—b; most of habitat included within OFNWR)
- ***Pteris lydgatei*** (Pteridaceae), central Ko'olau, steep streambanks or cliffs in wet 'ōhi'a-uluhe forest, currently unoccupied (Oahu 20—*Pteris lydgatei*—b; includes northern portion of OFNWR)
- ***Sanicula purpurea*** (Apiaceae), Ko'olau summit ridge designated, open 'ōhi'a mixed montane bogs or windswept shrubland in the cloud zone, currently 6 individuals between northern Ko'olau and Kalihi (Oahu

20—*Sanicula purpurea*—a; all of OFNWR summit ridge included)

- **Tetraplasandra gymnocarpa** ('ohe'ohe, Araliaceae), central Ko'olau, windswept summit ridges, slopes, and gullies in wet to sometimes mesic lowland forest or shrubland, currently 5 individuals (Oahu 20—*Tetraplasandra gymnocarpa*—b; includes northern portion of OFNWR)
- **Viola oahuensis** (Violaceae), Ko'olau summit ridge from Pūpūkea to Kalihi, exposed, windswept ridges of moderate to steep slope in wet 'ōhi'a-uluhe shrubland or 'ōhi'a mixed montane bogs in cloud zone, currently 67 individuals (Oahu 20—*Viola oahuensis*—a; all of OFNWR summit ridge included)

## II. METHODS

The remoteness of the survey area in the upland central Ko'olau meant that the best survey strategy was to be transported in by helicopter, with extended overnight campouts. The team did three separate 3-day, 2-night trips, with base camps set up in the north and south (OFNWR Base Camp and Kīpapa Campsite). Map 3 (p. 17) pinpoints the base camps and survey routes. The fieldwork strategy was to walk transects from base camp in teams of two or three while recording plant species and describing plant communities. Transects were selected that would complement those done in the 2003 survey (Hawaii Natural Heritage Program 2003), although some confirmation of 2003 sightings was also done. GPS points were taken frequently along transects and routes were mapped. Rare plants and communities, as well as weedy species of management concern, were georeferenced when possible; in some cases, such as in steep-sided gulches, GPS readings were not possible and point localities were approximated on USGS maps. Georeferencing was made using Garmin GPS units with a WGS 84 datum.

Trip 1 (2–4 May 2005) Chris Puttock, Clyde Imada, Maya LeGrande (Bishop Museum); Scott Lynch and Micah Ryder (Ko'olau Mountains Watershed Partnership); Eric Gaidos (University of Hawai'i, Mānoa). Helicopter drop at OFNWR base camp for 3-day botanical survey of ridges and valleys at northern end of refuge.

Trip 2 (24–26 May 2005) Clyde Imada (BISH), Ane Bakutis (O'ahu Genetic Safety Net), Scott Lynch and Micah Ryder (KMWP). Helicopter drop on ridge north of Kīpapa Trail (Kīpapa Campsite, Fig 2, p. 13) at 750 m elevation for three-day botanical survey of upper-elevation ridges and drainages at southern end of OFNWR.

Trip 3 (2–4 May 2006) Clyde Imada (BISH), Ane Bakutis (O'ahu GSN), Scott Lynch (KMWP), Susan Ching-Harbin (U.S. Army Natural Resources), Kay Lynch (Lā'au Hawai'i). Helicopter drop at Kīpapa Campsite for three-day botanical survey of mid-elevation ridges and drainages at southern end of OFNWR.

## III. RESULTS

A total of 175 taxa were noted during the survey, including 122 endemic, 14 indigenous (including "ind?"), and 39 naturalized (including "nat?") or Polynesian-introduced (including "pol?"). Thus, about 78% of all plant taxa seen were native (136 of 175), a remarkably high percentage by current standards, attesting to the relatively undisturbed nature of the vegetation. By comparison, about 70 years ago Hosaka (1937) calculated that 83% (85 of 102) of plant taxa were

native in his 'Ōhi'a Zone and 89% (51 of 57) in his Cloud Zone.

### IIIa. Vegetation Zones

The vegetation zones of O'ahu Forest National Wildlife Refuge vary by elevation, wind exposure, slope, and substrate. Five vegetation types were observed in OFNWR, all structural variants of Lowland Wet communities. They are described here, along with specific species associated with each type. The vegetation classification system of Gagné and Cuddihy (1999) was adopted for this section.

#### Lowland Wet Forests

**'Ōhi'a/Uluhe Fern Forest:** Many of the main ridges and side ridges in the upper sections of the survey area are dominated by *Dicranopteris linearis* (uluhe) fern thickets, which tend to form a continuous blanket with emergent trees such as *Metrosideros polymorpha* ('ōhi'a lehua), *Hedyotis* spp. (manono), *Myrsine* spp. (kōlea), *Syzygium sandwicensis* ('ōhi'a hā), *Bobea elatior* ('ahakea lau nui), *Ilex anomala* (kāwa'u), *Joinvillea ascendens* ('ohe), and rarely *Cyanea* sp. (hāhā). Some alien plant species noted in this community are *Pterolepis glomerata*, *Axonopus fissifolius* (narrow-leaved carpetgrass), *Clidemia hirta* (Koster's curse), and *Rubus rosifolius* (thimbleberry).—See Fig. 3, p. 13

**'Ōhi'a Lowland Wet Forest:** The main valley of Kīpapa is dissected by alternating side ridges and gulches that lead down to the many upper headwater streams. The vegetation at the top of these ridges tend to be more windswept, with a dominant groundcover of fern and scattered trees ('Ōhi'a/Uluhe Fern Forest). As the ridges lose elevation and tend to be less exposed to the sun and wind, tree species become more numerous and condensed and the filtered understory is more speciose. The dominant *Metrosideros polymorpha* ('ōhi'a lehua) stands are interspersed with *Bobea elatior* ('ahakea lau nui), *Elaeocarpus bifidus* (kalia), *Hedyotis terminalis* (manono), *Pittosporum glabrum* (hō'awa), *Syzygium sandwicensis* ('ōhi'a hā), *Psychotria* spp. (kōpiko), and *Melicope* spp. (alani). The understory is comprised of few shrubs, including *Wikstroemia oahuensis* ('ākia), *Broussaisia arguta* (kanawao), *Pipturus albidus* (māmaki), *Touchardia latifolia* (olonā), *Charpentiera* sp. (pāpala), and *Clidemia hirta* (Koster's curse). Ferns such as *Cibotium* spp. (hāpu'u) and *Nephrolepis* spp. are intermixed with climbing and vining species such as *Freycinetia arborea* ('ie'ie), *Smilax melastomifolia* (hoi kuahiwi), and *Alyxia oliviformis* (maile).

**'Ōhi'a/'Ōlapa Forest:** The headwaters of Kīpapa Valley originate at the summit ridge that divides the windward and leeward range of the Ko'olau Mountains. The drainages that begin at the summit catch the trade winds and clouds that blow over the summit, creating a wet cloud zone dominated by a somewhat dwarfed forest of *Metrosideros polymorpha* ('ōhi'a lehua), *Cheirodendron* spp. ('ōlapa), *Hedyotis* spp. (manono), *Dubautia* spp. (na'ena'e), *Ilex anomala* (kāwa'u), *Pipturus albidus* (māmaki), *Platydesma spathulata* (pilo kea), *Scaevola mollis* (naupaka kuahiwi), and *Cibotium* spp. (hāpu'u). A few of the alien species that were observed in this zone were *Rubus rosifolius* (thimbleberry) and *Clidemia hirta* (Koster's curse). The *Clidemia* forms small monotypic stands in some areas.



### Lowland Wet Shrublands

**‘Ōhi‘a Lowland Wet Shrubland:** This plant community is restricted to the main summit ridge and the upper ridges of Kīpapa Valley. The windswept ridge is dominated by groundcover consisting mainly of uluhe interspersed with *Vaccinium* sp. (‘ōhelo), *Machaerina angustifolia* (‘uki), *Plantago pachyphylla* (laukahi kuahiwi), and *Clidemia hirta* (Koster's curse). In areas below the ridgelines where plants are slightly more protected from the strong winds, stunted tree species of *Metrosideros rugosa* (lehua papa), *Hedyotis* spp. (manono), *Tetraplasandra oahuensis* (‘ohe mauka), *Cheirodendron platyphyllum* (lapalapa), *Ilex anomala* (kāwa‘u), *Scaevola* spp. (naupaka kuahiwi), and *Myrsine* spp. (kōlea) can be seen. Dominant shrubs include *Wikstroemia oahuensis* (‘ākia), *Dubautia laxa* (na‘ena‘e pua melemele), *Coprosma longifolia* (pilo), and *Broussaisia arguta* (kanawao). Several *Labordia* species were noted in this area along with *Tetraplasandra gymnocarpa* (‘ohe‘ohe, Araliaceae), which is listed as an endangered species.

### Lowland Wet Mixed Communities

**‘Uki Mixed Shrub and Sedgeland:** On wide, gently sloping, windswept ridges above 600 m elevation subject to heavy cloud cover and rain, a boglike vegetation community may be encountered. Because of their occurrence on open ridges, there is enough drainage so that there is no standing water. There are basically two layers of vegetation: a ground layer of grasses and mosses interspersed with dwarfed woody shrubs, ferns, and herbs. Native components include the grasses *Dichanthelium koolauense* and *Isachne distichophylla* (‘ohe); ferns and fern allies *Sadleria pallida* (‘ama‘u ‘i‘i), *Cibotium glaucum* (hāpu‘u pulu), *Sphenomeris chinensis* (pala‘ā), *Lycopodiella cernua* (wāwae‘iole), and *Dicranopteris linearis* (uluhe); and herbs *Bidens macrocarpa* (ko‘oko‘olau) and *Plantago pachyphylla* (laukahi kuahiwi). Shrubs include the diminutive form of *Metrosideros polymorpha*, *M. rugosa*, *Scaevola* spp. (naupaka kuahiwi), *Lobelia gaudichaudii*, *Vaccinium reticulatum* (‘ōhelo), *Dubautia laxa* (na‘ena‘e), and *Syzygium sandwicensis* (‘ōhi‘a hā). The few invasives mixed in are *Sacciolepis indica* (Glenwood grass), *Axonopus fissifolius* (narrow-leaved carpetgrass), the herbaceous melastome *Pterolepis glomerata*, and *Clidemia hirta* (Koster's curse). *Machaerina angustifolia* (‘uki) plants can be found at the edges of the sedgeland, as well as higher-statured native vegetation. The area is similar to the description of the Castle bog located in the Ko‘olau Mountains north of OFNWR described by Samuel Gon III in 1994 (Gon 1994).—See Figs. 4 & 5, p. 13

### IIIb. Noteworthy plant discoveries/Taxa of conservation significance (See Map 3, p. 17)

- **Chamaesyce rockii** (Endangered) [‘Akoko]—Scandent shrub in the Euphorbiaceae with thick, leathery, decussate leaves and milky sap. 1) Relocated 7 of 8 plants previously counted (Hawaii Natural Heritage Program 2003) in the vicinity of OFNWR Base Camp, 671 m elevation, N21.49940 W157.90040; 2) Relocated several of the 7 plants previously counted in 2003 in the vicinity of Kīpapa Campsite, 750 m elevation, N21.49072 W157.89722; 3) Eight adult plants ranging from 0.5–1.25 m tall, on steep slope 3–8 m above gulch bottom, flowering (early May), associated with loulu (*Pritchardia martii*) colony, kanawao (*Broussaisia*

*arguta*), 'uki (*Machaerina angustifolia*), *Clidemia hirta*, 700 m elevation, N21.48917 W157.89484. The USFWS places unoccupied critical habitat for *Chamaesyce rockii* within OFNWR (p. xxx).—See Fig. 7, p. 14)

- **Cyanea humboldtiana** (Endangered) [Hāhā]—Unbranched lobeliad (family Campanulaceae) with stiff leaves and purple flowers. One individual was observed just below the summit ridge in a small drainage upslope of the trail in a pocket of uluhe fern (*Dicranopteris linearis*) and *Clidemia* (738 m elevation, N21.49981 W157.89713). The individual located was a seedling only about 5 cm in height, presumably in the same area where 4 immature plants were located in 2003 (Hawaii Natural Heritage Program 2003).—See fig. 8, p. 14
- **Dichantheium koolauense** (Rare, not protected)—Perennial tussock- or mat-forming grass found on wet, exposed ridgetops and slopes in the central Ko'olau in association with dwarfed flowering 'ōhi'a, 'ama'u 'i'i (*Sadleria pallida*), and *Lobelia gaudichaudii*. Noted occasionally in the 'Uki Mixed Shrub and Sedgeland habitat at the Kīpapa Campsite.
- **Doodia lyonii** (Species of Concern)—Small to medium-sized fern with fronds arranged in a flattened rosette with persistent dead stipes. It is a rarely seen species, but can be locally common where it persists in dark, moist, overhanging stream banks. Several stream banks in the upper drainages of the refuge harbor significant populations of this beautiful fern. Populations include: 1) A long stretch of Waikakalaua Stream southwest of OFNWR Base Camp, reported in 2003 to include ca. 560 mature plants, along with immature plants and sporelings (Hawaii Natural Heritage Program 2003); 2) Two separate populations on overhanging streambanks along the southern branch of Kīpapa Stream, ca. 40 individuals at each site (including sporelings), a) 566 m elevation, N21.48748 W157.90128; b) 573 m elevation, N21.48754 W157.90071. Threats include displacement by Hāmākua pamakani (*Ageratina riparia*) and torrential floods.—See Fig. 9, p. 14
- **Gardenia mannii** (Endangered) [Nā'ū]—A tree up to 15 m tall in the Rubiaceae, produces fragrant white flowers and orange fruit at maturity. Two spindly sterile adult trees (2.5 m tall with 2 branches; 3 m tall with several branches) were found in Kīpapa Gulch on moderate slope under 'ōhi'a canopy with hame (*Antidesma platyphylla*), disturbed understory of *Clidemia*, thimbleberry (*Rubus rosifolius*), basketgrass (*Oplismenus hirtellus*), 610 m elevation, N21.48750 W157.89929. The USFWS places unoccupied critical habitat for *Gardenia mannii* within OFNWR (p. 4).
- **Joinvillea ascendens** subsp. **ascendens** (Species of Concern) ['Ohe]—A grasslike monocot (family Joinvilleaceae) up to 5 m tall with thick, canelike stems; the narrowly to broadly elliptic, pleated leaves are up to 80 cm long and somewhat reminiscent of palmgrass (*Setaria palmifolia*) or Philippine ground orchid (*Spathoglottis plicata*). This uncommon species has been recorded on Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i in wet forest and along streams, 300–1250 m elevation. Two adult plants were noted along the leeward slope of the Ko'olau Summit Trail: 1) clump of 7 stalks up to 1.5 m tall, just off the trail, just starting to flower, 'ōhi'a-uluhe shrubland, 792 m elevation, N21.49930 W157.89801; 2) single sterile plant noted 4–5 m downslope, 742 m elevation, N21.49321 W157.89404.
- **Labordia hosakana** (Species of Concern) [Kamakahala]—Low-growing branched shrub in the strychnine family (Loganiaceae) with dark green, coriaceous, rugose leaves and yellowish orange flowers, scattered on cloudswept ridges and valleys in wet forest. While no population count was made, the species was noted on the ridge heading down from the Ko'olau summit into OFNWR Base Camp.

- **Lobelia gaudichaudii** subsp. **gaudichaudii** (Species of Concern) and **L. gaudichaudii** subsp. **koolauensis** (Endangered)—Single-stemmed lobeliad (family Campanulaceae) producing a tight apical rosette of thick, glabrous, sessile leaves and unbranched or branched terminal inflorescences of large crimson or greenish to yellowish white flowers. Found in the cloud zone on the Ko'olau summit. Subspecies *gaudichaudii* has a crimson corolla and usually unbranched inflorescence, and inhabits the central and southern Ko'olau; subsp. *koolauensis* has a greenish or yellowish white corolla and 2–6-branched inflorescence, and inhabits the northern Ko'olau. On steep north-side slopes at the Kīpapa Campsite (750 m elevation, N21.49072 W157.89722) at least 100 plants of various ages are scattered in 'Uki Mixed Shrub and Sedgeland. Flowering plants of subsp. *koolauensis* were noted on both surveys in May 2005, but no flowering was observed in May 2006, perhaps affected by the recent extended period of heavy rains between February and April 2006. No flowering specimens of subsp. *gaudichaudii* were noted during the surveys, but survey team members Ching and Bakutis know of their presence in the area; the general vicinity is apparently part of the Ko'olau where the ranges of the two subspecies overlaps.—See Fig 10, p. 14
- **Lobelia oahuensis** (Endangered)—Single-stemmed lobeliad (family Campanulaceae) with an apical rosette of narrowly elliptic leaves densely grayish green on the underside; lengthy terminal inflorescences producing numerous pale blue flowers. Relocation of a specimen noted in 2003 on windward slope of Ko'olau crest outside the OFNWR boundary (Hawaii Natural Heritage Program 2003), 762 m elevation, N21.49879 W157.89727.
- **Tetraplasandra gymnocarpa** (Endangered) ['Ohe'ohe]—A tree up to 10 m tall with odd-pinnate leaves in the ginseng family (Araliaceae). The species is distinguished by its reduced hypanthium, resulting in the ovary appearing fully superior. Trees are usually observed on the windward side of the windswept Ko'olau summit, but occasionally individuals are observed on the leeward side. No new individuals aside from those reported in 2003 (Hawaii Natural Heritage Program 2003) were noted.
- **Zanthoxylum oahuense** (Candidate) [A'e]—Monoecious, branched trees up to 6 m tall with fragrant trifoliate leaves in the citrus family (Rutaceae). Two trees were noted off the ridgeline west of the Kīpapa Campsite: 1) 732 m elevation, N21.49019 W157.89755; 2) Tree 3 m tall on steep slope emergent above scrubby 'ōhi'a, 'ōhi'a hā (*Syzygium sandwicense*), and uluhe (*Dicranopteris linearis*), 721 m elevation, N21.49079 W157.89792.

### IIIc. Weedy plants of concern

- **Ageratina adenophora** (Maui pāmakani)—Malodorous, semi-woody erect shrub with white flowers. Is a prolific seeder and replaces native understory plants. On the Hawai'i State Department of Agriculture noxious weed list.
- **Ageratina riparia** (Hāmākua pāmakani)—Spreading, soft shrub with rooting stems. Is often found in and along stream banks. Displaces native stream vegetation, including *Doodia lyonii*, a rare Hawaiian fern that occurs in the upper drainages of the refuge. A State noxious weed.



- **Andropogon virginicus** (broomsedge)—Erect bunchgrass to 100 cm tall. Forms nearly monotypic stands in open and disturbed conservation lands. Mostly found on ridge tops and slopes impeding reestablishment of native plant species. A State noxious weed.
- **Clidemia hirta** (Koster's curse)—This shade-tolerant melastome shrub with purple, bird-dispersed fruit is rampant throughout the moister parts of the Ko'olau, and is quite established on some of the ridge slopes, where it forms monotypic stands. A State noxious weed.
- **Cryptomeria japonica** (sugi pine)—A grove of this aromatic member of the redwood family (Taxodiaceae) was encountered along a wind-whipped section of the Ko'olau Summit Trail (750 m elevation, N21.48905 W157.89225). Although not noticeably expanding its range, it might be best to eradicate the population.
- **Falcataria moluccana** (albizia)—This fast-growing invasive forestry tree from the Moluccan region is currently uncommon in the refuge.
- **Hedychium gardnerianum** (kāhili ginger)—This ornamental ginger from the Himalayan region prefers wet habitats, where it spreads by underground stolons and red, bird-dispersed seeds. It can form thickets that displace all other understory elements. A small population was noted on the ridge trail heading down from the summit into the Base Camp (705 m elevation, N21.49990 W157.89925), and another plant was seen growing epiphytically on a loulu palm along the Ko'olau Summit Trail (725 m elevation, N21.49784 W157.89635).
- **Heliocarpus popayanensis** (white moho)—This fast-growing forestry tree with usually 3-lobed leaves is spread by its wind-dispersed, plumose-bristly fruit. Attempts were made to destroy individual saplings during the survey, but it appears to be expanding its geographic range in gulch bottoms throughout the refuge.
- **Psidium cattleianum** (strawberry guava)—*Psidium cattleianum* is uncommon in the refuge. It is one of the most intractable of mesic and wet forest noxious pests, forming thick monotypic stands.
- **Psidium guajava** (common guava)—This widespread weedy tree is common in the disturbed upper valley gulches.
- **Spathodea campanulata** (African tulip)—This invasive tree with large, bright orange-red, bell-shaped flowers is a popular cultivated plant but is readily dispersed and naturalized in moist to wet forests by its flat, winged seeds. It has the ability to invade undisturbed native forests. It is presently uncommon in the refuge.

#### IV. RECOMMENDATIONS

- Eradication efforts should concentrate on weedy tree species that are just starting to become established, such as *Heliocarpus popayanensis* (white moho, occasionally noted), and the rarely noted *Falcataria moluccana* (albizia), *Spathodea campanulata* (African tulip), *Citharexylum caudatum* (fiddlewood), and *Psidium cattleianum* (strawberry guava).
- A grove of *Cryptomeria japonica* (sugi pine) along the Ko'olau summit should be cut down.
- *Hedychium gardnerianum* (kāhili ginger) is uncommon and should also be eliminated from the refuge.

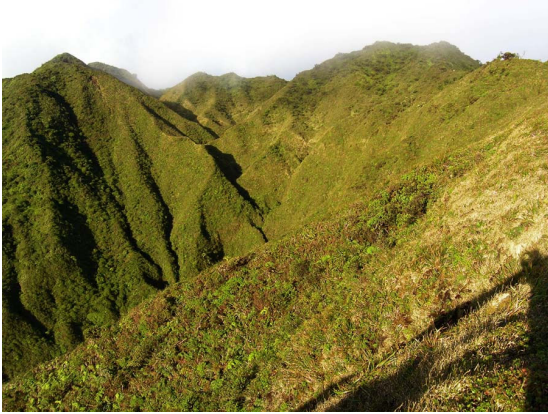
- Future surveillance efforts in the refuge should also be vigilantly on the lookout for invasives not noted on the survey, such as *Schefflera actinophylla* (octopus tree) and *Angiopteris evecta* (mule's-foot fern).

## **ACKNOWLEDGMENTS**

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**Figure 1.** A view towards the summit portion of the refuge.



**Figure 4.** The 'Uki Mixed Shrub and Sedgeland habitat is very wet, with low-growing vegetation, here featuring diminutive flowering 'ōhi'a (*Metrosideros polymorpha*).



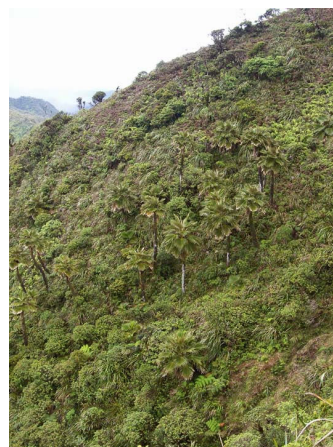
**Figure 2.** Kīpapa campsite.



**Figure 5.** A cushion-forming example of na'ena'e (*Dubautia laxa*) in wet 'Uki Sedgeland habitat on an open ridge.



**Figure 3.** Typical 'Ōhi'a/Uluhe Fern Forest habitat, the dominant wet upland vegetation community.



**Figure 6.** The native loulu palm (*Pritchardia martii*) is a common element on steep slopes.





**Figure 7.** The endangered 'akoko (*Chamaesyce rockii*) has large, leathery leaves adapted to a rainforest habitat.



**Figure 8.** A seedling, presumably of the endangered lobeliad *Cyanea humboldtiana*.



**Figure 9.** *Doodia lyonii* is a rare endemic fern found on moist, overhanging streamside banks.



**Figure 10.** *Lobelia gaudichaudii* ssp. *koolauensis* is an endangered lobeliad with branching inflorescences of yellowish white flowers.



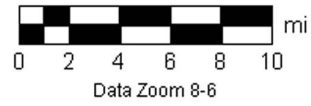
**Figure 11.** This hāpu'u fern trunk serves as a host for several young koli'i (*Trematolobelia macrostachys*), a native lobeliad.



### Map 1: Location of O'ahu Forest National Wildlife Refuge



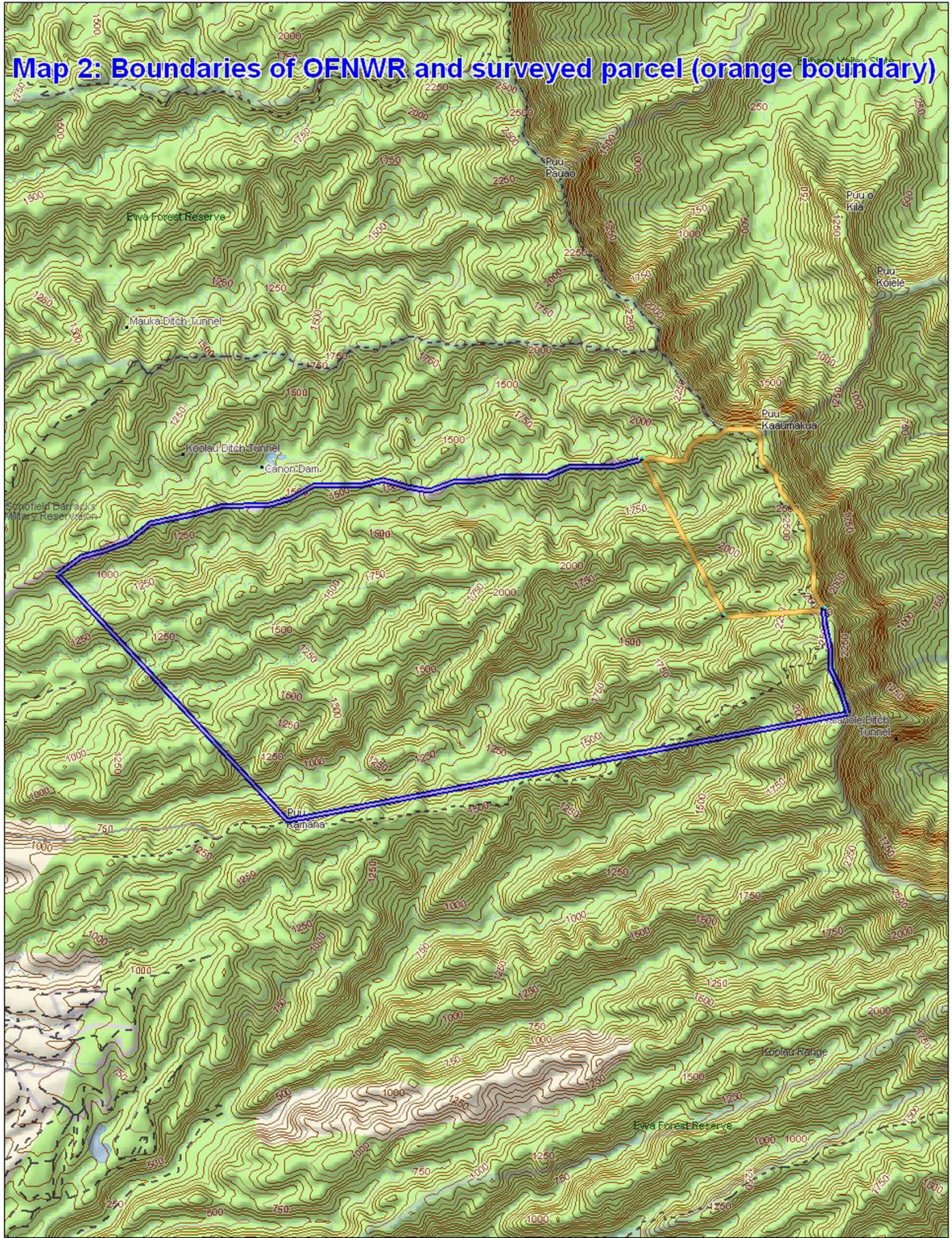
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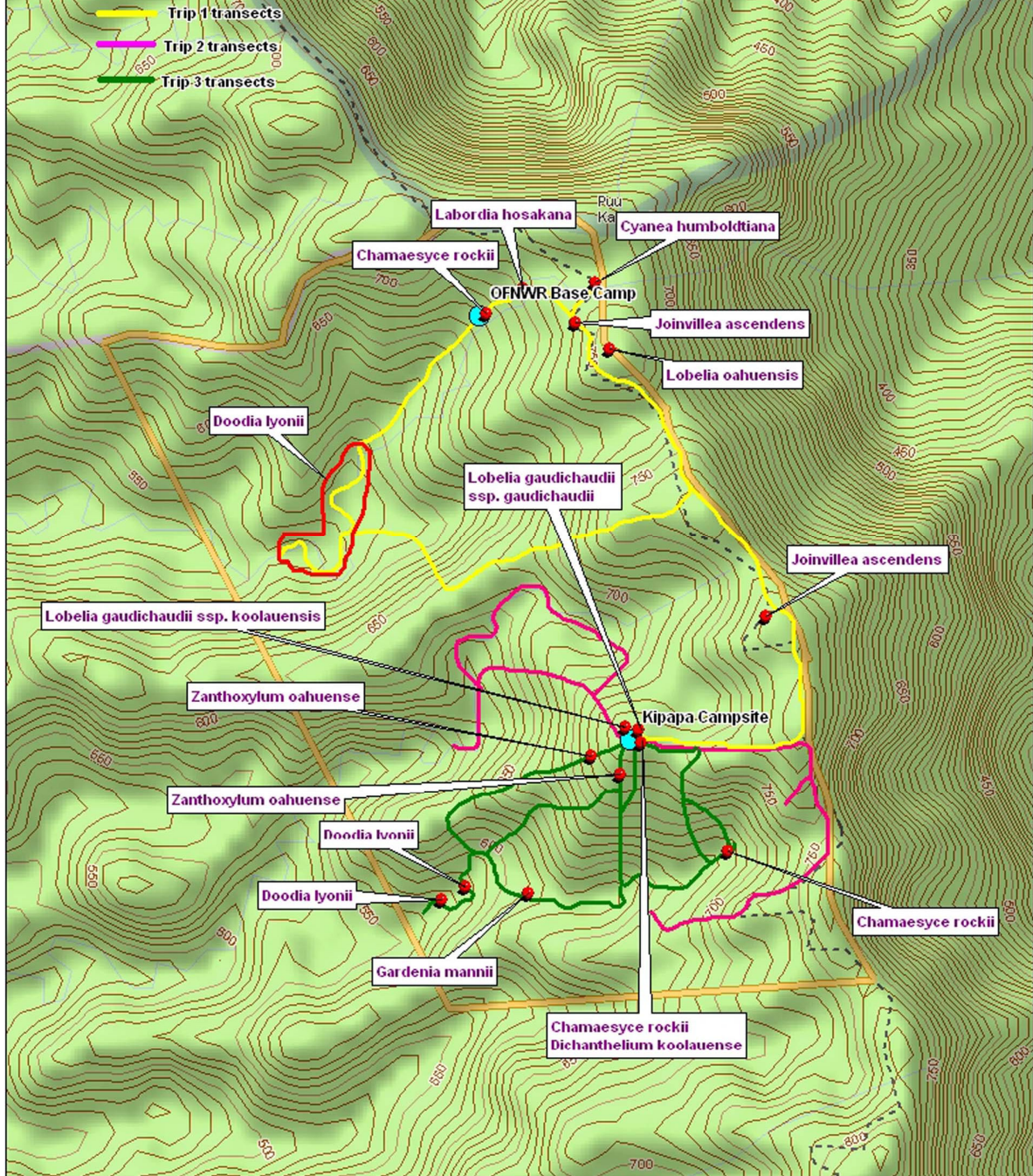


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### Map 3: Survey transects and Rare & Endangered plants



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MN (10.0° E)

0 120 240 360 480 600 m  
Data Zoom 13-6

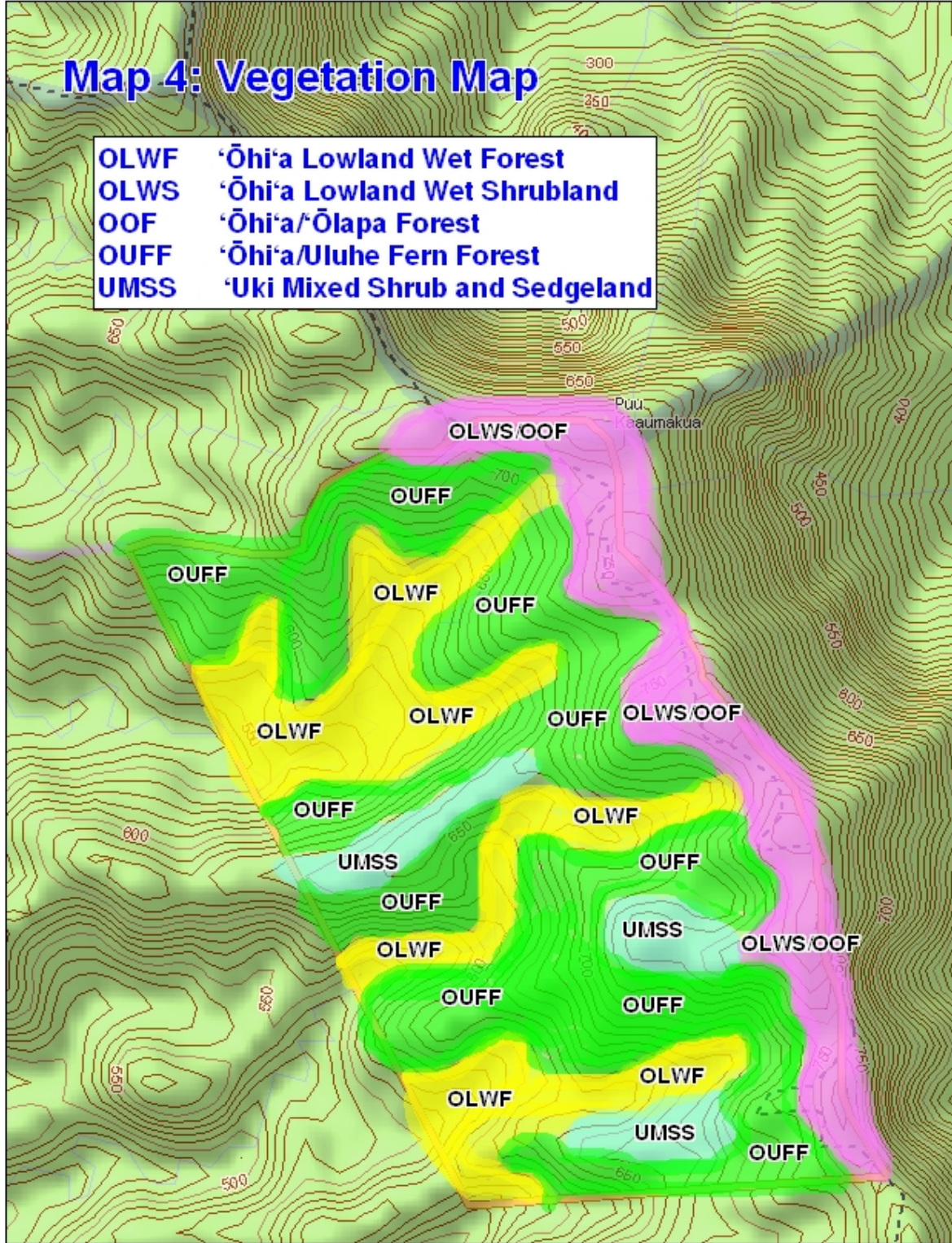


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## Map 4: Vegetation Map

- |             |                                       |
|-------------|---------------------------------------|
| <b>OLWF</b> | <b>‘Ōhi‘a Lowland Wet Forest</b>      |
| <b>OLWS</b> | <b>‘Ōhi‘a Lowland Wet Shrubland</b>   |
| <b>OOF</b>  | <b>‘Ōhi‘a/‘Ōlapa Forest</b>           |
| <b>OUFF</b> | <b>‘Ōhi‘a/Uluhe Fern Forest</b>       |
| <b>UMSS</b> | <b>‘Uki Mixed Shrub and Sedgeland</b> |



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MN (10.0° E)



Data Zoom 13-4



## **APPENDIX A: O'ahu Forest National Wildlife Refuge plant checklist**

The following is a list of vascular plant species noted during walk-through surveys of 190 hectares of O'ahu Forest National Wildlife Refuge (OFNWR) land between May 2005 and May 2006. A total of 175 taxa were noted during the survey, including 122 endemic, 14 indigenous (including "ind?"), and 39 naturalized or Polynesian-introduced (including "pol?").

Plants are divided into three main groups: dicots, monocots, gymnosperms, and pteridophytes. Within these groups, plants are arranged alphabetically by family, genus, and species. Each entry includes scientific name with author citation, biogeographic status, common name (if available), Hawaii State noxious weed status (Hawaii Department of Agriculture), and Federal endangerment status (if any). Taxonomy, status, and common names are in accordance with Wagner et al. (1999), Palmer (2003), or Staples and Herbst (2005). A number of specimens were collected and deposited in the Bishop Museum *Herbarium Pacificum*; some unknown species were collected and compared with herbarium collections to secure correct identifications. An explanation of abbreviations used in the list follows.

### **Biogeographic Status** (from Wagner et al. 1999)

- end      Endemic: native, occurring only in the Hawaiian Archipelago
- ind      Indigenous: native, occurring naturally in the archipelago but also outside of Hawai'i
- ind?     Questionably indigenous: probably indigenous, possibly naturalized
- nat      Naturalized: introduced to the archipelago directly or indirectly by humans since Western contact and reproducing and spreading vegetatively or by seed
- pol      Polynesian introduction: introduced by original Polynesian settlers, either intentionally or unintentionally, and now naturalized
- pol?     Questionably Polynesian-introduced: perhaps introduced by original Polynesian settlers, but possibly introduced in historic times

### **Federal Endangerment Status**

- E        Endangered: any species in danger of extinction throughout all or a significant portion of its range; protected under the U.S. Endangered Species Act of 1973 (ESA)
- C        Candidate: species for which there is sufficient information on biological status and threats to propose them as Endangered or Threatened, but not yet protected under ESA
- SOC     Species of Concern: rare species for which there is currently insufficient evidence on biological status and threats to propose them as Endangered or Threatened

### **Noxious Weed Status**

An asterisk (\*) preceding the scientific name indicates that the species is a noxious weed designated for eradication or control by the Hawaii Department of Agriculture (Hawaii Administrative Rules, Title 4 Subtitle 6 Chapter 68). A weed species must meet several criteria involving plant reproduction, growth characteristics, detrimental effects, necessary control measures, and distribution and spread before it is considered for addition to this list. The list was last updated on

O'ahu Forest National Wildlife Refuge Botanical Survey

18 June 1992. Four noxious weed species are included in the following checklist: *Ageratina adenophora*, *Ageratina riparia*, *Clidemia hirta* var. *hirta*, and *Andropogon virginicus*.

SCIENTIFIC NAME	STATUS	COMMON NAME	FEDST
<b>DICOTS</b>			
<b>Amaranthaceae</b>			
Charpentiera sp.	end	pāpala	
<b>Apiaceae</b>			
Centella asiatica (L.) Urb.	nat	Asiatic pennywort, pohe kula	
<b>Apocynaceae</b>			
Alyxia oliviformis Gaudich.	end	maile	
<b>Aquifoliaceae</b>			
Ilex anomala Hook. & Arn.	ind	kāwa'u	
<b>Araliaceae</b>			
Cheirodendron platyphyllum (Hook. & Arn.) Seem. ssp. platyphyllum	end	'ōlapa, lapalapa	
Cheirodendron trigynum (Gaudich.) A. Heller ssp. trigynum	end	'ōlapa, lapalapa	
Tetraplasandra gymnocarpa (Hillebr.) Sherff	end	'ohe'ohe	E
Tetraplasandra oahuensis (A. Gray) Harms	end	'ohe mauka	
<b>Asteraceae</b>			
* <i>Ageratina adenophora</i> (Spreng.) R. M. King & H. Rob.	nat	Maui pāmakani	
* <i>Ageratina riparia</i> (Regel) R. M. King & H. Rob.	nat	Hāmākua pāmakani, spreading mist flower	
<i>Ageratum conyzoides</i> L.	nat	maile hohono	
<i>Bidens macrocarpa</i> (A. Gray) Sherff	end	ko'oko'olau, ko'olau	
<i>Dubautia laxa</i> Hook. & Arn. ssp. <i>bryanii</i> (Sherff) G. D. Carr	end	na'ena'e pua meleleme	
<i>Dubautia laxa</i> Hook. & Arn. ssp. <i>pseudoplantaginea</i> (Skotts.) G. D. Carr	end	na'ena'e pua meleleme	
<i>Dubautia plantaginea</i> Gaudich. ssp. <i>plantaginea</i>	end	na'ena'e, kūpaoa	
<i>Erechtites valerianifolia</i> (Wolf) DC.	nat	fireweed	
<i>Pluchea carolinensis</i> (Jacq.) G. Don	nat	sourbush, marsh fleabane	
<i>Youngia japonica</i> (L.) DC.	nat	Oriental hawkbeard	
<b>Bignoniaceae</b>			
<i>Spathodea campanulata</i> P.Beauv.	nat	African tulip	
<b>Buddleiaceae</b>			
<i>Buddleia asiatica</i> Lour.	nat	huelo 'ilio, dog tail, butterfly bush	
<b>Campanulaceae</b>			
<i>Clermontia oblongifolia</i> Gaudich. ssp. <i>oblongifolia</i>	end	'ōhā wai, 'ōhā, hāhā	
<i>Clermontia</i> sp.	end	'ōhā wai, 'ōhā, hāhā	
<i>Cyanea humboldtiana</i> (Gaudich.) Lammers, Givnish & Sytsma	end	hāhā	E
<i>Cyanea</i> sp.	end	hāhā	
<i>Lobelia gaudichaudii</i> A. DC. ssp. <i>gaudichaudii</i>	end		SOC
<i>Lobelia gaudichaudii</i> A. DC. ssp. <i>koolauensis</i> (Hosaka & Fosberg) Lammers	end		E

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SCIENTIFIC NAME	STATUS	COMMON NAME	FEDST
<i>Lobelia hypoleuca</i> Hillebr.	end	kuhi 'aikamo'owahie	
<i>Lobelia oahuensis</i> Rock	end		E
<i>Trematolobelia macrostachys</i> (Hook. & Arn.) Zahlbr.	end	koli'i	
<b>Celastraceae</b>			
<i>Perrottetia sandwicensis</i> A. Gray	end	olomea	
<b>Elaeocarpaceae</b>			
<i>Elaeocarpus bifidus</i> Hook. & Arn.	end	kalia	
<b>Ericaceae</b>			
<i>Vaccinium dentatum</i> Sm.	end	'ōhelo	
<i>Vaccinium reticulatum</i> Sm.	end	'ōhelo, 'ōhelo 'ai	
<b>Euphorbiaceae</b>			
<i>Antidesma platyphyllum</i> H. Mann var. <i>platyphyllum</i>	end	hame	
<i>Bischofia javanica</i> Blume	nat	koka, toog	
<i>Chamaesyce rockii</i> (C. N. Forbes) Croizat & O. Deg.	end	'akoko	E
<b>Fabaceae</b>			
<i>Acacia koa</i> A. Gray	end	koa	
<i>Falcataria moluccana</i> (Miq.) Barneby & J. W. Grimes	nat	albizia	
<b>Gesneriaceae</b>			
<i>Cyrtandra cordifolia</i> Gaudich.	end	hahala, ha'iwale, kanawao ke'oke'o	
<i>Cyrtandra hawaiiensis</i> C. B. Clarke	end	ha'iwale, kanawao ke'oke'o	
<i>Cyrtandra paludosa</i> Gaudich. var. <i>paludosa</i>	end	moa, hahala, ha'iwale, kanawao ke'oke'o	
<i>Cyrtandra</i> sp.	end	ha'iwale, kanawao ke'oke'o	
<b>Goodeniaceae</b>			
<i>Scaevola gaudichaudiana</i> Cham.	end	naupaka kuahiwi	
<i>Scaevola glabra</i> Hook. & Arn.	end	'ohe naupaka	
<i>Scaevola mollis</i> Hook. & Arn.	end	naupaka kuahiwi	
<b>Hydrangeaceae</b>			
<i>Broussaisia arguta</i> Gaudich.	end	kanawao, pū'ahanui	
<b>Lamiaceae</b>			
<i>Phyllostegia grandiflora</i> (Gaudich.) Benth.	end	kāpana	
<i>Phyllostegia lantanoides</i> Sherff	end		
<i>Phyllostegia</i> sp.	end		
<b>Loganiaceae</b>			
<i>Labordia fagraeoides</i> Gaudich.	end	kāmakahala	
<i>Labordia hosakana</i> (Sherff) W. L. Wagner, D. R. Herbst & Sohmer	end	kāmakahala	SOC
<i>Labordia sessilis</i> A. Gray	end	kāmakahala	
<i>Labordia waiolani</i> Wawra	end	kāmakahala	
<b>Lythraceae</b>			
<i>Cuphea carthagenensis</i> (Jacq.) J. F. Macbr.	nat	tarweed, Colombian cuphea	
<b>Malvaceae</b>			
<i>Hibiscus arnottianus</i> A. Gray ssp. <i>arnottianus</i>	end	koki'o ke'oke'o, hau hele	

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SCIENTIFIC NAME	STATUS	COMMON NAME	FEDST
<b>Melastomataceae</b>			
*Clidemia hirta (L.) D. Don var. hirta	nat	Koster's curse	
Pterolepis glomerata (Rottb.) Miq.	nat		
<b>Myrsinaceae</b>			
Myrsine degeneri Hosaka	end	kōlea	
Myrsine lessertiana A. DC.	end	kōlea lau nui, kōlea	
Myrsine pukooensis (H. Lév.) Hosaka	end	kōlea	
Myrsine sandwicensis A. DC.	end	kōlea lau li'i, kōlea	
<b>Myrtaceae</b>			
Metrosideros macropus Hook. & Arn.	end	'ōhi'a, 'ōhi'a lehua, lehua	
Metrosideros polymorpha Gaudich. var. glaberrima (H. Lév.) H. St. John	end	'ōhi'a, 'ōhi'a lehua, lehua	
Metrosideros polymorpha Gaudich. var. incana (H. Lév.) H. St. John	end	'ōhi'a, 'ōhi'a lehua, lehua	
Metrosideros polymorpha Gaudich. var. polymorpha	end	'ōhi'a, 'ōhi'a lehua, lehua	
Metrosideros polymorpha Gaudich. var. pumila (A. Heller) J. W. Dawson & Stemmerm.	end	'ōhi'a, 'ōhi'a lehua, lehua	
Metrosideros rugosa A. Gray	end	lehua papa	
Metrosideros tremuloides (A. Heller) Knuth	end	lehua 'āhihi, 'āhihi	
Psidium cattleianum Sabine	nat	strawberry guava, waiawī 'ula'ula	
Psidium guajava L.	nat	common guava, kuawa	
Syzygium sandwicensis (A. Gray) Nied.	end	'ōhi'a hā	
<b>Onagraceae</b>			
Ludwigia octovalvis (Jacq.) P. H. Raven	pol?	primrose willow, kāmole	
<b>Piperaceae</b>			
Peperomia ellipticibacca C. DC.	end	'ala'ala wai nui	
Peperomia latifolia Miq.	end	'ala'ala wai nui	
Peperomia membranacea Hook. & Arn.	end	'ala'ala wai nui	
Peperomia sp.		'ala'ala wai nui	
<b>Pittosporaceae</b>			
Pittosporum confertiflorum A. Gray	end	hō'awa	
Pittosporum glabrum Hook. & Arn.	end	hō'awa, papahekili	
<b>Plantaginaceae</b>			
Plantago pachyphylla A. Gray	end	laukahi kuahiwi, manene	
<b>Rosaceae</b>			
Rubus rosifolius Sm.	nat	thimbleberry, Mauritius raspberry	
<b>Rubiaceae</b>			
Bobeia elatior Gaudich.	end	'ahakea lau nui	
Coprosma longifolia A. Gray	end	pilo, hupilo	
Gardenia manni H. St. John & Kuykendall	end	nānū, nā'ū	E
Hedyotis centranthoides (Hook. & Arn.) Steud.	end		
Hedyotis fosbergii W. L. Wagner & D. R. Herbst	end	manono	
Hedyotis terminalis (Hook. & Arn.) W. L. Wagner & D. R. Herbst	end	manono	
Psychotria fauriei (H. Lév.) Fosberg	end	kōpiko	



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SCIENTIFIC NAME	STATUS	COMMON NAME	FEDST
<i>Psychotria mariniana</i> (Cham. & Schltdl.) Fosberg	end	kōpiko	
<b>Rutaceae</b>			
<i>Melicope clusiifolia</i> (A. Gray) T. G. Hartley & B. C. Stone	end	alani, alani kuahiwi	
<i>Melicope hosakae</i> (H. St. John) W. L. Wagner & R. K. Shannon	end	alani, alani kuahiwi	
<i>Melicope oahuensis</i> (H. Lév.) T. G. Hartley & B. C. Stone	end	alani, alani kuahiwi	
<i>Melicope wawraeana</i> (Rock) T. G. Hartley & B. C. Stone	end	alani, alani kuahiwi	
<i>Zanthoxylum oahuense</i> Hillebr.	end	a'e, mānele, hea'e	C
<b>Sapotaceae</b>			
<i>Pouteria sandwicensis</i> (A. Gray) Baehni & O. Deg.	end	'āla'a, āulu	
<b>Thymelaeaceae</b>			
<i>Wikstroemia oahuensis</i> (A. Gray) Rock var. <i>oahuensis</i>	end	'ākia, kauhi	
<b>Tiliaceae</b>			
<i>Heliocarpus popayanensis</i> Kunth	nat	moho, white moho	
<b>Urticaceae</b>			
<i>Boehmeria grandis</i> (Hook. & Arn.) A. Heller	end	'ākōlea	
<i>Pipturus albidus</i> (Hook. & Arn.) A. Gray	end	māmaki	
<i>Touchardia latifolia</i> Gaudich.	end	olonā	
<b>Verbenaceae</b>			
<i>Citharexylum caudatum</i> L.	nat	fiddlewood	
<i>Stachytarpheta australis</i> Moldenke	nat	ōwī, oī	
<i>Stachytarpheta cayennensis</i> (Rich.) Vahl	nat	ōwī, oī	
<b>Viscaceae</b>			
<i>Korthalsella complanata</i> (Tiegh.) Engl.	ind	hulumoa, kaumahana	
<i>Korthalsella cylindrica</i> (Tiegh.) Engl.	end	hulumoa, kaumahana	
GYMNOSPERMS			
<b>Taxodiaceae</b>			
<i>Cryptomeria japonica</i> (L.f.) D. Don	nat	sugi pine	
MONOCOTS			
<b>Agavaceae</b>			
<i>Cordyline fruticosa</i> (L.) A. Chev.	pol	kī, ti	
<b>Arecaceae</b>			
<i>Pritchardia martii</i> (Gaudich.) H. Wendl.	end	loulu hiwa, loulu	
<b>Cyperaceae</b>			
<i>Carex wahuensis</i> C. A. Mey. ssp. <i>wahuensis</i>	end		
<i>Gahnia beecheyi</i> H. Mann	end		
<i>Kyllinga brevifolia</i> Rottb.	nat	kili'o'opu, kaluhā, manunēnē	
<i>Machaerina angustifolia</i> (Gaudich.) T. Koyama	ind	'uki	
<i>Machaerina mariscoides</i> (Gaudich.) J. Kern ssp. <i>meyenii</i> (Kunth) T. Koyama	end	'ahaniu, 'uki	
<i>Rhynchospora rugosa</i> (Vahl) Gale ssp. <i>lavarum</i> (Gaudich.) T. Koyama	ind	pu'uko'a	

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SCIENTIFIC NAME	STATUS	COMMON NAME	FEDST
<b>Joinvilleaceae</b>			
Joinvillea ascendens Gaudich. ex Brongn. & Gris ssp. ascendens	end	'ohe	SOC
<b>Juncaceae</b>			
Juncus planifolius R. Br.	nat	rush, bog rush	
<b>Liliaceae</b>			
Dianella sandwicensis Hook. & Arn.	ind	'uki'uki, 'uki	
<b>Orchidaceae</b>			
Arundina graminifolia (D. Don) Hochr.	nat	bamboo orchid	
Spathoglottis plicata Blume	nat	Malayan ground orchid, Philippine ground orchid	
<b>Pandanaceae</b>			
Freycinetia arborea Gaudich.	ind	'ie'ie, 'ie	
<b>Poaceae</b>			
*Andropogon virginicus L.	nat	broomsedge, yellow bluestem	
Axonopus fissifolius (Raddi) Kuhl.	nat	narrow-leaved carpetgrass	
Dichanthelium koolauense (H. St. John & Hosaka) C. A. Clark & Gould	end		
Isachne distichophylla Munro ex Hillebr.	end	'ohe	
Isachne pallens Hillebr.	end		
Oplismenus hirtellus (L.) P. Beauv.	nat	basketgrass, honohono kukui	
Paspalum conjugatum P. J. Bergius	nat	Hilo grass, sour paspalum	
Paspalum scrobiculatum L.	ind?	ricegrass, mau'u laiki	
Sacciolepis indica (L.) Chase	nat	Glenwood grass	
Setaria parviflora (Poir.) Kerguélen	nat	yellow foxtail, perennial foxtail	
<b>Smilacaceae</b>			
Smilax melastomifolia Sm.	end	hoi kuahiwi	
<b>Zingiberaceae</b>			
Hedychium gardnerianum Ker. Gawl.	nat	kāhili ginger	
PTERIDOPHYTES			
<b>Aspleniaceae</b>			
Asplenium acuminatum Hook. & Arn.	end	lola	
Asplenium aethiopicum (Burm. f.) Bech.	ind	'iwa'iwa a Kāne	
Asplenium contiguum Kaulf. var. contiguum	end		
<b>Athyriaceae</b>			
Athyrium microphyllum (J. Sm.) Alston	end	'ākōlea	
Deparia petersenii (Kunze) M. Kato	nat		
Deparia prolifera (Kaulf.) Hook. & Grev.	end		
<b>Blechnaceae</b>			
Blechnum appendiculatum Willd.	nat		
Doodia lyonii O. Deg.	end		SOC
Sadleria cyatheoides Kaulf.	end	'ama'u	
Sadleria pallida Hook. & Arn.	end	'ama'u 'i'i	

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SCIENTIFIC NAME	STATUS	COMMON NAME	FEDST
Sadleria souleyetiana (Gaudich.) T. Moore	end	'ama'u	
Sadleria squarrosa (Gaudich.) T. Moore	end	'apu'u	
<b>Dicksoniaceae</b>			
Cibotium chamissoi Kaulf.	end	hāpu'u	
Cibotium glaucum (Sm.) Hook. & Arn.	end	hāpu'u, hāpu'u pulu	
Cibotium menziesii Hook.	end	hāpu'u 'i'i	
<b>Dryopteridaceae</b>			
Tectaria gaudichaudii (Mett.) Maxon	end	'iwa'iwa lau nui	
<b>Elaphoglossaceae</b>			
Elaphoglossum aemulum (Kaulf.) Brack.	end	'ēkaha, 'opeha, laukahi nunui	
Elaphoglossum alatum Gaudich.	end	hoe a Māui, 'ēkaha	
Elaphoglossum crassifolium (Gaudich.) W. R. Anderson & Crosby	end	hoe a Māui, 'ēkaha	
Elaphoglossum pellucidum Gaudich.	end	hoe a Māui, 'ēkaha 'ula	
<b>Gleicheniaceae</b>			
Dicranopteris linearis (Burm f.) Underw. f. linearis	ind	uluhe	
Diplopterygium pinnatum (Kunze) Nakai	end	uluhe lau nui	
<b>Grammitidaceae</b>			
Adenophorus haalilioanus (Brack.) K. A. Wilson	end		
Adenophorus hymenophylloides (Kaulf.) Hook. & Grev.	end	pai, palai huna	
Adenophorus pinnatifidus Gaudich. var. pinnatifidus	end		
Adenophorus tamariscinus (Kaulf.) Hook. & Grev. var. tamariscinus	end	wahine noho mauna	
Grammitis tenella Kaulf.	end	kolokolo, mahinalua	
<b>Hymenophyllaceae</b>			
Mecodium recurvum (Gaudich.) Copel.	end	'ōhi'a kū	
Sphaerocionium lanceolatum (Hook. & Arn.) Copel.	end	palai hinahina	
Sphaerocionium obtusum (Hook. & Arn.) Copel.	end	palai lau li'i	
Vandenboschia davallioides (Gaudich.) Copel.	end	palai hihi, kīlau	
<b>Lindsaeaceae</b>			
Sphenomeris chinensis (L.) Maxon	ind	pala'ā	
<b>Lycopodiaceae</b>			
Huperzia erubescens (Brack.) Holub	ind		
Huperzia phyllantha (Hook. & Arn.) Holub	ind	wāwae'irole	
Huperzia serrata (Thunb. ex Murray) Trevis.	ind		
Huperzia subintegra (Hillebr.) Beitel & W. H. Wagner	end		
Lycopodiella cernua (L.) Pic. Serm.	ind	wāwae'irole, hulu 'irole	
<b>Nephrolepidaceae</b>			
Nephrolepis exaltata (L.) Schott ssp. hawaiiensis W.H. Wagner	end	ni'ani'au, 'ōkupukupu, kupukupu	
<b>Polypodiaceae</b>			
Phlebodium aureum (L.) J. Sm.	nat	laua'e haole, rabbit's-foot fern	
<b>Selaginellaceae</b>			
Selaginella arbuscula (Kaulf.) Spring	end	lepelepe a moa	

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SCIENTIFIC NAME	STATUS	COMMON NAME	FEDST
<b>Thelypteridaceae</b>			
<i>Amauropelta globulifera</i> (Brack.) Holttum	end	palapalai a Kamapua'a	
<i>Christella cyatheoides</i> (Kaulf.) Holttum	end	kikawaiō	
<i>Christella parasitica</i> (L.) Lév.	nat		
<i>Pneumatopteris sandwicensis</i> (Brack.) Holttum	end	hō'i'o kula	



**APPENDIX B: Historical vouchers of rare and endangered taxa located at Bishop Museum**

The Herbarium Pacificum at Bishop Museum houses over 600,000 preserved plant specimens from all over the world, but primarily concentrated in the Hawaiian Islands and the Pacific Basin. The Hawaiian vascular plant collection itself numbers about 135,000 specimens, and data entry into a relational database has been completed for all attached label information, thus allowing for queries of geographical distribution based on place name localities provided by the collector. Such a query, based on the keywords Kīpapa, Waikakalaua, and Waiawa on O'ahu, produced over 1600 collections from throughout the length of each stream drainage. The list was then distilled to include only those collections from upland drainages representing rare and endangered taxa, namely, those recognized by the U.S. Fish and Wildlife Service as Endangered, Candidate, or Species of Concern (M. Bruegmann, pers. comm.), and is reproduced below for historical background.

Family	Scientific name	Locality/Habitat/Plt description	Elev	Collector	Coll date
Apiaceae	Sanicula purpurea H.St.John & Hosaka	Kipapa Gulch, on exposed mossy, turfy ridge; bad odor	860m	Fosberg 9734	6.viii.1933
Apiaceae	Sanicula purpurea H.St.John & Hosaka	Kipapa–Waihole crest, <i>Metrosideros-Cheirodendron</i> forest	850m	Grant 7224	7.viii.1934
Apiaceae	Sanicula purpurea H.St.John & Hosaka	Kipapa Gulch, on wet windswept main divide of range		Hosaka 1135	6.viii.1933
Apiaceae	Sanicula purpurea H.St.John & Hosaka	Ridge S of Kipapa Gulch; rain forest	790m	Morley 74	10.xii.1933
Araliaceae	Tetraplasandra gymnocarpa (Hillebr.) Sherff	Head of Waiawa Valley 20 ft. below Kipapa trail		Rogers s.n.	29.ix.1946
Araliaceae	Tetraplasandra gymnocarpa (Hillebr.) Sherff	Waikakalaua Gulch, along wooded stream bed; 35 ft. tree	305m	Hosaka 301	14.ix.1930
Araliaceae	Tetraplasandra gymnocarpa (Hillebr.) Sherff	Kipapa Gulch, S ridge; denuded slope; 25 ft. tree	762m	Hosaka 688	18.ix.1932
Araliaceae	Tetraplasandra gymnocarpa (Hillebr.) Sherff	Kipapa–Waiawa Ridge; <i>Metrosideros</i> forest; 15 ft. tree	792m	Grant 7240	7.viii.1934
Araliaceae	Tetraplasandra gymnocarpa (Hillebr.) Sherff	Ridge S of Kipapa Gulch; moderate rain forest	762m	Morley 64	10.xii.1933
Asteraceae	Hesperomannia arborescens A.Gray	Kipapa Trail between 4 and 4.5 mileposts; in forest		Degener et al. 10007	2.vi.1935
Asteraceae	Hesperomannia arborescens A.Gray	Kipapa Trail		Degener et al. 10080	2.vi.1935
Asteraceae	Hesperomannia arborescens A.Gray	Kipapa Gulch; involucre wine-colored; midrib of leaves reddish	575m	Fosberg 9791	8.viii.1933
Asteraceae	Hesperomannia arborescens A.Gray	Kipapa Gulch; plant 5 ft. tall, stem 1.5 in. diam.	518m	Pearsall s.n.	5.vii.1958
Asteraceae	Hesperomannia arborescens A.Gray	Kipapa Gulch, S ridge; 15 ft. tree	549m	Hosaka 619	04.vii.1932
Asteraceae	Hesperomannia arborescens A.Gray	Kipapa Trail		Kerr sub Degener 19632	30.v.1949
Asteraceae	Hesperomannia arborescens A.Gray	Kipapa Gulch; tree 15 ft. tall	503m	Grant 7251	8.viii.1934
Blechnaceae	Doodia lyoni O.Deg.	Kipapa Gulch, streambed	460m	Hosaka 803	16.x.1932

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Family	Scientific name	Locality/Habitat/Plt description	Elev	Collector	Coll date
Blechnaceae	Doodia lyonii O.Deg.	Kipapa Gulch; shady bank above stream	550m	Fosberg 9797	8.viii.1933
Blechnaceae	Doodia lyonii O.Deg.	Kipapa Stream; damp gorge	305m	St. John 10012	10.xi.1929
Blechnaceae	Doodia lyonii O.Deg.	Kipapa; Waikakalaua Gulch; steep damp slope	425m	Topping sub Degener 5895	6.iv.1930
Campanulaceae	Cyanea acuminata (Gaudich.) Hillebr.	Kipapa Gulch, in <i>Metrosideros-Antidesma</i> forest; shrub 7 ft. tall	460m	Grant 7261	3.viii.1934
Campanulaceae	Cyanea acuminata (Gaudich.) Hillebr.	Kipapa Gulch	520m	Hosaka 1185	07.viii.1933
Campanulaceae	Cyanea acuminata (Gaudich.) Hillebr.	Kipapa Gulch, S ridge; in stream bed	488m	Hosaka 807	16.x.1932
Campanulaceae	Cyanea calycina (Cham.) Lammers	Kipapa Gulch; erect, unbranched undershrub 6 ft. high; flower dark purple	457m	Bryan Jr 774	18.ix.1934
Campanulaceae	Cyanea calycina (Cham.) Lammers	Kipapa–Waiau Ridge; <i>Metrosideros</i> forest; erect, 3 ft. tall	548m	Grant 7205	7.viii.1934
Campanulaceae	Cyanea calycina (Cham.) Lammers	Kipapa Gulch, S ridge; moist gully	335m	Hosaka 1029	14.v.1933
Campanulaceae	Cyanea calycina (Cham.) Lammers	Kipapa Gulch, S ridge	518m	Hosaka 1106	2.vii.1933
Campanulaceae	Cyanea calycina (Cham.) Lammers	Kipapa Gulch; in denuded depression	823m	Hosaka 1158	6.viii.1933
Campanulaceae	Cyanea calycina (Cham.) Lammers	Kipapa Gulch; on wooded slope	610m	Hosaka 1192	7.viii.1933
Campanulaceae	Cyanea calycina (Cham.) Lammers	Waiakakalaua Gulch	274m	Hosaka 299	14.ix.1930
Campanulaceae	Cyanea calycina (Cham.) Lammers	Waiakakalaua Gulch	366m	Hosaka 302	14.ix.1930
Campanulaceae	Cyanea calycina (Cham.) Lammers	Kipapa Gulch, S ridge; moist woods	305m	Hosaka 554	15.v.1932
Campanulaceae	Cyanea calycina (Cham.) Lammers	Kipapa Gulch, S ridge; moderately moist gully	305m	Hosaka 573	29.v.1932
Campanulaceae	Cyanea calycina (Cham.) Lammers	Kipapa Gulch, S ridge; wet woods	488m	Hosaka 717	18.ix.1932
Campanulaceae	Cyanea calycina (Cham.) Lammers	Waiawa–Waipio ridge; rain forest	600m	Macdaniels 15	06.x.1926
Campanulaceae	Cyanea crispa (Gaudich.) Lammers, Givnish & Sytsma	Kipapa Gulch; in moist gully	520m	Hosaka 1000	6.v.1933
Campanulaceae	Cyanea crispa (Gaudich.) Lammers, Givnish & Sytsma	Kipapa 2nd N branch	305m	Hosaka 217	13.iv.1930
Campanulaceae	Cyanea crispa (Gaudich.) Lammers, Givnish & Sytsma	Kipapa Gulch, S ridge; in moderately moist gully	275m	Hosaka 568	20.v.1932
Campanulaceae	Cyanea crispa (Gaudich.) Lammers, Givnish & Sytsma	Kipapa Gulch, in lower forest	305m	Hosaka 982	30.iv.1933

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Family	Scientific name	Locality/Habitat/Plt description	Elev	Collector	Coll date
Campanulaceae	<i>Cyanea crispa</i> (Gaudich.) Lammers, Givnish & Sytsma	E. of Puu Kamana; S ridge of Kipapa Gulch, moist gulch	488m	St. John s.n.	15.v.1932
Campanulaceae	<i>Cyanea crispa</i> (Gaudich.) Lammers, Givnish & Sytsma	Waikakalaua Gulch; flowers reddish purple, one plant 3 m tall	245m	St. John 10469	6.iv.1930
Campanulaceae	<i>Cyanea grimesiana</i> Gaudich. <i>grimesiana</i>	Kipapa Gulch, in <i>Acacia</i> forest	366m	Grant 7275	8.viii.1934
Campanulaceae	<i>Cyanea grimesiana</i> Gaudich. <i>grimesiana</i>	Kipapa Gulch, along stream bed, second N fork	335m	Hosaka 830	13.xi.1932
Campanulaceae	<i>Cyanea grimesiana</i> Gaudich. <i>grimesiana</i>	Kipapa; near stream bed; shrub	425m	Hume 87	15.ii.1931
Campanulaceae	<i>Cyanea humboldtiana</i> (Gaudich.) Lammers, Givnish & Sytsma	Kipapa Gulch, S ridge, moderately moist gully	305m	Hosaka 1043	15.v.1932
Campanulaceae	<i>Cyanea humboldtiana</i> (Gaudich.) Lammers, Givnish & Sytsma	Kipapa Gulch, S ridge, moderately moist gully	305m	Hosaka 516	15.v.1932
Campanulaceae	<i>Cyanea humboldtiana</i> (Gaudich.) Lammers, Givnish & Sytsma	Kipapa Gulch, S ridge, moderately moist gully	305m	Hosaka 569	15.v.1932
Campanulaceae	<i>Cyanea humboldtiana</i> (Gaudich.) Lammers, Givnish & Sytsma	Kipapa Gulch, second N fork; along moist stream bed	305m	Hosaka 829	13.xi.1932
Campanulaceae	<i>Cyanea humboldtiana</i> (Gaudich.) Lammers, Givnish & Sytsma	Waiawa–Waipio ridge; rain forest	500m	Macdaniels 13	06.x.1926
Campanulaceae	<i>Cyanea koolauensis</i> Lammers, Givnish & Sytsma	Kipapa Gulch trail; flowers deep red-magenta		Cowan 712	05.x.1947
Campanulaceae	<i>Cyanea koolauensis</i> Lammers, Givnish & Sytsma	Kipapa–Waiuu Ridge, in <i>Metrosideros-Acacia</i> forest	549m	Grant 7185	7.viii.1934
Campanulaceae	<i>Cyanea koolauensis</i> Lammers, Givnish & Sytsma	Kipapa-Waiuu Ridge, in <i>Metrosideros</i> forest	610m	Grant 7283	7.viii.1934
Campanulaceae	<i>Cyanea koolauensis</i> Lammers, Givnish & Sytsma	Kipapa Gulch, S ridge, on wooded ridge	518m	Hosaka 596	4.vii.1932
Campanulaceae	<i>Cyanea koolauensis</i> Lammers, Givnish & Sytsma	S ridge of Kipapa Gulch, 2–3 ft. off trail, in thicket	518m	Chang s.n.	15.v.1932
Campanulaceae	<i>Cyanea lanceolata</i> (Gaudich.) Lammers, Givnish & Sytsma	Kipapa Gulch, SE ridge; <i>Metrosideros-Acacia</i> forest	374m	Grant 7078	13.vii.1934
Campanulaceae	<i>Cyanea lanceolata</i> (Gaudich.) Lammers, Givnish & Sytsma <i>lanc</i>	Kipapa Gulch, 2nd N fork	335m	Hosaka 1027	
Campanulaceae	<i>Cyanea longiflora</i> (Wawra) Lammers, Givnish & Sytsma	SE ridge, Kipapa Gulch, growing in <i>Metrosideros-Acacia</i> forest	372m	Grant 7087	13.vii.1934



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Family	Scientific name	Locality/Habitat/Plt description	Elev	Collector	Coll date
Campanulaceae	Cyanea longiflora (Wawra) Lammers, Givnish & Sytsma	Kipapa Gulch, S ridge, moderately moist gully	305m	Hosaka 516	15.v.1932
Campanulaceae	Cyanea longiflora (Wawra) Lammers, Givnish & Sytsma	Kipapa Gulch, S ridge, in moist woods	366m	Hosaka 918	5.iii.1933
Campanulaceae	Cyanea longiflora (Wawra) Lammers, Givnish & Sytsma	Waipio		Lydgate s.n.	
Campanulaceae	Cyanea longiflora (Wawra) Lammers, Givnish & Sytsma	Western division of main ridge, from Waipio to Helemano		Hillebrand s.n.	
Campanulaceae	Cyanea st.-johnii (Hosaka) Lammers, Givnish & Sytsma	Koolau summit, above Kipapa gulch, bush 1 m tall. Fls waxy white, anthers purple	900m	Fosberg & Hosaka 8715	18.ix.1932
Campanulaceae	Cyanea st.-johnii (Hosaka) Lammers, Givnish & Sytsma	Kipapa-Waiahole crest, in <i>Metrosideros-Cheirodendron</i> forest	855m	Grant 7265	7.viii.1934
Campanulaceae	Cyanea st.-johnii (Hosaka) Lammers, Givnish & Sytsma	Kipapa Gulch	853m	Hosaka 1159	06.viii.1933
Campanulaceae	Cyanea st.-johnii (Hosaka) Lammers, Givnish & Sytsma	Kipapa Gulch main divide; 1.5 ft. shrub	853m	Hosaka 1256	7.viii.1934
Campanulaceae	Cyanea st.-johnii (Hosaka) Lammers, Givnish & Sytsma	Kipapa Gulch; shrub 1.5 ft. high	853m	Hosaka 743	18.ix.1932
Campanulaceae	Lobelia gaudichaudii A.DC. gaudichaudii	Kipapa trail right of Kipapa Gulch, lower cloud zone, 200 yds from top	823m	Ozaki 561	27.ix.1953
Campanulaceae	Lobelia gaudichaudii A.DC. gaudichaudii	Kipapa-Waiahole crest, <i>Metrosideros-Cheirodendron</i> forest; ascending 3 ft		Grant 7217	07.viii.1934
Campanulaceae	Lobelia gaudichaudii A.DC. gaudichaudii	Kipapa Gulch, main divide	853m	Hosaka 686	18.ix.1932
Campanulaceae	Lobelia gaudichaudii A.DC. gaudichaudii	Kipapa Gulch, Waipio-Waiahole divide, S ridge; flowers claret	853m	St. John 12077	18.ix.1932
Campanulaceae	Lobelia gaudichaudii A.DC. gaudichaudii	1st peak S of Puu Kaaumakua, windswept in cloud zone; shrub 1 m. tall, fl. rose-magenta,	808m	St. John 20252	14.ix.1941
Campanulaceae	Lobelia oahuensis Rock	Kipapa Gulch, main divide, on wet open slope; upright plant, 8 ft. high		Hosaka 1156	06.viii.1933
Campanulaceae	Lobelia oahuensis Rock	Kipapa Gulch, main divide, on wet open slope; upright plant, 10 ft. high	853m	Hosaka 685	18.ix.1932
Gesneriaceae	Cyrtandra kalihii Wawra	Kipapa Gulch; moist gully	549m	Hosaka 1021	6.v.1933
Gesneriaceae	Cyrtandra kalihii Wawra	Kipapa Gulch, S ridge; on wet ridge	640m	Hosaka 1150	6.viii.1933
Gesneriaceae	Cyrtandra kalihii Wawra	Kipapa Gulch, 2nd branch	305m	Hosaka 154	16.ii.1930
Gesneriaceae	Cyrtandra kalihii Wawra	Kipapa Gulch, S Ridge	518m	Hosaka 606	4.vii.1932
Gesneriaceae	Cyrtandra kalihii Wawra	Kipapa Gulch, N Ridge, in moist streambed	366m	Hosaka 649	10.vii.1932
Gesneriaceae	Cyrtandra kalihii Wawra	Kipapa Gulch, S Ridge; near stream	518m	Hosaka 702	18.ix.1932

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Family	Scientific name	Locality/Habitat/Plt description	Elev	Collector	Coll date
		bed			
Gesneriaceae	Cyrtandra kalihii Wawra	Kipapa Gulch, 2nd N fork	518m	Hosaka 846	13.xi.1932
Gesneriaceae	Cyrtandra kalihii Wawra	Kipapa Gulch; by stream	610m	St. John 12075	18.ix.1932
Gesneriaceae	Cyrtandra kalihii Wawra	N Fork of Kipapa Gulch, in dark ravine	366m	Storey 210	13.xi.1932
Gesneriaceae	Cyrtandra kalihii Wawra	Kipapa Gulch, in small, densely shaded, humid ravine, leading into main stream	457m	Storey 259	11.ii.1935
Gesneriaceae	Cyrtandra viridiflora H.St.John & Storey	Waikane-Waipio, 1st peak S of Puu Kaaumakua, low moist turf, wind-swept windward crest among <i>Lycopodium serratum</i> , <i>Rollandia st.johnii</i> , etc.; 5 dm shrub; leaves pale green, almost velvety, with dense tawny pubescence, plant sterile	762m	St. John 20031	7.v.1939
Joinvilleaceae	Joinvillea ascendens Gaudich. ex Brongn. & Gris ascendens	Kipapa Gulch; canes 2–3 m tall	500m	Fosberg 9548	12.vi.1933
Joinvilleaceae	Joinvillea ascendens Gaudich. ex Brongn. & Gris ascendens	Kipapa Gulch, <i>Metrosideros-Antidesma</i> forest; 8 ft. tall	549– 610m	Grant 7250	7.viii.1934
Joinvilleaceae	Joinvillea ascendens Gaudich. ex Brongn. & Gris ascendens	S ridge, Kipapa Gulch	518m	Hosaka 1014	6.v.1933
Joinvilleaceae	Joinvillea ascendens Gaudich. ex Brongn. & Gris ascendens	S ridge, Kipapa Gulch, on wooded ridge	518m	Hosaka 1104	2.vii.1933
Joinvilleaceae	Joinvillea ascendens Gaudich. ex Brongn. & Gris ascendens	S ridge, Kipapa Gulch	549– 610m	Yamaguchi 1237	15.v.1932
Lamiaceae	Phyllostegia hirsuta Benth.	Kipapa Trail 1 mile from summit; sprawling; 3 ft. high; corolla white except outer upper pink		Degener et al. 9977	2.vi.1935
Lamiaceae	Phyllostegia hirsuta Benth.	Kipapa Gulch, 3 ft. shrub	518m	Hosaka 1011	6.v.1933
Lamiaceae	Phyllostegia hirsuta Benth.	Waikakalaua Gulch	305m	Hosaka 204	6.iv.1930
Lamiaceae	Phyllostegia hirsuta Benth.	Waikakalaua Gulch, near Waikakalaua-Kipapa divide	457m	Nitta 64	6.iv.1930
Lamiaceae	Phyllostegia parviflora (Gaudich.) Benth.	Kipapa Gulch, 2nd N fork		Hosaka 1071	11.vi.1933
Lauraceae	Cryptocarya mannii Hillebr.	Kipapa gulch, lower forest; tree 20 ft. high	366m	Hosaka 1000	30.iv.1933
Loganiaceae	Labordia cyrtandrae (Baill.) H.St.John	Kipapa trail to Koolau summit, N-facing slope; in wet forest gully	518m	Degener et al. 10000	02.vi.1935
Loganiaceae	Labordia cyrtandrae (Baill.) H.St.John	Kipapa Gulch; wet forest; bush 1.5 m tall; flowers pale yellow (tube white)	450m	Fosberg 9551	12.vi.1933
Loganiaceae	Labordia cyrtandrae (Baill.) H.St.John	Kipapa Gulch; in wet gully; 4 ft. shrub	518m	Hosaka 1002	6.v.1933
Loganiaceae	Labordia cyrtandrae (Baill.)	Kipapa Gulch, 2nd N fork; in moist	457m	Hosaka 1062	11.vi.1933

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	H.St.John	gully; 5 ft. shrub			
Loganiaceae	Labordia cyrtandrae (Baill.) H.St.John	Kipapa Gulch, S ridge; in wet gully; 4 ft. shrub	457m	Hosaka 1063	04.vii.1932
Loganiaceae	Labordia cyrtandrae (Baill.) H.St.John	Waikakalaua Gulch; in moist gully	457m	Hosaka 205	6.iv.1930
Loganiaceae	Labordia cyrtandrae (Baill.) H.St.John	S ridge, Kipapa Gulch	457m	Hosaka 602	4.vii.1932
Loganiaceae	Labordia hosakana (Sherff) W.L. Wagner, D.R.Herbst & Sohmer	Kipapa Trail summit		Degener et al. 10152a	2.vi.1935
Loganiaceae	Labordia hosakana (Sherff) W.L. Wagner, D.R.Herbst & Sohmer	Kipapa Gulch; exposed ridge		Fosberg 9729	6.viii.1933
Loganiaceae	Labordia hosakana (Sherff) W.L. Wagner, D.R.Herbst & Sohmer	Kipapa-Waiahole crest; <i>Metrosideros-Cheirodendron</i> forest	853m	Grant 7236	7.viii.1934
Loganiaceae	Labordia hosakana (Sherff) W.L. Wagner, D.R.Herbst & Sohmer	Kipapa Gulch, S ridge; denuded ridge; shrub 4 ft. high	762m	Hosaka 679	04.vii.1932
Loganiaceae	Labordia hosakana (Sherff) W.L. Wagner, D.R.Herbst & Sohmer	Ridge S of Kipapa Gulch; rain forest	792m	Morley 71	10.xii.1933
Orchidaceae	Anoectochilus sandvicensis Lindl.	Kipapa-Waiawa Ridge, <i>Metrosideros</i> forest	579m	Grant 7246	7.viii.1934
Orchidaceae	Anoectochilus sandvicensis Lindl.	Kipapa Gulch, S ridge; mossy tree trunk	610m	Hosaka 1230	12.xi.1933
Orchidaceae	Liparis hawaiiensis H.Mann	S Kipapa Gulch; ridge, rainforest, on bark of tree	610m	Fosberg 8679	18.ix.1932
Orchidaceae	Liparis hawaiiensis H.Mann	Kipapa Gulch, <i>Metrosideros</i> , <i>Antidesma</i>	518m	Grant 7179	7.viii.1934
Orchidaceae	Liparis hawaiiensis H.Mann	Between head of Kipapa and Uwau gulches; mossy trunk	792m	Hosaka & Fosberg 1872	30.v.1937
Orchidaceae	Liparis hawaiiensis H.Mann	S ridge, Kipapa Gulch; mossy trunk	457m	St. John 10570	4.vii.1932
Orchidaceae	Liparis hawaiiensis H.Mann	Waikakalaua Gulch; mossy tree branch 15 ft. in air	396m	Hosaka 614	14.ix.1930
Orchidaceae	Platanthera holochila (Hillebr.) Kraenzl.	Head of Kipapa Gulch		Selling 2622	3.vii.1938
Poaceae	Panicum koolauense H.St.John & Hosaka	Kipapa Trail to summit ridge, on wind- and cloud-swept summit; forming tussocks; anthers and stigma purplish red		Degener et al.. 9997	2.vi.1935
Poaceae	Panicum koolauense H.St.John & Hosaka	Kipapa Trail, S ridge of Kipapa Gulch, in tufts on ground	792m	Ozaki 564	27.ix.1953
Poaceae	Panicum koolauense H.St.John & Hosaka	Main divide, crest of Koolau Mts., betw. Uwau Gulch and Kipapa Gulch; forming tussocks	800m	Fosberg 13918	30-31.v.1937
Poaceae	Panicum koolauense H.St.John & Hosaka	Koolau summit above Kipapa Gulch, Waiahole; windward-facing ledges;	900m	Fosberg 8671	18.ix.1932



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		In tufts and mats betw. rocks			
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	Kipapa Gulch, on wet exposed ridge; dense turf	860m	Fosberg 9746	8.vi.1933
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	Kipapa-Waiahole crest, <i>Metrosideros-Antidesma</i> forest	853m	Grant 7219	7.viii.1934
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	Main divide, Kipapa Gulch, forming mat	853m	Hosaka 1154	6.viii.1933
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	Main divide, Kipapa Gulch, on wet windswept ridge	853m	Hosaka 630	4.vii.1932
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	Main divide, Kipapa Gulch, on wet denuded ridge; forming mat	853m	Hosaka 709	18.ix.1932
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	Back of Kipapa, near summit	762m	Beardsley s.n.	17.iv.1958
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	Kipapa-Waiahole summit		Kerr s.n.	4.vii.1946
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	On top of ridge at junction of ridge S of Kipapa Gulch with the main Koolau Ridge; wet forest	853m	Morley 190	10.ii.1935
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	Ridge S of Kipapa Gulch	792m	Morley 56	10.xii.1933
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	Ridge S of Kipapa Gulch, densely tufted, 2-3 in. high	792m	Morley s.n.	10.xii.1933
Poaceae	<i>Panicum koolauense</i> H.St.John & Hosaka	Kipapa Gulch, ridge on right-hand side; forming one large cushion	366- 610m	Kondo s.n.	14.iv.1946
Rubiaceae	<i>Gardenia mannii</i> H.St.John & Kuykendall	Waipio-Waiawa Ridge		Degener & Shear 3244	5.iii.1928
Rubiaceae	<i>Gardenia mannii</i> H.St.John & Kuykendall	Kipapa Gulch, tree 20 ft. tall	457m	Grant 7170	6.viii.1934
Rubiaceae	<i>Gardenia mannii</i> H.St.John & Kuykendall	Kipapa Gulch, S ridge	305m	Hosaka 565	29.v.1932
Rubiaceae	<i>Gardenia mannii</i> H.St.John & Kuykendall	Kipapa Gulch, S ridge	457m	Hosaka 625	4.vii.1932
Rubiaceae	<i>Gardenia mannii</i> H.St.John & Kuykendall	Kipapa Valley trail, SE edge of valley; in lower rain forest, bottom of gully, edge of staghorn fern, 300 yds N of large stand of <i>Psidium</i> ; tree 40 ft. high, spreading foliage	335m	Kuykendall 116	30.ix.1945
Rubiaceae	<i>Hedyotis fluviatilis</i> (C.N.Forbes) Fosberg	Kipapa Gulch, near stream	425m	Hume 85	11.ii.1931
Rubiaceae	<i>Hedyotis fluviatilis</i> (C.N.Forbes) Fosberg	Kipapa Gulch	305m	Hosaka 150	16.ii.1930
Rubiaceae	<i>Hedyotis fluviatilis</i> (C.N.Forbes) Fosberg	Kipapa Gulch N ridge, moist gully	274m	Hosaka 566	29.v.1932
Rubiaceae	<i>Hedyotis fluviatilis</i> (C.N.Forbes) Fosberg	Kipapa Gulch 2nd N fork		Hosaka 836	13.xi.1932
Rubiaceae	<i>Hedyotis fluviatilis</i> (C.N.Forbes) Fosberg	Kipapa Gulch		Koike s.n.	15.ii.1931
Rubiaceae	<i>Hedyotis fluviatilis</i> (C.N.Forbes) Fosberg	2nd N fork, Kipapa Gulch; flowers white	427m	St. John 11023	15.ii.1931
Rubiaceae	<i>Hedyotis fluviatilis</i>	N Fork, Kipapa Gulch	335-	Storey 115	15.ii.1931

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	(C.N.Forbes) Fosberg		427m		
Rubiaceae	Psychotria hexandra H.Mann oahuensis Degener & Fosberg hosakana Fosberg	2nd N fork, Kipapa Gulch, wet forest; 8 m tree; flower white; leaves pale beneath	450m	Fosberg et al. 9567	11.vi.1933
Rubiaceae	Psychotria hexandra H.Mannoahuensis O.Deg. & Fosberg	Kipapa Gulch; wet forest, bottom of gulch	600m	Fosberg 9759	07.viii.1933
Rubiaceae	Psychotria hexandra H.Mann oahuensis Degener & Fosberg hosakana Fosberg	Kipapa Gulch, stream bed; 35 ft. tall tree	518m	Hosaka 1167	7.viii.1933
Rutaceae	Melicope hiiakae (B.C.Stone) T.G.Hartley & B.C.Stone	Kipapa Gulch; 10 ft. tall tree; odd fruit	457m	Grant 7258	8.viii.1934
Rutaceae	Melicope hiiakae (B.C.Stone) T.G.Hartley & B.C.Stone	Kipapa Gulch, S ridge; on wooded ridge	549m	Hosaka 809	16.x.1932
Rutaceae	Melicope lydgatei (Hillebr.) T.G.Hartley & B.C.Stone	Kipapa Gulch, N ridge; wooded slope	396m	Hosaka 674	10.vii.1932
Rutaceae	Melicope lydgatei (Hillebr.) T.G.Hartley & B.C.Stone	Kipapa Gulch, S ridge; on moist wooded ridge	549m	Hosaka 820	16.x.1932
Rutaceae	Melicope lydgatei (Hillebr.) T.G.Hartley & B.C.Stone	S ridge of Kipapa Gulch, E of Puu Kamana; wooded slope; 10 ft. prostrate shrub; 2 in diameter	503m	St. John 11686	15.v.1932
Rutaceae	Melicope lydgatei (Hillebr.) T.G.Hartley & B.C.Stone	S ridge of Kipapa Gulch, on ridge in woods; 15 ft. fastigiate shrub	457m	St. John 12083	18.ix.1932
Rutaceae	Platydesma cornuta Hillebr.	Kipapa Gulch, S ridge; 4 ft. tall shrub	533m	Hosaka 1017	6.v.1933
Rutaceae	Platydesma cornuta Hillebr.	Kipapa Gulch, 2nd N fork	335m	Hosaka 844	13.xi.1932
Rutaceae	Platydesma cornuta Hillebr.	Waikakalaua Gulch, wooded bank		St. John 10465	6.iv.1930
Rutaceae	Zanthoxylum oahuense Hillebr.	Kipapa trail, ridge ~1 mi. from summit, rainy		Degener & others 10088	2.vi.1935
Rutaceae	Zanthoxylum oahuense Hillebr.	Kipapa-Waiawa Ridge. <i>Metrosideros</i> forest; 15 ft. tree	579m	Grant 7190	7,viii,1934
Rutaceae	Zanthoxylum oahuense Hillebr.	Ridge S of Kipapa Gulch; moderate forest	640m	Morley 75	10,xii,1933
Rutaceae	Zanthoxylum oahuense Hillebr.	Kipapa Gulch, S ridge; in low, moist forest; young tree 4m tall		St.John 22667	13,iv,1947
Rutaceae	Zanthoxylum oahuense Hillebr.	S ridge, Kipapa Gulch, 10 ft. tree, on wet ridge	671m	Hosaka 1255	8.viii.1934
Rutaceae	Zanthoxylum oahuense Hillebr.	Kipapa Gulch, S ridge, denuded; 10 ft. tall tree	610m	Hosaka 639	4.vii.1932
Rutaceae	Zanthoxylum oahuense Hillebr.	Kipapa Gulch, S ridge, denuded; 10 ft. tall tree	610m	Hosaka 793	4.vii.1932
Rutaceae	Zanthoxylum oahuense Hillebr.	Waipio-Waiawa Ridge; rain forest	750m	Macdaniels 21	6.x.1926
Rutaceae	Zanthoxylum oahuense Hillebr.	Kipapa Gulch, S ridge	701m	Yamaguchi 1247	4.vii.1932

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Family	Scientific name	Locality/Habitat/Plt description	Elev	Collector	Coll date
Rutaceae	Zanthoxylum oahuense Hillebr.	Waipio-Waiawa ridge		Swezey s.n.	21.ix.1934
Santalaceae	Exocarpos gaudichaudii A.DC.	Waipio-Waiawa ridge		Degener & Shear 3297	5.iii.1928
Santalaceae	Exocarpos gaudichaudii A.DC.	Kipapa Gulch	549m	Hosaka 1013	06.v.1933
Santalaceae	Exocarpos gaudichaudii A.DC.	Kipapa Gulch, S ridge; 20 ft. tree	518m	Hosaka 1128	23.vii.1933
Santalaceae	Exocarpos gaudichaudii A.DC.	Kipapa Gulch, S ridge, 20 ft. tree	488m	Hosaka & St. John 1234	12.xi.1933
Santalaceae	Exocarpos gaudichaudii A.DC.	Kipapa Gulch, S ridge	518m	Hosaka 644	4.vii.1932
Santalaceae	Exocarpos gaudichaudii A.DC.	S ridge of Kipapa Gulch	533m	Chang s.n.	15.v.1932
Santalaceae	Exocarpos gaudichaudii A.DC.	Waipio-Waiawa Ridge; rain forest	700m	Macdaniels 006	6.x.1926
Santalaceae	Exocarpos gaudichaudii A.DC.	Waipio-Waiawa Ridge	600m	Macdaniels 36	06.x.1926
Santalaceae	Exocarpos gaudichaudii A.DC.	Ridge S of Kipapa Gulch; much-branching plant	732m	Morley s.n.	10.xii.1933
Santalaceae	Exocarpos gaudichaudii A.DC.	Ridge S of Kipapa Gulch	732m	Morley 61	10.xii.1933
Sapindaceae	Alectryon macrococcus Radlk.	Kipapa Gulch, S ridge, 30 ft. tree	366m	Hosaka 857	27.xi.1932
Theaceae	Eurya sandwicensis A.Gray	Waiawa trail, S ridge of Kipapa Gulch; moist forest; bushy tree 5 m tall, fruit black	500m	Fosberg & Hosaka 13908	29.v.1937
Theaceae	Eurya sandwicensis A.Gray	Waipio-Waiawa Ridge, shrub 2 m high	600m	Macdaniels 057	6.x.1926
Theaceae	Eurya sandwicensis A.Gray	Kipapa-Waiawa Ridge spur that runs into Waiawa Valley	442m	Kondo s.n.	23.x.1951
Violaceae	Viola oahuensis C.N.Forbes	Kipapa Gulch, exposed, turfy ridge	860m	Fosberg 9737	6.viii.1933
Violaceae	Viola oahuensis C.N.Forbes	Kipapa Gulch, S ridge; wet place, exposed; plants 1 ft. tall	670m	Hosaka 1119	9.vii.1933
Violaceae	Viola oahuensis C.N.Forbes	Waipio-Kipapa Gulch, main divide; wet place; 10 in. tall	853m	Hosaka 1157	6.viii.1933
Violaceae	Viola oahuensis C.N.Forbes	Kipapa Gulch, main divide; wet place	853m	Hosaka 712	18.ix.1932
Violaceae	Viola oahuensis C.N.Forbes	Waipio-Waiawa Ridge; rain forest	600m	MacDaniels 011	6.x.1926
Violaceae	Viola oahuensis C.N.Forbes	Waipio-Kipapa Gulch, S ridge; rain forest; upright shrub	792m	Morley s.n.	10.xii.1933