

Hono O Nā Pali Natural Area Reserve (NAR) Management Plan



Upper plateau portion of the Reserve

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**Department of Land and Natural Resources
Division of Forestry and Wildlife
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Cliff portion of the Reserve

1. EXECUTIVE SUMMARY

Hono O Nā Pali Natural Area Reserve (NAR or Reserve) occupies 3,579 acres (ac) (1,448 hectares (ha)) on the island of Kaua‘i. The Reserve was designated in 1983 and expanded in 2009 to preserve native natural communities in the Hanalei and Waimea Districts, including the Hanakāpī‘ai, Hanakoa, and Waiahuakua ahupua‘a. The NAR includes perennial streams, riparian and ridgeline habitat, lowland and montane forests, rare plants, endemic stream fauna, and forest bird and seabird habitat. The Reserve stretches from sea level along the picturesque Nā Pali coast to the highest point at Pihea (4,284 feet (ft), 1,306 meters (m)). The Reserve encompasses parts of Hanakāpī‘ai and Hanakoa streams and all of Waiahuakua Stream; the southern boundary of the NAR is the south side of the Alaka‘i Swamp Trail.

This plan describes the management program for Hono O Nā Pali NAR. The Reserve was established to protect perennial streams, riparian and ridgeline lowland and montane forests, rare plants, endemic stream fauna, and forest bird habitat. This management plan updates the 1989 Management Plan for Hono O Nā Pali to reflect management accomplishments and current management needs of this reserve.

The primary threats to biodiversity and watershed integrity at Hono O Nā Pali NAR are feral ungulates (wild, hoofed animals), especially feral pigs (*Sus scrofa*) and feral goats (*Capra hircus hircus*), small predatory mammals (feral cats (*Felis catus*) and rats (*Rattus* spp.), and non-native, invasive weeds.

The overall management goal is to protect, maintain, and enhance the Reserve’s unique natural, cultural, and geological resources. Management programs have been developed to support this overall goal and include the following:

1. Infrastructure and Facilities
2. Ungulate Management
3. Weed Management
4. Habitat Protection and Rare Species Restoration
5. Monitoring
6. Outreach and Education
7. Fire Prevention and Response
8. Enforcement
9. Partnership Collaboration

The 2011 Management Plan for Hono O Nā Pali NAR outlines the planned management activities over the next ten years, along with an estimated budget for full implementation.

2. INTRODUCTION

The Natural Area Reserves System (NARS) was created in 1971 by the Hawai‘i State Legislature to “preserve in perpetuity specific land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites, of Hawai‘i (HRS § 195-1).” The legislature further found that these unique natural assets should be protected and preserved, both for the enjoyment of future generations and to provide baselines against which changes to the environment can be measured.

NARS is administered by the Hawai‘i Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW). NARS Commission members act in an advisory capacity for the Board of Land and Natural Resources, which sets policies for the Department.

The NARS is based on the concept of protecting ecosystems – not merely single species. Because the natural resources of Hawai‘i are under constant threat from invasive species, human encroachment, feral ungulates, climate change, and other threats, the NARS seeks to protect the best remaining examples of the State’s unique ecosystems. In addition to setting aside these areas as reserves, the NARS program strives to actively manage these reserves in order to preserve the unique characteristics that make these areas an integral part of the natural heritage of Hawai‘i. Reflecting this, the mission of the NARS program is: “The NARS exists to ensure the highest level of stewardship for Hawaii’s natural resources through acquisition, active management, and other strategies.”

The NARS presently consists of 20 reserves on five islands, encompassing more than 123,000 ac (49,776 ha) of the State’s most unique ecosystems. The diverse areas found in the NARS range from marine and coastal environments to alpine desert, and from fresh lava flows to wet forests. These areas often serve as habitat for rare native plants and animals, many of which are on the verge of extinction. The NARS also include important watersheds, contributing to Hawaii’s sources of drinking water. Finally, the NARS forms an important part of the scenic landscape and contributes to the natural beauty of Hawai‘i, contributing to the islands’ overall appeal to visitors. Some of the most recognizable and visited NARS include Mauna Kea Ice Age NAR (Hawai‘i), Ka‘ena Point NAR (O‘ahu), and ‘Āhihi-Kīna‘u NAR (Maui).

Hono O Nā Pali NAR was established in January 1983 by Executive Order 3161 and extended in 2009 by Executive Order 4270. It was created to protect perennial streams, riparian and ridgeline habitat, lowland and montane forests, rare plants, endemic stream fauna, and forest bird habitat. Long-term management of the Hono O Nā Pali NAR provides multiple benefits to the state including protection of the island’s water resources and undeveloped open space. The natural communities within the reserve provide habitat for a diverse range of native plants and animals, from rare birds to endemic invertebrates, preserving Hawaii’s biodiversity.

The NARS website located at <http://hawaii.gov/dlnr/dofaw/nars> provides general information on NARS programs and policies as well as information on NARS management across the state.

3. HONO O NĀ PALI: BIOPHYSICAL RESOURCES

Location

Hono O Nā Pali NAR occupies 3,579 ac (1,448 ha) in the Hanalei and Waimea Districts on the island of Kaua‘i and is part of TMK’s 4-5-9-001-001 and 4-1-4-001-003. Surrounding lands include Nā Pali Coast State Wilderness Park (managed by Division of State Parks), Nā Pali Kona Forest Reserve and Alaka‘i Wilderness Preserve (Managed by Division of Forestry and Wildlife (DOFAW), and private lands (Alexander and Baldwin, Robinson, National Tropical Botanical Garden) (Figure 1).

Stretching from sea level along the picturesque Nā Pali coast, the Reserve crosses the famous Kalalau Trail approximately 2.5 miles (4 kilometers (km)) from the trail head at Hā'ena State Park, and continues rising south to the Reserve's highest point at Pihea (4,284 feet (ft)) (1,306 meters (m)). The Reserve encompasses parts of Hanakāpī'ai and Hanakoa streams and all of Waiahuakua and Ho'ololu streams; the southern boundary is the south side of the Alaka'i Swamp Trail. The western-most point of the reserve is Alealau peak, and its easternmost point is Hono O Nā Pali peak.

Climate, Geology, and Soils

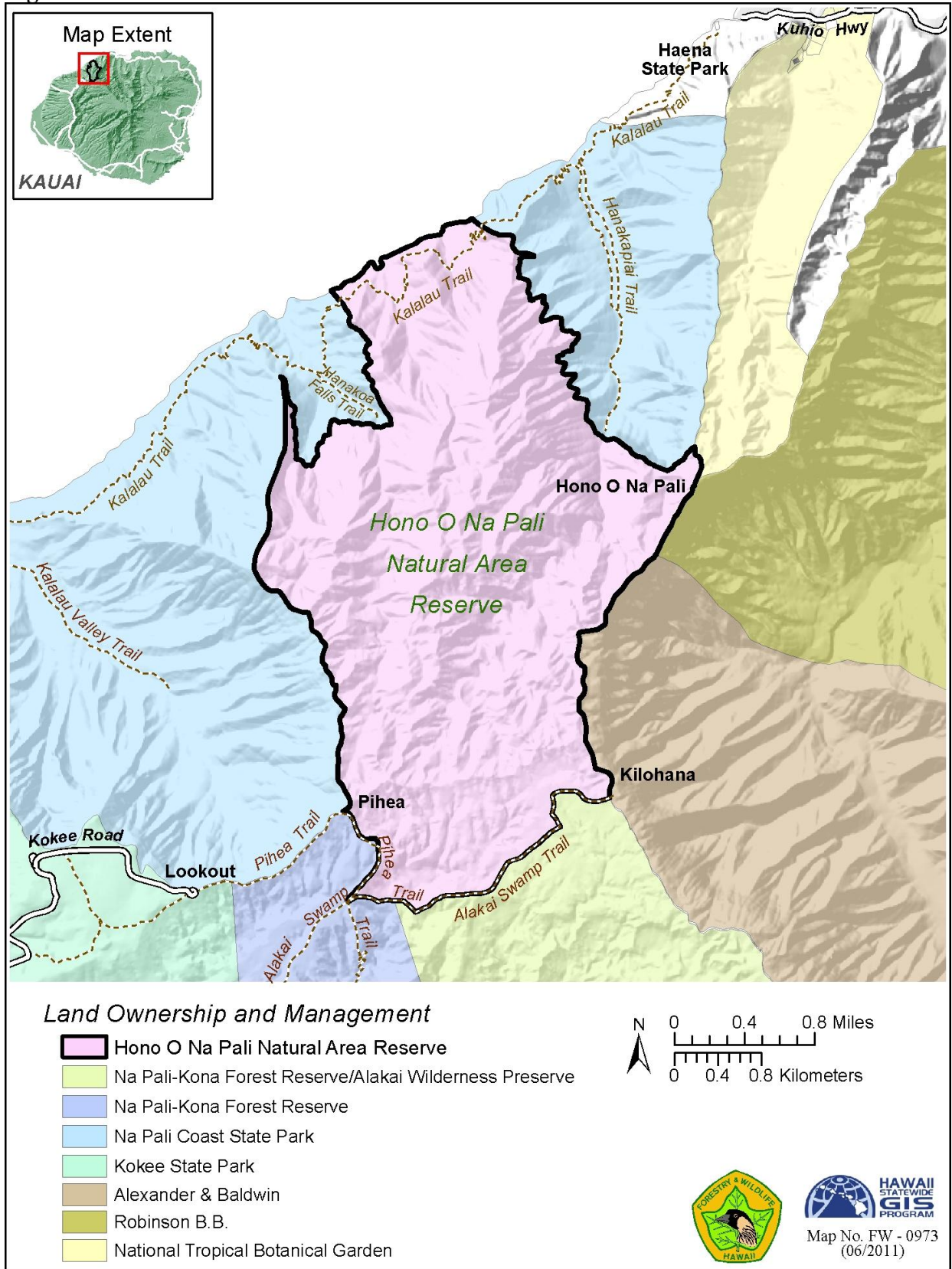
Kaua'i is the oldest of the eight major Hawaiian islands, and the island consists of one main extinct shield volcano estimated to be about 5 million years old as well as numerous younger lava flows (between 3.65 million years to 500,000 years old). The island is characterized by severe weathering, which has formed the spectacular cliffs of the Nā Pali coast and Waimea canyon areas (Juvik *et al.* 1998).

Rainfall in the Hawaiian Islands depends greatly on topography, and the orographic (mountain-caused) effect causes a wide range in the pattern of annual rainfall. Annual rainfall in the Reserve averages from 80 inches (in) (2,000 millimeters (mm)) in the drier coastal lowlands, to more than 160 in (4,000 mm) in the upland forests (Giambelluca *et al.* 1986).

The Hawai'i Division of Aquatic Resources has compiled information on streams within the Reserve. Data on streams and watersheds within the Reserve is included in the Atlas of Hawaiian Watersheds and Their Aquatic Resources (Parham *et al.* 2008). Streams within the Reserve include parts of upper tributaries for the Waimea River (Kawaikōi tributary), Hanakāpī'ai and Hanakoa streams and all of the Waiahuakua and Ho'ololu streams.

Most of the soils in the area are classified as rough mountainous land with rocky outcroppings. The southern portions of the Reserve in the Alaka'i swamp region contain Wai'ale'ale mucky silty clay loam with 30-70% slopes and Alaka'i mucky peat of 0-30% slope (Natural Resources Conservation Service 2006).

Figure 1. Hono O Nā Pali NAR Location



Ecosystems and Species

Vegetation

The Reserve can be broadly classified as containing three major ecosystems including lowland mesic, lowland wet, and montane wet (Price *et al.* 2007). Nine terrestrial communities within these broader zones were described in the 1989 management plan (State of Hawaii 1989); however, these descriptions have been generalized into broader ecosystems in this plan (Figure 2).

Lowland mesic ecosystems include a variety of grasslands, shrublands, and forests, generally below 3,000 ft (914 m) elevation, with 50 to 75 in (1270 to 1905 mm) of annual rainfall (TNC 2006). Major native components include hala (*Pandanus tectorius*) forests in the coastal valleys and lama (*Diospyros sandwicensis*)/ ‘ōhi‘a (*Metrosideros polymorpha*) forest along ridges above 400 ft (122 m) elevation. Other native species include alahe‘e (*Psydrax odorata*), ‘akoko (*Chamaesyce celastroides* var. *celastroides*), ko‘oko‘olau (*Bidens* sp.), ‘ama‘u (*Sadleria cyatheoides*), nehe (*Lipochaeta succulenta*), kalia (*Elaeocarpus bifidus*), ‘ōhi‘a ha (*Syzygium sandwicensis*), olopua (*Nestegis sandwicensis*), ‘aulu (*Pouteria sandwicensis*), halapepe (*Pleomele aurea*), kōpiko (*Psychotria mariniana*), and *Carex wahuensis* spp. *wahuensis*.

Lowland wet ecosystems are generally found below 3,000 ft (914 m) elevation on the windward sides of the island in areas that receive greater than 75 in (1905 mm) of annual precipitation (TNC 2006). The Reserve’s lowland wet ecosystems are dominated by kukui, a tree introduced by the Hawaiians who burned its nut oil for light. Kukui forest with an understory of ti (*Cordyline fruticosa*) and non-native species covers the gulch bottoms in both Ho‘olulu and Waiahuakua valleys above 300 feet elevation. In some sections of the kukui forest, native plants such as pāpala kēpau (*Pisonia umbellifera*), kōpiko, kōlea (*Myrsine lessertiana*), lama (*Diospyros sandwicensis* and *D. hillebrandii*), alahe‘e, and ferns such as ‘ākōlea (*Athyrium microphyllum*), hō‘i‘o (*Diplazium sandwichianum*) are sometimes quite abundant.

Lowland mesic and wet communities in the Reserve are generally heavily invaded by non-native plants such as *Oplismenus hirtellus*, *Lantana camara*, *Clidemia hirta*, *Pluchea symphytifolia*, guava (*Psidium guajava*), mountain apple (*Syzygium malaccense*), coffee (*Coffea arabica*) and air plant (*Kalanchoe pinnata*), although native species are sometimes locally dominant.

Rare plants found within these lowland mesic and wet ecosystems include *Brighamia insignis*, *Hibiscus kokio* ssp. *saintjohnianus*, loulou (*Pritchardia napaliense*), *Munroidendron racemosum*, *Pittosporum napaliense* and *Peucedanum sandwicense*.

The Reserve’s lowland coastal ecosystems also contain steep cliffs characterized by plants found in drier areas. These cliffs are dominated by common coastal plants such as kāwelu (*Eragrostis variabilis*), ‘āhinahina (*Artemisia australis*), ‘akoko, nehe, ko‘oko‘olau, ‘ilima (*Sida fallax*), and akoko (*Chamaesyce celastroides*). Rare plants known from cliffs in the Reserve include ālula (*Brighamia insignis*), *Hibiscus kokio* ssp. *saintjohnianus*, dwarf iliau (*Wilkesia hobdyi*), *Lobelia niihauensis* and *Peucedanum sandwicense*.

Montane wet communities are found at elevations between 3,000 and 6,600 ft (914 and 2,012 m) in areas with annual precipitation greater than 75 in (1905 mm) (TNC 2006). The upper part of Hono O Nā Pali Reserve is an eroded plateau with a series of ridges and valleys covered with 'ōhi'a dominated montane wet forest communities. The forest canopy is a mix of 'ōhi'a and other native trees including lapalapa (*Cheirodendron platyphyllum* subsp. *kauiense*), 'ōlapa (*Cheirodendron trigynum*), kāwa'u (*Ilex anomala*), kōlea (*Myrsine lessertiana* and *M. alyxifolia*), and 'ohe (*Tetraplasandra* spp.). Understory tree and shrub species include kanawao (*Broussaisia arguta*), pūkiawe (*Leptecophylla tameiameia*), na'ena'e (*Dubautia knudsenii*, *D. raillardoides* and *D. laxa*), koli'i (*Trematolobelia kauaiensis*), ōhelo kau lā'au (*Vaccinium calycinum*), ālani (*Melicope clusiifolia*), and mokihana (*Melicope anisata*).

Ground cover in the Reserve's montane wet communities includes ferns such as kīlau or hohiu (*Dryopteris glabra*), 'ākōlea, wāwae'iole (*Lycopodium* spp.), *Asplenium* spp., *Athyrium microphyllum*, *Diplazium sandwichianum*, and other epiphytic mosses, liverworts and ferns. Steeper slopes contain an understory of uluhe (*Dicranopteris linearis*, *Sticherus owhyensis*, and *Diplopterygium pinnatum*) with emergent native trees and shrubs. Ground cover also includes herbs and sedges such as pa'iniu (*Astelia argyrocoma*), 'ala'ala wai nui (*Peperomia* spp.), mākole (*Nertera granadensis*), 'uki'uki (*Dianella sandwicensis*), *Carex alligata*, *Gahnia beecheyi* and 'uki (*Machaerina angustifolia*).

Montane wet communities also include bogs with low-stature 'ōhi'a, and a variety of bog-adapted, low-growing shrubs, herbs and sedges including kuolohia (*Rhynchospora chinensis* var. *spiciformis*), *Machaerina angustifolia*, *Carex* sp., *Oreobolus furcatus*, sundew (*Drosera anglica*), uluhe, *Viola kauaensis*, laukahi kuahiwi (*Plantago pachyphylla*), and the rare *Keysseria erici* and species such as *Viola wailenalanae*, 'ohe naupaka (*Scaevola glabra*), and alani wai (*Melicope waialealae*) at bog margins.

A total of 118 rare plant taxa have been reported from the Hono O Nā Pali NAR area (Table 1). The Reserve contains designated critical habitat for 69 rare plant taxa as well as critical habitat for the following ecosystems: lowland mesic, lowland wet, dry cliff, wet cliff and montane wet (USFWS 2004; USFWS 2010). Ten of these taxa are among the rarest of the plant species in Hawaii with less than 50 individuals known in the wild. These species are the focus of the Plant Extinction Prevention Program (PEPP) and are a high priority for conservation. Appendix A contains plant lists including rare taxa as well native and non-native plant species currently known from the Reserve (Wood and Wysong 2010). These lists are regularly updated by NARS staff.

Table 1. Rare Plants of Hono O Nā Pali Natural Area Reserve (compiled using information from USFWS 2004, USFWS 2010, Wood and Wysong 2010)

Scientific Name	Common Name	Status	Critical Habitat within HON	PEPP*	Confirmed Within (past surveys)
<i>Acacia koaia</i>	koai‘a, koai‘e, koa‘ohā	SOC			X
<i>Adenophorus periens</i>	palai lā‘au	E	X	X	X (Historical, no current populations known)
<i>Alphitonia ponderosa</i>	kauila, kauwila	SOC			X
<i>Anoectochilus sandvicensis</i>	jewel orchid	SOC			X
<i>Asplenium schizophyllum</i>		SOC			X
<i>Astelia waialeale</i>	painiu	E	X	X	not documented from within the Reserve
<i>Bidens campylotheca</i>		SOC			X
<i>Bonamia menzesii</i>		E			X
<i>Brighamia insignis</i>	ālula, hāhā	E	X	X	X
<i>Canavalia napaliensis</i>	‘āwikiwiki, puakauhi	E	X		X
<i>Canavalia pubescens</i>	‘āwikiwiki, puakauhi	C			X (Historical, no current populations known)
<i>Capparis sandwichiana</i>	maiapilo, pilo, pua pilo	SOC			X

<i>Centaurium sebaeoides</i>	‘āwiwi	E	X		not documented from within Reserve
<i>Chamaesyce eleanoriae</i>	‘akoko	E	X		not documented from within Reserve
<i>Chamaesyce remyi</i> var. <i>kauaiensis</i>	‘akoko	E	X		not documented from within Reserve
<i>Chamaesyce remyi</i> var. <i>remyi</i>	‘akoko	E	X		not documented from within Reserve
<i>Charpentiera densiflora</i>	Pāpala	E	X		X
<i>Cheirodendron dominii</i>	‘ōlapa, lapalapa	SOC			X
<i>Cyanea eleeeleenis</i>	hāhā	E	X	X	not documented from within Reserve
<i>Cyanea habenata</i>	hāhā	SOC			X
<i>Cyanea kolekoleensis</i>	hāhā	E	X	X	not documented from within Reserve
<i>Cyanea kuhihewa</i>	hāhā	E	X	X	not documented from within Reserve
<i>Cyanea pseudofauriei</i>	hāhā	SOC			X
<i>Cyanea recta</i>	hāhā	T	X		X
<i>Cyanea remyi</i>	hāhā	E	X		not documented from within Reserve
<i>Cyanea rivularis</i> (listed as <i>Delissea rivularis</i>)	hāhā	E (EX)	X†	X	X
<i>Cyrtandra cyaneoides</i>	māpele	E			X
<i>Cyrtandra heinrichii</i>	ha‘iwale, kanawao ke‘oke‘o	SOC			X

<i>Cyrtandra kamooolaensis</i>	ha'iwale	SOC			X
<i>Cyrtandra kealiae</i> subsp. <i>kealiae</i> (used to be <i>C. limahuliensis</i>)	hā'iwale, kanawao ke'oke'e	T	X		X
<i>Cyrtandra oenobarba</i>	ha'iwale, kanawao ke'oke'o	E	X		X
<i>Cyrtandra pickeringii</i>	ha'iwale, kanawao ke'oke'o	SOC			X
<i>Delissea undulata</i>		E (EX)	X		X
<i>Doryopteris angelica</i>		E	X	X	not documented from within the Reserve
<i>Dryopteris crinalis</i> var. <i>poposorus</i>	palapalai aumakua	E	X	X	not documented from within the Reserve
<i>Dryopteris glabra</i> var. <i>pusilla</i>	kīlau, hohiu	SOC			X
<i>Dubautia imbricata</i> ssp. <i>imbricata</i>	na'ena'e, kūpaoa	E	X		not documented from within Reserve
<i>Dubautia kalalauensis</i>	na'ena'e, kūpaoa	E	X	X	not documented from within Reserve
<i>Dubautia kenwoodii</i>	na'ena'e, kūpaoa	E	X	X	not documented from within the Reserve
<i>Dubautia knudsenii</i>	na'ena'e, kūpaoa	SOC			X
<i>Dubautia microcephala</i>	na'ena'e, kūpaoa	SOC			X
<i>Dubautia waialealae</i>	na'ena'e, kūpaoa	E	X		X (Historical, no current populations known)
<i>Erythrina sandwicensis</i>	wiliwili	SOC			X
<i>Euphorbia haeleeleana</i>		E			X
<i>Euphorbia remyi</i>	'akoko, koko, 'ekoko, kōkōmālei	E			X

<i>Eurya sandwicensis</i>	ānini, wānini	SOC			X
<i>Exocarpus luteolus</i>	heau, au	E	X		X
<i>Flueggea neowawraea</i>	mehamehame	E	X†		X
<i>Geranium kauaiense</i>	nohoanu				not documented from within Reserve
<i>Hesperomannia lydgatei</i>		E	X		not documented from within Reserve
<i>Hibiscadelphus woodii</i>		E	X	X	not documented from within Reserve
<i>Hibiscus kokio subsp. saintjohnianus</i>	koki‘o, koki‘o ‘ula, koki‘o ‘ula ‘ula, mākū	SOC			X
<i>Hibiscus waimae subsp. hannerae</i>	koki‘o ke‘oke‘o, koki‘o kea	E	X		X
<i>Hillebrandia sandwicensis</i>	pua maka nui, aka‘aka‘awa	SOC			X
<i>Ischaemum byrone</i>	Hilo ischaemum	E	X		X
<i>Isodendron longifolium</i>	aupaka	T	X		X
<i>Kadua cookiana</i>	‘āwiwi	E	X		X
<i>Kadua elatior</i>	‘āwiwi	SOC			X
<i>Kadua fluviatilis</i>	kamapua‘a, pilo	C			X
<i>Kadua flynnii</i>		SOC			X
<i>Kadua stjohnii</i>		E	X		not documented from within Reserve
<i>Kadua tryblium</i>		SOC			X
<i>Keysseria erici</i>		E	X		X

<i>Keysseria helenae</i>		E	X		not documented from within Reserve
<i>Labordia helleri</i>	kāmakahala	E	X		not documented from within Reserve
<i>Labordia lydgatei</i>	kāmakahala	E	X	X	X
<i>Labordia pumila</i>	kāmakahala	E	X		X
<i>Lobelia nīhauensis</i>		E	X		X
<i>Lobelia villosa</i>		SOC			X
<i>Lobelia xkauaensis</i>	pu'e	SOC			X
<i>Lobelia yuccoides</i>	pānaunau	SOC			X
<i>Lysimachia daphnoides</i>	lehua makanoē, kolokolo kuahiwi, kolekole lehua, kolokolo lehua	E	X		X
<i>Lysimachia scopulensis</i>	lehua makanoē, kolokolo kuahiwi, kolekole lehua, kolokolo lehua	E	X	X	not documented from within Reserve
<i>Melicope degeneri</i>	alani, alani kuahiwi	E	X	X	X
<i>Melicope pallida</i>	alani, alani kuahiwi	E	X†		X
<i>Melicope paniculata</i>	alani, alani kuahiwi	E	X		X
<i>Melicope puberula</i>	alani, alani kuahiwi	E	X		X
<i>Munroidendron racemosum</i>		E	X		X
<i>Myrsine fosbergii</i>	kōlea	C			X
<i>Myrsine linearifolia</i>	kōlea	T	X		X
<i>Myrsine mezii</i>	kōlea	E	X	X	not documented from within Reserve

<i>Neraudia melastomifolia</i>	ma'aloa, ma'oloa, 'oloa	SOC			X
<i>Nesoluma polynesianum</i>	keahi	SOC			X
<i>Ochrosia kauaiensis</i>	hōlei	SOC			X
<i>Panicum lineale</i>		SOC			X
<i>Peucedanum sandwicense</i>	makou	T			X
<i>Phyllostegia renovans</i>		E	X	X	X
<i>Phyllostegia wawrana</i>		E	X	X	X
<i>Phytolacca sandwicensis</i>	pōpolo kū mai, pōpolo	SOC	X		X
<i>Pisonia wagneriana</i>	pāpala kēpau, pāpala	SOC			X
<i>Pittosporum napaliense</i>	hō'awa, hā'awa	E	X		X
<i>Plantago princeps var. anomola</i>	laukahi kuahiwi, ale	E	X		not documented from within Reserve
<i>Plantago princeps var. longibracteata</i>	laukahi kuahiwi, ale	E			X
<i>Platydesma rostrata</i>	pilo kea lau li'i	E	X		X
<i>Plantanthera holochila</i>		E	X	X	not documented from within Reserve
<i>Poa manii</i>		E	X		X
<i>Poa sandwicensis</i>		E	X		X
<i>Pritchardia hardyi</i>	Loulu	E			not documented from within the Reserve
<i>Pritchardia limahuliensis</i>	loulu	SOC			X
<i>Pritchardia minor</i>	loulu	SOC			X

<i>Pritchardia napaliensis</i>	loulu	E			X
<i>Psychotria grandiflora</i>	kōpiko	E	X	X	not documented from within the Reserve
<i>Psychotria hobdyi</i>	kōpiko	E	X		not documented from within the Reserve
<i>Psychotria wawrae</i>	kōpiko	SOC			X
<i>Pteralyxia kauaiensis</i>	kaulu	E	X†		X
<i>Remya montgomeryi</i>		E	X†		not documented from within the Reserve
<i>Schiedea apokremnos</i>		E			X
<i>Schiedea attenuata</i>		E	X	X	not documented from within the Reserve
<i>Schiedea kauaiensis</i>		E	X	X	not documented from within Reserve
<i>Schiedea lychnoides</i> (listed as <i>Alsinidendron lychnoides</i>)	kuawāwaenohu	E	X		X
<i>Stenogyne campanulata</i>		E	X†		not documented from within Reserve
<i>Stenogyne kealiae</i>		E	X		not documented from within the Reserve
<i>Tetraplasandra bisattenuata</i>	‘ohe‘ohe	E	X	X	not documented from within the Reserve
<i>Tetraplasandra flynnii</i>		E	X	X	not documented from within the Reserve
<i>Tetraplasandra kawaiensis</i>	‘ohe‘ohe	SOC			X

<i>Wikstroemia hanalei</i>	‘ākia, kauhi	SOC (EX)			X
<i>Wilkseya hobdyi</i>	dwarf iliau	E	X		X
<i>Zanthoxylum dipetalum</i>	kāwa‘u, kāwa‘u kua kuku kapa	SOC			X

Key

Federal Status - E = Endangered, C = Candidate, and T = Threatened

SOC = No Federal Status but is considered a Species of Concern

EX - species may be extinct † indicates plants with less than one acre of critical habitat within the reserve

*PEPP (Plant Extinction Prevention Program) species have less than 50 individuals known in the wild. These species are the focus of the Plant Extinction Prevention (PEP) Program and are a high priority for conservation.

Terrestrial Fauna

The Reserve is significant to forest birds and seabirds in Hawai‘i for three main reasons: 1) the large elevation gradient provides habitat diversity; 2) there is a high proportion of native plant communities, thus providing high quality bird habitat and greater robustness to disturbance (i.e. invasive plant invasion); and 3) the remoteness of Hono Nā Pali puts greater distance between known threats to birds including cats, feral ungulates, powerlines and artificial lights.

The Reserve has not been systematically surveyed for forest birds, however; the adjacent Alaka‘i and Nā Pali - Kona Forest Reserve areas have been surveyed on numerous occasions (Sincock *et al.* 1983; Scott *et al.* 1986; Foster *et al.* 2004; Camp *et al.* 2004). Data from various surveys has been compiled and synthesized by the Hawai‘i forest bird interagency database project (USGS 2006b). The plateau area of the Reserve adjacent to the Alaka‘i Wilderness Preserve is important habitat for native forest birds (Table 2), particularly upper elevation areas (above 4,000 ft (1,219 m) (USFWS 2010). Native forest birds known from the area include ‘apapane (*Himatione sanguinea*), Kaua‘i ‘elepaio (*Chasiempis sclateri*), Kaua‘i ‘amakihi (*Hemignathus kauaiensis*), ‘anianiau (*Hemignathus parvus*), and ‘i‘iwi (*Vestiaria coccinea*). The Reserve’s montane wet ecosystems also contain populations of and critical habitat for federally listed endangered forest birds including the ‘akeke‘e or Kaua‘i ‘ākepa (*Loxops caeruleirostris*), ‘akikiki or Kaua‘i creeper (*Oreomystis bairdi*) (USFWS 2006; USFWS 2010). The U.S. Fish and Wildlife Service (FWS) has designated parts of the Reserve as Recovery Habitat for the endangered puaiohi or small Kauai thrush (USFWS 2006).

Surveys of the rim of the upper plateau of the Reserve above Wainiha and Kalalau valleys have found breeding locations and activity for three rare species of seabirds; the federally threatened ‘a‘o or Newell’s shearwater (*Puffinus auricularis newelli*), the federally endangered ‘ua‘u or Hawaiian petrel (*Pterodroma sandwichensis*) and the ‘āke‘akē or band-rumped storm-petrel (*Oceanodroma castro*), a candidate for listing. These seabirds are nocturnal, burrow and crevice nesting, colonial breeding petrels that return each summer to Kaua‘i to breed (Holmes 2010). The coastal areas and cliffs of the Reserve provide habitat for a number of other seabirds including ‘iwa (*Fregata minor*), brown booby (*Sula leucogaster*), and both red and white-tailed tropicbirds (*Phaethon rubricauda* and *P. lepturus*, respectively) (Table 2).

The Reserve also contains habitat for raptors and waterbirds (Table 2). The pueo, or Hawaiian owl (*Asio flammeus sandwichensis*) is known from the Reserve. The koloa maoli or Hawaiian duck (*Anas wyvilliana*) may occur in the Reserve as it regularly uses montane streams in the Alaka‘i swamp area. ‘Auku‘u or black-crowned night heron (*Nycticorax nycticorax hoactli*) uses aquatic habitats in the lowland portions of the Reserve. Nēnē or Hawaiian goose (*Branta sandvicensis*) may be found along the lowland portions of the Reserve along the Nā Pali coast.

The NAR provides habitat for the endangered ‘ōpe‘ape‘a or Hawaiian hoary bat (*Lasiurus cinereus semotus*) which have been observed by researchers within the Reserve and in adjacent areas (Holmes 2010).

Table 2. Native Birds of Hono O Nā Pali Natural Area Reserve

Taxon	Common Name	Status	Federal Status
Forest Birds			
<i>Chasiempis sclateri</i>	Kaua‘i ‘elepaio	endemic	
<i>Hemignathus kauaiensis</i>	Kaua‘i ‘amakihi	endemic	
<i>Hemignathus parvus</i>	‘anianiau, lesser ‘amakihi	endemic	
<i>Himatione sanguinea</i>	‘apapane	endemic	
<i>Loxops caeruleirostris</i>	‘akeke‘e, Kaua‘i ‘ākepa	endemic	Endangered
<i>Myadestes palmeri</i>	puaiohi, small Kaua‘i thrush	endemic	Endangered
<i>Oreomystis bairdi</i>	‘akikiki, Kaua‘i creeper	endemic	Endangered
<i>Vestiaria coccinea</i>	‘i‘iwi	endemic	
Seabirds			
<i>Anous minutus</i>	noio, black noddy	indigenous	
<i>Fregata minor</i>	‘iwa	indigenous	
<i>Oceanodroma castro</i>	‘āke‘akē, band-rumped storm-petrel	indigenous	Candidate for listing
<i>Phaethon lepturus</i>	koa‘e kea, white-tailed tropicbird	indigenous	
<i>Phaethon rubricauda</i>	koa‘e ‘ula, red tailed tropicbird	indigenous	
<i>Puffinus auricularis newelli</i>	‘a‘o, Newell’s shearwater	endemic	Threatened
<i>Pterodroma sandwichensis</i>	‘ua‘u, Hawaiian petrel	endemic	Endangered
<i>Sula leucogaster</i>	‘ā, brown booby	indigenous	
Waterbirds			
<i>Anas wyvilliana</i>	koloa maoli or Hawaiian duck	endemic	Endangered
<i>Branta sandvicensis</i>	nēnē or Hawaiian goose	endemic	Endangered
<i>Nycticorax nycticorax hoactli</i>	auku‘u, black-crowned night heron	indigenous	
Migratory birds			
<i>Pluvialis fulva</i>	kōlea or Pacific golden plover	indigenous	
Raptors			
<i>Asio flammeus sandwichensis</i>	pueo, Hawaiian short-eared owl	endemic	

Numerous non-native birds are also present in the Reserve including Japanese white-eye (*Zosterops japonicus*), hwamei or melodious laughing-thrush (*Garrulax canorus*), white-rumped shama (*Copsychus malabaricus*), and Erckel’s francolin (*Francolinus erckelii*) (State of Hawai‘i 1989). Other non-native bird species observed in recent surveys of the Alaka‘i swamp area

include the common myna (*Acridotheres tristis*), northern cardinal (*Cardinalis cardinalis*), house finch (*Carpodacus mexicanus*), Japanese bush-warbler (*Cettia diphone*), feral fowl (*Gallus gallus*), zebra dove (*Geopelia striata*), nutmeg manikin (*Lonchura punctulata*), ring-necked pheasant (*Phasianus colchicus*), red-crested cardinal (*Paroaria coronata*) and spotted dove (*Streptopelia chinensis*) (Camp et al. 2004). The non-native barn owl (*Tyto alba*), a predator of native seabirds, has been detected in the Reserve (Holmes 2010).

A variety of non-native mammals such as feral pigs, Columbian black-tailed deer (*Odocoileus hemionus columbianus*), feral goats, rats, mice (*Mus musculus*), and cats are present in the Reserve.

Terrestrial Invertebrates

The Reserve has not been systematically surveyed for terrestrial invertebrates but there have been some collections in adjacent areas and limited sampling of specific taxa within the Reserve. Montane wet ecosystems of the Reserve have been designated as critical habitat for one species of fly; *Drosophila sharpii*. The adult flies are believed to be generalist microbivores (microbe eaters) and feed upon a variety of decomposing plant material. The host plants for *D. sharpii* are believed to be species of native *Cheirodendron* and *Tetraplasandra* (USFWS 2010).

Gruner (2004) surveyed and developed a checklist of arthropod species in association with ‘ōhi‘a in the adjacent Nā Pali - Kona Forest Reserve along the Alaka‘i swamp trail. This study found new records and range extensions for arthropod species associated with ‘ōhi‘a. Other collections in the Reserve have resulted in the discovery of undescribed species including, but not limited to, endemic seed bugs in the genus *Nysius* (Heteroptera: Lygaeidae) (Eiben 2008) and members of an endemic lineage of spiders in the genus *Tetragnatha* (Gillespie 1992). Although spiders are one of the most important groups of predators in the Hawaiian forests, little data is available on their biology and life history, perhaps because many are exclusively nocturnal (Gillespie 1992). Another study found a new endemic species of long-legged fly from the Reserve, *Sigmatineurum napali* (Diptera: Dolichopodidae) which is limited to riparian areas next to small splashing waterfalls in areas of mesic forest (Evenhaus *et al.* 1994).

There have also been two new species of *Hyposmocoma* (Lepidoptera: Cosmopterigidae) collected from the Reserve. This endemic Hawaiian moth genus is very diverse, and is noted for its case-bearing caterpillars, which create shelters in an array of shapes, from a diversity of natural materials. Two new species have been found in the Alaka‘i swamp including a species which exploits specialized habitat of exposed, lichen covered roots of fallen ‘ōhi‘a trees (Schmitz and Rubinoff 2010a) and another species which has larvae adapted to an underwater lifestyle in fast moving mountain streams (Schmitz and Rubinoff 2010b).

Two species of *Carelia*, a genus of Hawaiian land snails endemic to Kauai and Niihau, and the largest native land snail in the Hawaiian archipelago were once known from the area. The most recent record of *Carelia kalalauensis* in the Reserve is a 1946 report from Hanakoa Valley; the most current record of this species on Kauai is from 1951 in Kalalau Valley, west of the Reserve.

C. bicolor was last recorded in 1947 from Ho‘olulu Valley (State of Hawaii 1989). These species are now considered extinct (IUCN 2010).

Aquatic Ecosystems

The Reserve contains perennial streams with unique native aquatic biota (Table 3). These streams flow throughout the year (perennial) and are not diverted along their course to the ocean. Streams within the Reserve include parts of upper tributaries for the Waimea River system (Kawaikōī tributary), Hanakāpī‘ai and Hanakoa streams and all of the Waiahuakua and Ho‘olulu streams (Figure 2). Portions of Hanakāpī‘ai and Hanakoa streams within the Reserve contain critical habitat for the Newcomb’s snail (*Erinna newcombi*), federally listed as threatened.

Table 3. Important Aquatic Species of Hono O Na Pali NAR (Source: Parham *et al.* 2008)

Type of organism	Scientific Name	Hawaiian Name
Freshwater fish (family Gobiidae)	<i>Awaous guamensis</i>	O`opu nakea
	<i>Lentipes concolor</i>	‘O`opu ‘alamo‘o (female) ‘O`opu hi‘ukole (male)
	<i>Sicyopterus stimpsoni</i>	O`opu nopili
Freshwater fish (family Eleotridae)	<i>Eleotris sandwicensis</i>	O`opu akupa
Freshwater shrimp Crustacean	<i>Atyoida bisulcata</i>	‘Ōpae kalaole
Freshwater snail Mollusk	<i>Neritina granosa</i>	Hīhīwai
	<i>Erinna newcombi</i> **	n/a
	<i>Lymnaea aulacospira</i>	n/a
Insect – Damsefly (family Zygoptera)	<i>Megalagrion heterogamias</i>	Pinao
	<i>Megalagrion orobates</i>	
	<i>Megalagrion oresitrophum</i>	
	<i>Megalagrion vagabundum</i>	

** Listed under the Endangered Species Act as threatened

4. HONO O NĀ PALI: SOCIOCULTURAL RESOURCES

Land Use

The Reserve is state-owned land set aside as a NAR, under the administration of DLNR, DOFAW. Hono O Nā Pali NAR is located within the Protective subzone of the State Conservation District. Conservation District Use Permit 1459 approved the creation and management of the NAR as a permitted use of the Conservation District (State of Hawai‘i 1982). The eastern boundary of the Reserve is the boundary between Hanalei and Waimea Districts; the southern boundary is the Alaka‘i Wilderness Preserve, and the western boundary is the Pihea Trail and the Kalalau rim.

Public access is allowed in the Reserve for recreational and cultural uses. Current public use of Hono O Nā Pali NAR primarily includes hiking, bird watching, and hunting. Some uses, including organized educational activities, research, scientific collecting, gathering (including Native Hawaiian religious and customary gathering rights) and commercial uses require a Special Use Permit from the Executive Secretary of the NARS in Honolulu (808-587-0063).

Hunting in the NAR is regulated by Chapter 13-123, Hawaii Administrative Rules (Rules Regulating Game Mammal Hunting). The upper portion of the NAR is designated as part of Hunting Unit E. Lower elevation portions on the Reserve (below 3,000 ft (914 m) along the Nā Pali coast are designated as Hunting Unit G. Information regarding hunting rules, current seasons and bag limits for all game species can be obtained by contacting the DLNR Lihue office at 3060 Eiwa Street, Room 306, Lihue, Hawai‘i 96766; phone (808) 274-3433.

Approximately 1.9 miles (3 km) of the 11-mile (18 km) Kalalau trail passes through Hono O Nā Pali NAR beginning at the eastern entrance to Ho‘olulu valley; 2.5 miles from the Kalalau trailhead. Information regarding the Kalalau trail can be found at: <http://www.hawaiistateparks.org/hiking/kauai/kalalau.cfm>. The Alaka‘i swamp and the Pihea trails in the Reserve are part of the Na Ala Hele State Trail and Access Program <http://hawaiitrails.ehawaii.gov/>.

The upper section of the Reserve was put into Territorial Forest Reserve (Nā Pali - Kona Forest Reserve) for protection in 1907. Even before that time, the concern for native forest prompted cattle eradication activities in this area during 1882 and 1890. There were cattle and agricultural pursuits in the lower Reserve until it gained Forest Reserve status in 1938 (State of Hawai‘i 1989). Forest Reserve lands were withdrawn from the Nā Pali Kona Forest Reserve and set aside to establish Hono O Nā Pali NAR through Executive Order 3161 in 1983 (State of Hawai‘i 1982, 1983, 1984). Additional Nā Pali Kona Forest Reserve lands (486 ac (197 ha)) were withdrawn and added to Hono O Nā Pali NAR in 2009 by Executive Order 4270 (State of Hawai‘i 2009a, 2009b). A summary of the additions and withdraws creating Hono O Na Pali NAR is provided is provided in Table 4.

Table 4. Summary of public land additions (A) and withdrawals (W) for Hono O Na Pali NAR

Action	Date	A/W	Description	Acres	CSF	TMK
EO 3156	20-Dec-1982	W	Portion of Na Pali-Kona Forest Reserve (Governor's Proclamation, June 12, 1907)	3,150	18,813	5-9-01
EO 3161	12-Jan-1983	A	Set aside land for NAR	3,150	18,814	5-9-01
EO 3240*	01-May-1984	W	Portion of Na Pali-Kona Forest Reserve (Governor's Proclamation, May 2, 1938)	180	19,821	5-9-01:1
EO 4269	23-Mar-2009	W	Portion of Na Pali-Kona Forest Reserve (Governor's Proclamation, June 12, 1907)	486	24,702	(4) 1-4-001:Por.003
EO 4270	23-Mar-2009	A	Set aside land for NAR	486	24,703	(4) 1-4-001:Por.003

*There was no Land Board approval to withdraw 180 acres for State Parks in EO 3240. The 180 acres still remains under the jurisdiction of DOFAW - NARS.

The Hono O Nā Pali Management Plan is consistent with or implements portions of numerous existing plans and cooperative efforts (Table 5).

Table 5. Consistency with other plans and cooperative efforts.

Plan/Cooperative Effort	Comment
DOFAW Statewide Assessment and Resource Strategy (SWARS) 2010	SWARS identifies areas of greatest need and opportunity for forests in Hawaii and develops a long-term strategy for management. SWARS objectives include: 1.1. Identify and conserve high-priority forest ecosystems and landscapes; 2.2. Identify, manage and reduce threats to forest and ecosystem health; 3. 3. Enhance public benefits from trees and forests; 3.1. Protect and enhance water quality and quantity; 3.5. Protect, conserve and enhance wildlife and fish habitat; 3.7. Manage and restore trees/forests to mitigate and adapt to global climate change.
U.S. Fish and Wildlife Service. 2010. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for 48 Species on Kauai and Designation of Critical Habitat; Final Rule. Federal Register Vol. 75, No.70.	Supports recommendations for habitat management for endangered plants with critical habitat within Hono O Nā Pali NAR (32 species listed in Table 1).
U.S. Fish and Wildlife Service. 2006. Revised Recovery Plan for Hawaiian Forest Birds. Region 1, Portland, OR. 622 pp.	Supports recovery actions 1 and 2: protect and manage ecosystems for the benefit and recovery of native forest birds.
Kauai Watershed Alliance (KWA)	Supports mission and goals of the KWA watershed partnership.

Management Plan (2005)	
Hawai'i Comprehensive Wildlife Conservation Strategy (2005)	Implements objectives 1, 2, 3, 4, and 5
U.S. Fish and Wildlife Service Recovery Plans for endangered plants (USFWS 1995; USFWS; 1998a; USFWS 1999)	Supports recovery actions recommended for endangered species of plants

Cultural Resources and Archeological Sites

Most research on cultural resources and archeological sites in the general area has focused on the lowland and coastal areas along the Nā Pali coast. Portions of the Reserve within this area include Waiahuakua and Ho‘olulu valleys.

The traditional Nāpali District consisted of five ahupua‘a - Hanakāpī‘ai (including Ho‘olulu valley), Hanakoa (including Waiahuakua valley), Kalalau Valley, Honopu (including Kalalau beach, Honopu and ‘Awa‘awapuhi valleys), and Pohakuo (Tomonari-Tuggle 1989).

Maly (2003) completed a collection of historical accounts and oral history interviews with kama‘āina residents and fisher-people of lands in the Halele‘a-Nāpali region on the island of Kaua‘i. There is no information specifically on the valleys in the Reserve, however; this study provides a general overview of the history, legends and cultural resources of the Nā Pali area.

“The lands of the Halele‘a-Nāpali districts were favored with streams and fresh water resources which could be diverted into extensive lo‘i kalo (taro pond field systems). The wealth of the land was further enhanced by the sheltered bays and rich fisheries fronting them. Thus, the region was highly valued by its native tenants. Unfortunately, by the middle 1800s, dramatic changes in the condition of the native people—a result of introduced diseases, and the changing system of economics and land tenure—resulted in changes in residency and land use.

Lands of the Nāpali District were all but abandoned by the middle 1800s, thus, only limited historical documentation describing residency in the district is available.

By the middle 1840s, the Hawaiian system of land tenure was undergoing radical alteration, and the Hawaiian system of land and fishery rights being defined and codified. The laws set the foundation for implementing the Māhele ‘Aina of 1848, which granted fee-simple ownership rights to the hoā‘āina (common people of the land, native tenants)... The records of the Māhele are of great importance, as they identify families associated with lands; describe practices on the land; and also identify fishery resources.

Only two claims were located for land in the Nāpali District. During the Māhele, the King also granted lands to the Kingdom (Government), the revenue of which was to support government functions. In the Nāpali District, the ahupua‘a of Kalalau, Pohakuo,

Honopu, Hanakāpī'ai and one-half of Hanakoa were granted to the Government Land inventory... Portions of the lands that fell into the government inventory, were subsequently sold as Royal Patent Grants to individuals who applied for them. The grantees were generally long-time kama'āina residents of the lands they sought... Thirty grants were sold in the Nāpali District to twenty-seven applicants; the lands being situated in Kalalau and Honopu (Hawaiian Government 1887:7).

The valleys of the Nā Pali coast appear difficult to access, however these valleys were intensively cultivated and the larger valleys such as Kalalau were densely inhabited. Taro was raised in terraced lo'i along the streams and other crops such as bananas, sugar cane and sweet potato were grown above the lo'i. Other plants including wauke and mamaki for bark cloth and kukui nuts for food and oil for light were grown in the gulches. There were overland trails connecting many of these valleys and these areas were also accessed via canoe (Handy *et al.* 1972).

Coastal areas and streams in the Nā Pali region were used by Hawaiians for marine and freshwater resources, and oral history interviews confirm that these resources are still used and are culturally important (Maly 2003).

Maly (2003) also translated and synthesized an account of the journey of the goddess Hi'iaka to fetch the chief Lohiau from Hāena and return with him to Pele's domain at Kīlauea, Hawai'i. In this account, Hi'iaka describes the Nā Pali region through which she travelled and many events and sites in this legend occur along the Nā Pali coast and in the mountains above.

Tomonari-Tuggle (1989) completed an archeological reconnaissance survey of the Nā Pali coast state park and noted evidence of extensive pre-contact population and agriculture. This study reported the earliest dates for people living in the Nāpali District are from around A.D. 1,000-1,300. Archeological sites along the Nā Pali coast include house sites, irrigated agricultural systems, heiau, burials, and trails (Tomonari-Tuggle 1989). The Nāpali District was placed on the state and national register of historic places in 1984 due to its research potential, abundance of pre-historic archeological sites in a setting of isolated, undisturbed and spectacular scenic beauty (Carpenter *et al.* 2010).

Although Tomonari-Tuggle (1989) found no archeological sites in Ho'olulu valley, their surveys were limited. NARS staff has noted sites such as terraces in this valley. An informant to Tomonari-Tuggle (1989) noted that the narrow ledges at the base of the sea cliffs of Ho'olulu valley were a place canoes stopped to dry out belongings on trips along the coast (Tomonari-Tuggle 1989). Pukui and Elbert (1986) translate Ho'olulu as "to lie quietly in calm water; to gather together, or to wait, as for transportation" (Tomonari-Tuggle 1989).

Waiahuakua valley has extensive archeological resources and this valley shows maximum use of a limited amount of space. Limited survey in the valley along the Kalalau trail showed geographically extensive and impressive complex of irrigated fields and mapped two sites in good to excellent condition. No habitation features were located. Uncontrolled camping may be having a destructive impact on these archeological sites (Tomonari-Tuggle 1989).

Land use records from 1856-1857 show that lands in Kalalau, Pohakuaao and Honopu valleys were being used for the cultivation of kalo, olona and kula. In the late 1800's Hanakoa and Hanakāpī'ai were also used for coffee cultivation. Kalalau was abandoned in 1919 and then used for cattle grazing in the 1920's for a limited time (Tomonari-Tuggle 1989).

Carpenter *et al.* (2010) surveyed the first two miles of the Kalalau Trail prior to trail restoration and repair. This report recommended that the trail itself qualified as a significant historical property due to its association with local agriculture and commerce as well as the likelihood it would provide information on historic stone masonry techniques for trail/road construction in the Hawaiian Kingdom period. The Kalalau trail is an eleven mile historic route constructed circa 1860 and was an important route connecting communities and facilitating trade. The route of the trail has existed in its present alignment for a century and a half, although there have been some changes due to flooding, erosion, re-routing and degradation by residents and visitors. Prior to development of this trail, canoe travel was probably the main mode of transport along the coast due to rugged terrain; however, the Nāpali District was famous for its trail network and there were numerous overland routes which connected valleys along the coast (Carpenter *et al.* 2010).

The upland portions of the Reserve have not had as much cultural or archeological work as the lowlands. Cultural Impact Assessments have been prepared for conservation projects in the Alaka'i (Hammat 2008) and Waihiha (Gon 2009), upland areas immediately adjacent to the Reserve. These studies discuss the important cultural resources in these types of upland areas, and the montane portions of the Reserve are likely to be similar. Trails were used in traditional times to connect the settlements in the various ahupua'a and districts of the island (Hammat 2008; Gon 2009). Existing trails in this area are still widely used for cultural purposes. The upland forests in the area are sacred to Hawaiians and are still used for traditional and cultural practices such as collection of plants for medicinal or cultural purposes, ceremonial purposes (hula, oli or chant) (Hammat 2008; Gon 2009).

Although these Cultural Impact Assessments were for adjacent areas, they found no traditional or historical documentation and no archaeological evidence of any human burials in these upland areas (Hammat 2008; Gon 2009). The upland portions of the Reserve are similarly remote and inaccessible.

The upland areas bear significance as the wao nahele (forested zone) containing native plants and animals of great cultural value, and as wahi pana (storied places) (Gon 2009).

“Hawaiian customs and practices demonstrate the belief that all portions of the land and environment are related, like members of an extended family, each environmental zone was named, and their individual attributes were known. Acknowledging the relationship of one environmental zone (*wao*) to another is rooted in traditional land management practices and values. Just as place names tell us that areas are of cultural importance, the occurrence of a Hawaiian nomenclature for environmental zones also tells us that there was an intimate relationship between Hawaiians and their environment” (Maly 2010).

The Reserve contains trails along its southern edge, through the Alaka'i swamp and in the Pihea area; however no other trails from the remote and precipitous interior montane portions of the

Reserve are currently known. It is unlikely the remote upland portions of the Reserve were heavily used, and no archeological sites are known from this area.

Upland area were used by Hawaiians for activities such as bird hunting, harvesting timber, gathering forest plants for medicinal uses, and ceremonial purposes. Hawaiian hunting practices were primarily associated with bird hunting for food and feathers (Hammat 2008).

Infrastructure

Infrastructure within the Reserve consists of unimproved trails. Access into the upper portions of the Reserve is from the Pihea or Alaka'i Swamp Trails. These trails are managed by the State Na Ala Hele Program. The Pihea trail originates from the Pu'u O Kila lookout, at the end of Highway 550 (the closest road to the Reserve) and follows the western border of the Reserve. The Alaka'i Swamp Trail follows the southern boundary of the Reserve. The Na Ala Hele program has constructed a boardwalk over most of the Alaka'i Swamp Trail and the Pihea trail. This boardwalk has improved access to the area and at the same time has increased protection for the natural resources by providing a clear path for users of the area, limiting the amount of unintentional damage from trampling. The Kalalau Trail along the Nā Pali coast is managed by the Division of State Parks. This trail crosses the Reserve at Ho'olulu and Waiahuakua valleys, approximately 2.5 miles (4 km) from the trail head at Hā'ena State Park and exits the Reserve at mile 4.3 (7 km).

Helicopters are the primary means of NARS staff access to remote portions of the Reserve, but strong winds and cloud cover are major impediments to the predictability and consistency of this mode of travel.

Regional Partnerships

Hono O Nā Pali NAR is part of the Kaua'i Watershed Alliance (KWA), a group of public and private landowners working cooperatively to manage critical watershed lands on Kaua'i. KWA members include the Kaua'i County Water Department, Grove Farm Company Inc., Kamehameha Schools, Kaua'i Ranch LLC, Lihu'e Land Company, McBryde Sugar Company Ltd., Namahana Farms, the National Tropical Botanical Garden (NTBG), the Nature Conservancy (TNC) and DLNR. The KWA completed a watershed management plan in 2005, which includes resource management programs such as ungulate management, weed management, and watershed monitoring.

NARS staff work closely with the Kōke'e Resource Conservation Program (KRCP), a program of Garden Island Resource Conservation and Development. KRCP staff and volunteers assist with fencing projects and on-the-ground weed control.

NARS staff will also work with the Kaua'i Invasive Species Committee (KISC), a partnership working cooperatively on invasive species issues. KISC published a 2007 Action Plan that addresses invasive species issues on an island-wide basis. Target species for control include both plants and animals, and emphasis is placed on early detection through efforts such as the creation of a plant prevention field guide, roadside surveys, workshops, and public awareness

through community education and specific topics to target audiences.
<http://www.hawaiiinvasivespecies.org/iscs/kisc/>

5. SUMMARY OF MAJOR THREATS

Invasive Species - Ungulates

The primary ungulates of concern in Hono O Nā Pali NAR are feral pigs, feral goats and Columbian black-tailed deer (*Odocoileus hemionus columbianus*).

Pigs (*Sus scrofa*) were originally brought to Hawaii with the first Polynesian settlers as a domesticated species. After the arrival of Captain Cook, the larger European wild boar was intentionally introduced and quickly became feral. Feral pigs in Hawaii today are generally smaller in size than their mainland cousins as a result of over 200 years of interbreeding between the smaller Polynesian pig and the larger European boar (Tomich 1986).

Feral pigs pose a significant threat to the native biodiversity and watershed integrity of Hawaiian forests by damaging native vegetation and exposing soil to erosion (Stone 1985). In montane wet forests, there is a direct correlation between pig-induced soil disturbance and the increase of alien plants (Aplet *et al.* 1991). In addition, feral pigs have been shown to spread root-rot fungi (Baker, 1979), create muddy areas that spread mosquitoes that carry avian diseases such as avian pox and malaria (Baker 1979, USGS 2005; USGS 2006c), eat native plants (Cooray and Mueller-Dombois 1981), and carry parasites and diseases transmittable to humans and dogs, such as leptospirosis (Warner 1959 – 1969) and tuberculosis (Giffin 1978). Pigs are also known to eat endangered ground-nesting seabirds and destroy their nests (Mitchell *et al.* 2005). Decades of feral pig control in Hawai‘i verify that the only successful method of completely protecting an area from feral pigs is to use physical barriers such as fencing to exclude the animals (Stone 1985).

Feral pigs are present throughout the Reserve. Most adjacent lands also have feral pig populations however; there is currently no evidence of pigs in Kalalau Valley due to steep cliffs along the coast which prevent pig ingress into the valley from the east.

Goats were brought to Hawai‘i by Captain James Cook in 1778 (Tomich 1986). As was the practice by European sailors throughout the Pacific, goats were brought to islands as a food reserve for shipwrecked sailors (Atkinson and Atkinson 2000). Goats are extremely destructive herbivores capable of eating nearly any type of vegetation. They are particularly damaging to young trees and shoots of plants by eating them with such voracity that establishment of a successive generation is difficult to impossible. Goats are especially damaging to native plant species, which having evolved without browsing mammals, lack defense mechanisms such as spines or chemicals that are poisonous or foul tasting (Carlquist 1980). Feral goats can turn forested areas into grasslands in relatively short periods of time (Loope *et al.* 1988). As goats remove vegetation, they increase erosion (Hawaii Conservation Alliance 2007) and increase the incidence of rock falls (NTBG 2008).

Feral goats are present throughout Kauaʻi, including the valleys of Hanakāpīʻai and Lumahai, as well as along Nā Pali coast (NTBG 2008). Feral goats are the major threat to the native ecosystems at lower elevations of the Reserve, and much of the native habitat in these areas has been severely degraded by foraging and activity of large populations of goats. Goats are present in low numbers in the upper elevation Hono O Nā Pali area and pose a significant threat to the montane forest, but their population level and distribution in that area are not well known.

Black-tailed deer were brought to Kauaʻi in 1961 from Oregon by the State of Hawaiʻi to be promoted as a game species ([Rarehawaii](#) 2002). Deer feed on a number of different plants including both introduced and native species. Since black-tailed deer are known to eat a variety of introduced species, it is very likely that they act as seed dispersers. Deer also strip tree bark (Anderson 1999), girdle trees by rubbing their antlers on tree trunks and branches (Scowcroft *et al.* 1983; Anderson, 1999), and create trails which compact soil and destroys native vegetation (Anderson 1999). Black-tailed deer occur in both wet and dry areas, although they are currently not as widespread as pigs and goats, and mainly occupy areas in Waimea Canyon and in Kōkeʻe State Park (State of Hawaiʻi 2009b). Although deer have not been observed within the Reserve their numbers and range are expanding and they occur just outside the Reserve. Thus there is a high likelihood that they will eventually impact Hono O Nā Pali.

Invasive Species - Plants

Invasive non-native plants, or weeds, constitute a severe threat to the native ecosystems in the Reserve. Certain priority weeds are problematic because they can establish and survive in undisturbed native forest, disperse long distances via wind or birds, affect large portions of land, displace native vegetation, grow and reproduce rapidly, convert diverse assemblages of native plants to monoculture of alien species, and encourage fire by increasing fuels. These weeds can displace distinctive native flora, resulting in a loss of species diversity and eventually in more pronounced and permanent changes to ecosystem function such as alteration of primary productivity and nutrient cycling. Many invasive weed species completely replace native vegetation resulting in total loss of native habitats thereby negatively affecting native bird, arthropod and snail communities (Cuddihy and Stone 1990; Vitousek 1992).

Invasive weeds with great potential for spreading and causing habitat modification are identified in this plan as high priority for control or eradication. Weed species were prioritized based on observed invasiveness and other criteria including growth form, dispersal mechanisms, ability to displace native vegetation and ability to alter ecosystem cycles (water, nutrients and succession). High priority invasive weeds currently present in the upper elevation, montane portions of Hono O Nā Pali NAR include:

- Kāhili ginger (*Hedychium gardnerianum*)
- Australian tree fern (*Sphaeropteris cooperi*)
- Blackberry (*Rubus argutus*)
- Strawberry guava (*Psidium cattleianum*)
- Butterfly bush (*Buddleia asiatica*)
- *Clidemia hirta*

Additional weed species that are a serious concern to land managers are present in adjoining areas and have either not yet been detected or are present in small populations in the upper portion of the NAR. It is a high priority to prevent the establishment and/or spread of these species in this region of the NAR. Species of concern include but are not limited to Koster's curse (*Clidemia hirta*), banana poka (*Passiflora tarminiana*), faya (*Morella faya*), karaka nut (*Corynocarpus laevigatus*), broomsedge (*Andropogon virginicus*), yellow-eyed grass (*Xyris complanata*), mule's-foot fern (*Angiopteris evecta*), daisy fleabane (*Erigeron karvinskianus*), paperbark (*Melaleuca quinquenervia*) and African tulip tree (*Spathodea campanulata*). Other weed species may be added to the priority weed list if monitoring shows their range and abundance increasing in native ecosystems targeted for management.

The lower elevations of the Reserve contain dozens of weedy species. Some of the more common and problematic weeds in these portions of the Reserve include common guava (*Psidium guajava*), strawberry guava (*Psidium cattleianum*), java plum (*Syzygium cumini*), lantana (*Lantana camara*), molasses grass (*Melinis minutiflora*), perennial foxtail (*Setaria gracilis*), mountain apple (*Syzygium malaccense*), Koster's curse (*Clidemia hirta*), thimbleberry (*Rubus rosifolius*), airplant (*Kalanchoe pinnata*), *Oplismenus hirtellus*, *Elephantopus mollis*, *Pluchea carolinensis*, *Blechnum appendiculatum*, sword fern (*Nephrolepis multiflora*), bush beardgrass (*Schizachyrium condensatum*), daisy fleabane (*Erigeron karvinskianus*) and fireweed (*Erechtites valerianifolia*).

Invasive Species - Other Animals

A variety of non-native small animals have the potential to become serious pests to the biodiversity found in Hono O Nā Pali NAR. Feral cats, rats, mice, dogs, birds, amphibians and reptiles are known to consume or compete with native species and may contribute the spread of invasive weeds. Kaua'i has remained free of the Indian mongoose (*Herpestes auropunctatus*) and therefore has more ground nesting birds than other Hawaiian Islands, however; other non-native mammalian predators such as feral cats have a severe impact on native birds in the Reserve. Feral cats kill birds, which nest, feed, and roost in trees, as well as native sea birds and other species that nest on the ground or in burrows (USGS 2006a). Rats prey on native bird eggs, nestlings, native land snails and are also known to eat the fruits and/or strip the bark of native plants. Similarly, mice consume the seeds of native plants and for rare plants, seed predation can be a major factor contributing to species decline. The NAR has been invaded by non-native forest birds. Non-native birds may compete with native forest birds for food and other resources and act as vectors for avian diseases. Non-native birds also contribute to the spread of weeds by eating the fruits of weedy species and spreading seeds.

Non-native invertebrates are present, but largely undocumented, and can consume native plants, interfere with plant reproduction, predate or act as parasites on native species, transmit disease, affect food availability for native birds, and disrupt ecosystem processes. The invasion of the yellowjacket wasp (*Vespula pennsylvanica*), voracious predators of numerous species of native invertebrates, is of concern. Other non-native parasitoids adversely impact native moth species, and ants are a significant mortality factor for native invertebrates. Slugs (*Milax gagates*, *Limax maximus*, *Veronicella* spp.) consume fruit from native plants and prey on seedlings and mature

plants. The two-spotted leafhopper (*Sophonia rufofascia*) is a major concern for the *uluhe* fern, which is particularly sensitive to leafhopper feeding. Mosquitoes (*Aedes albopictus* and *Culex quinquefasciatus*) transmit deadly diseases to native birds.

Fire

Due to the high rainfall at Hono O Nā Pali NAR, fire is not normally a concern in the NAR. However, fire does occasionally pose a threat to the NAR, particularly during times of drought and in trailside areas accessible to human activity. Continued feral ungulate damage to native ecosystems can convert native forest to non-native grasses and shrubs, which are more vulnerable to fires caused by lightning strikes or humans. Wildfires leave the landscape bare and vulnerable to erosion and non-native weed invasions. Hawaii's flora evolved with infrequent, naturally-occurring episodes of fire, so most native species are not fire-adapted and are unable to recover well after wildfires. Alien plants, particularly grasses, are often more fire-adapted than native species and will quickly exploit suitable habitat after a fire. The principal human-caused ignition threats are from illegal campfires, primarily along the Nā Pali coast. People have been responsible for several wildfires since 2007 along the Nā Pali coast and in the Alaka'i swamp. Three wildfires in these areas burned over 50 ac (20 ha). Fires have even been started in very wet native forest areas. A wildfire in the Alaka'i swamp was started by a lost hiker. The principal natural ignition source is lightning, although this is extremely rare.

Additional Threats - Disease, Hurricanes, Climate Change, Illegal Human Activity

Introduced diseases and pathogens threaten native animals and plants. Given the lack of biosecurity in Hawaii, the introduction of new diseases and pathogens is possible. Avian pox and avian malaria are mosquito-transmitted diseases that currently affect native Hawaiian birds. In the extreme isolation of the Hawaiian Islands, birds evolved in the absence of these diseases and lost their natural immunity. Avian pox is caused by a virus (*Avipoxvirus*) and avian malaria by a single-celled parasite (*Plasmodium relictum*). For many native forest bird species, infection with these diseases is almost always fatal (USGS 2005; USGS 2006c).

Introduced plant diseases such as 'ōhi'a rust (*Puccinia psidii*) and koa wilt have the potential to impact the major components of the forest throughout the NAR. 'Ōhi'a rust affects 'ōhi'a as well as other plants in the same family (Myrtaceae) (HEAR 2010). In severe infections, growing tips wither and die back. Koa wilt is a serious, often fatal disease of the native tree, koa. Trees affected with the disease rapidly lose their canopies and may die within a few months (UH-CTAR 2010).

Climate change may affect the NAR through altering rainfall patterns and amounts. Changing climate may affect the abundance and seasonality of precipitation, thereby altering forest composition, growth and structure. Rare ecosystems and species may be affected by relatively rapid changes in precipitation, temperature, and humidity that result from a rapid and drastic change in regional or local climate patterns (e.g. prolonged drought, higher temperatures). Detrimental invasive species may change their distribution and abundance due to changes in the

climate (e.g. mosquitoes may be more frequently found at higher elevations due to warming temperatures).

Illegal human activity occurs on a small scale, primarily in the form of illegal camping and dumping along the Kalalau trail, harvesting (maile, hāpu‘u, and other native trees and plants), and vandalizing signs and fences. Marijuana cultivation may also occur. These activities destroy infrastructure and native species. Some illegal activities create openings in the forest that can be invaded by weeds.

Although natural disturbances such as hurricanes are regular occurrences in Hawai‘i, native species and ecosystems are not able to recover from hurricanes as readily due to low populations and/or invasion of non-native weed species. Hurricane ‘Iwa in 1982 and Hurricane ‘Iniki in 1992 had a devastating effect on Kaua‘i, particularly for populations of rare plants and birds (Foster *et al.* 2004; USFWS 2010).

6. OVERVIEW OF EXISTING MANAGEMENT

In general, management at Hono O Nā Pali NAR has primarily included habitat protection through the construction of several small fenced exclosures, weed control and habitat restoration within these exclosures, and rare species monitoring and collecting. Major accomplishments from these management programs are summarized below. NAR staff also work on monitoring, education and outreach, and review special use permits for certain activities proposed in the NAR.

In 1988, an initial threat assessment and monitoring was conducted within the Reserve in preparation for the original management plan (State of Hawai‘i 1989). Survey crews collected data along 11 transects ranging from 490 – 4,430 ft (149 - 1,350 m) in length. Transects sampled the presence of natural communities, rare plants, native birds, feral ungulates and invasive weeds. In general, the results of the survey showed little to no ungulate and weed presence in the upper plateau region and moderate to heavy weed and ungulate presence in the lower preserve. Locations of rare plants identified from this previous survey are also included in this updated management plan.

In 1990, three small fenced exclosures of approximately .20 ac (.1 ha) in size were built in the lowland portion of the Reserve to protect rare species and native mesic habitat (Figure 4). One exclosure was built in Ho‘olulu valley and two exclosures were built in Waiahuakua valley. The exclosures are 5 ft (1.5 m) in height and were constructed using steel T-posts, hog wire, and barbed and smooth wire. Table 6 shows a list of native species found within these exclosures.

Table 6. Native plant species found within lower Reserve exclosures

Scientific name	Common name	Status	WW	EW	HO
<i>Diospyros sandwicensis</i>	lama	end	X	X	X
<i>Metrosideros polymorpha</i>	‘ohia	end	X		X
<i>Pandanus tectorius</i>	hala	ind	X		

<i>Bidens forbesii</i>	ko‘oko‘olau, ko‘olau	end	X	X	
<i>Alyxia stellata</i>	maile	end	X	X	X
<i>Psychotria mauiensis</i>	kōpiko, ‘ōpiko	end	X		X
<i>Psydrax odorata</i>	alahe‘e	end	X		X
<i>Pouteria sandwicensis</i>	‘a‘ala, aulu, kaulu	end	X		
<i>Ochrosia kauaensis</i>	hōlei	end, SOC	X		X
<i>Pittosporum napaliense</i>	hō‘awa, hā‘awa	end, SOC	X		X
<i>Nestegis sandwicensis</i>	olopua, pua, ulupua	end	X		
<i>Freycinetia arborea</i>	‘ie‘ie, ‘ie	ind			X

Key

end = endemic, ind = indigenous, WW = western Waiahuakua exclosure, EW = eastern Waiahuakua exclosure, HO = Ho‘olulu exclosure

In 1992, a fence was constructed up Pohakea ridge starting from the area known as “bellstone” at the 3 mile marker along the Kalalau trail, running approximately 800 ft (244 m) up the ridge and terminating at the base of a steep cliff. In addition, at bellstone, a self-closing gate was installed across the trail. The purpose of the fence and gate was to prevent feral pig access into the Reserve and further west along the Nā Pali Coast. Shortly after the gate was built, it was vandalized and pulled out. A second gate was put in but that was vandalized as well. Additionally, soon after the fence was built, Kaua‘i was hit with Hurricane Iniki and the fence was severely damaged. It has not been repaired since.

In 1998, several medium-sized fenced exclosures were built in the Alaka‘i plateau to protect sensitive bog habitat from feral pigs. An exclosure of 1.8 ac (.7 ha) was built within the Reserve at North bog in the upper plateau section. Since the fence was constructed, staff has visited the bog approximately once every two years to monitor the condition of the fence and conduct invasive species control within the fenced area. Plans are underway to retrofit the North bog fence to the height of 7 ft (2 m) to protect the bog from goats and deer.

In 2009, multispectral and natural color aerial imagery data was collected for the Kaua‘i watershed which included the upper plateau portion of the NAR. This imagery has been analyzed to obtain precise locations for priority weeds, particularly Australian tree fern and kāhili ginger, in order to target aerial weed control (Figure 5).

In 2010, staff built a weatherport within the NAR. Located just outside of the North Bog fence on the east side, this weatherport will serve as a main location for staging natural resources management operations into the Upper Hanakāpī‘ai and Alaka‘i units (see Fig. 4). Management goals for these units are described in the Management Program section of this plan.

7. MANAGEMENT PROGRAM

The overall management goal is to manage threats to the integrity, diversity and functioning of Hono O Nā Pali NAR ecosystems so that the unique natural resources are protected, maintained, and enhanced.

Management programs that support this overall goal include the following:

1. Infrastructure and Facilities
2. Ungulate Management
3. Weed Management
4. Habitat Protection and Rare Species Restoration
5. Fire Prevention and Response
6. Monitoring
7. Outreach and Education
8. Enforcement
9. Partnership Collaboration

Management of key areas is proposed in this plan, and priorities are based on biological resources, threats to those resources and the feasibility of management (e.g. topography and access). Cultural resource protection is included in management programs. Protection of the natural resources in the Reserve through the programs above is the primary means to protect the cultural resources. According to Maly (2004), "...the mountain landscape, its' native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property."

The Reserve has been divided into three general management areas with unique qualities and different threats and management priorities.

Upper Plateau - This area is the highest priority management area in the Reserve due to the intactness of the native ecosystems. This area includes the upper elevation, montane portions of the Reserve and forests within the Alaka'i plateau. This area contains some of the least disturbed native forest communities in the entire Reserve due to the extremely rugged topography and contains numerous critically endangered birds and plants. Management priorities include feral ungulate control, rare species restoration and non-native weed control. Management units in this area include North Hanakāpī'ai, South Hanakāpī'ai, Alaka'i and Honakoa (Figure 4).

Lowland - This area includes the lowland portions of the Reserve and contains a diversity of lowland native and introduced vegetation (Figure 4). The main threats to this area are feral goats, feral pigs and invasive weeds. The area's highest management priority is ungulate control, followed by non-native weed control.

Cliffs - This area is made up of steep and mostly inaccessible cliffs containing native grass and forest communities (Figure 4). Feral goats pose a threat to native plants as they use the rocky cliffs for shelter. The area's highest management priority is goat control, followed by non-native weed control.

Infrastructure and Facilities

Objective: Install necessary infrastructure to facilitate staff, volunteer and partner access into remote areas of the Reserve to conduct natural resources management activities.

Actions:

1. Construct up to three weatherports and associated infrastructure (water catchment, outhouse, helicopter landing zones) to serve as remote field stations for staff, partners and volunteers.
2. Install a solar powered radio repeater at one of the weathports for NARS staff and partner communications and safety.
3. Assist in the maintenance of public trails within the Reserve.

The Hono O Nā Pali Reserve is large and much of the Reserve is extremely remote, steep and inaccessible. The installation of basic infrastructure is required for NARS staff and partners to safely and effectively implement resource management actions outlined in this plan.

Weatherports are pre-fabricated weatherproof tents that will be erected on a raised pre-fabricated platform raised 2 - 4 ft (.6 - 1.2 m) off the ground (Figure 3). The approximate size of the shelters will be 16 ft wide by 20 ft long and 8 ft in height (5 m x 6 m x 2 m). The size of the platforms will be slightly larger (26 ft long x 18 ft wide) (8 m x 5.5 m) to accommodate a deck entrance. Up to 3 weatherports will be constructed in order to support fence building and field logistics. Each weatherport will be capable of housing 6-10 people. Additionally, weatherports will have a 6 ft x 6 ft (2 m x 2 m) water catchment system with a 500 gallon (1.9 kiloliter) capacity water tank located near the platform and a helicopter landing zone.

Outhouses consist of a small enclosed 2 ft x 4 ft (.6 - 1.2 m) unit with a vented composting toilet and corrugated roof. Outhouses will be built directly adjacent to the weatherport structures.

Figure 3. Weatherport and Outhouse



NARS staff relies on helicopters to access many areas for management, and helicopter use is currently limited by the lack of safe landing zones. Helicopter landing zones will consist of a

small 16 ft x16 ft (5 m x 5 m) clearing with wooden posts leveled and anchored in the ground to serve as landing pads. Landing zones will be located adjacent to weatherports.

Installation of weatherports and helicopter landing zones will require clearing a small area of vegetation; however, impacts will be minimized by keeping clearing of vegetation to a minimum and primarily choosing sites on ridges where the vegetation is sparse and dominated by ferns and shrubs rather than trees. Staff will monitor weatherports and helicopter landing zones for invasive weeds, and control weeds, if necessary. Figure 4 shows approximate weatherport locations. Final locations will be chosen to minimize impacts to native ecosystems as well as to conceal structures from view planes. Where staff needs are anticipated to be less, smaller weatherports or alternatively designed, low impact camps may be constructed.

DOFAW will install a solar powered radio repeater at one of the weatherports to improve staff and partner communications and safety during natural resource management activities. The radio repeater will be housed in weather protective cases and powered by solar panels. Additional instrumentation may be added to repeater structure. The height of the antennae (tallest component) will be approximately 10 - 15 ft (3 - 4.6 m) above grade.

The portion of the Kalalau trail that passes through the Reserve is the joint responsibility of the Kaua'i Natural Area Reserve Program and the Division of State Parks, maintenance will be collaborative and based upon mutual management goals. The Alaka'i swamp and the Pihea trails in the Reserve are managed in conjunction with the Na Ala Hele State Trail and Access Program.

Ungulate Management

Objective: Preserve and protect native forest and watershed from feral ungulate damage by constructing and maintaining strategic fencing, completely removing ungulates from fenced management areas and reducing ungulates in unfenced areas.

Actions:

1. Construct strategic fencing to protect native forests and watershed within the Reserve from feral ungulate damage.
2. Implement feral ungulate control using a variety of methods that may include special public hunts, trapping, staff control, and other approved methods to completely remove animals from fenced areas after fence construction.
3. Monitor fenced areas for ungulate presence following ungulate removal and control ingress, if necessary.
4. Inspect and maintain all fences on a regular basis.

Ungulate management for feral pigs, goats, and deer is needed to protect the biological and water resources of the Reserve and limit damage to native Hawaiian ecosystems and endangered plants and animals. To reduce ungulate numbers sufficiently to protect the resources of the NAR, a combination of strategic fencing and animal removal from high priority areas is needed. Without fencing, perpetual ungulate control is needed because of reproduction of existing populations and ingress from adjacent properties.

Fences will contain gates or step-overs to continue to allow pedestrian access for recreational and cultural uses of the Reserve.

New strategic fences will be constructed in the approximately 2,200 ac (890 ha) upper plateau portion of the Hono O Na Pali NAR, including a majority of the North Hanakāpī‘ai, South Hanakāpī‘ai, Alaka‘i and Honakoa units (Figure 4). Management in this area will focus on pig removal and preventing the establishment of goats and deer within the upper plateau portion of the preserve.

Additionally, existing deteriorated fencing along lower Pōhakea ridge will be replaced to protect approximately 1,000 ac (405 ha) of lowland wet and mesic forests. Using strategic fencing in conjunction with natural barriers to prohibit the ingress of ungulates into the area will make ungulate control efforts more effective.

While ungulate ingress into the low elevation portion of the NAR is primarily from Hanakapiai, it is possible that ingress into the Reserve from the west may become an issue if feral pigs become established in Kalalau. Therefore, while it is not necessary at this time, it may become necessary in the future to construct additional fence along the northwest boundary of the Reserve, similar to the one constructed along lower Pohakea ridge, to prevent ingress of feral pigs from the west.

Fencing will be constructed of hog wire or panels at a minimum height of 4 ft. Where control of deer and goats is a priority, the fence will be topped with plastic deer mesh. The mesh will overlap with the lower fence portion resulting in a fence height of 7 ft (2.1 m). The width of fence corridors will be kept to a minimum so as to create as little forest disturbance as possible. Proposed strategic fencing may cross multiple streams in the upland portions of Hanakoa, Waiahuakua, Ho‘olulu, and the Alaka‘i plateau (see Fig 4). Fence design at stream crossings will allow for movement of water and stream fauna but will prevent feral ungulate ingress. Where fences cross known game trails, one way animal gates may be installed to allow animals to exit, but not enter, the protected upper plateau area.

NAR and/or KWA staff and/or contractors will implement fence construction in phases. Initial field surveys have been conducted to identify approximate locations for the planned fence alignments. The final alignments for strategic fencing will be based on terrain, feral ungulate movement patterns, sensitive resources, and feasibility. Final fence alignments will be sited to avoid impacts to botanical, faunal, and archaeological resources; in particular no construction will occur at or near seabird nesting sites. When practical, strategic fences may follow existing trails to avoid impacts to sensitive habitats. Strategic fences may run along and/or across major ridgelines to prevent movement of animals. Approximately 4.8 miles (7.7km) of fencing is needed, at an estimated average cost of \$180,000 per mile (labor, materials and helicopter).

As fence construction is completed, various methods will be used to remove ungulates. Public hunting will be encouraged during the first phase of ungulate removal in non-sensitive habitat portions of the Reserve that are easily accessible and where human and dog activity does not

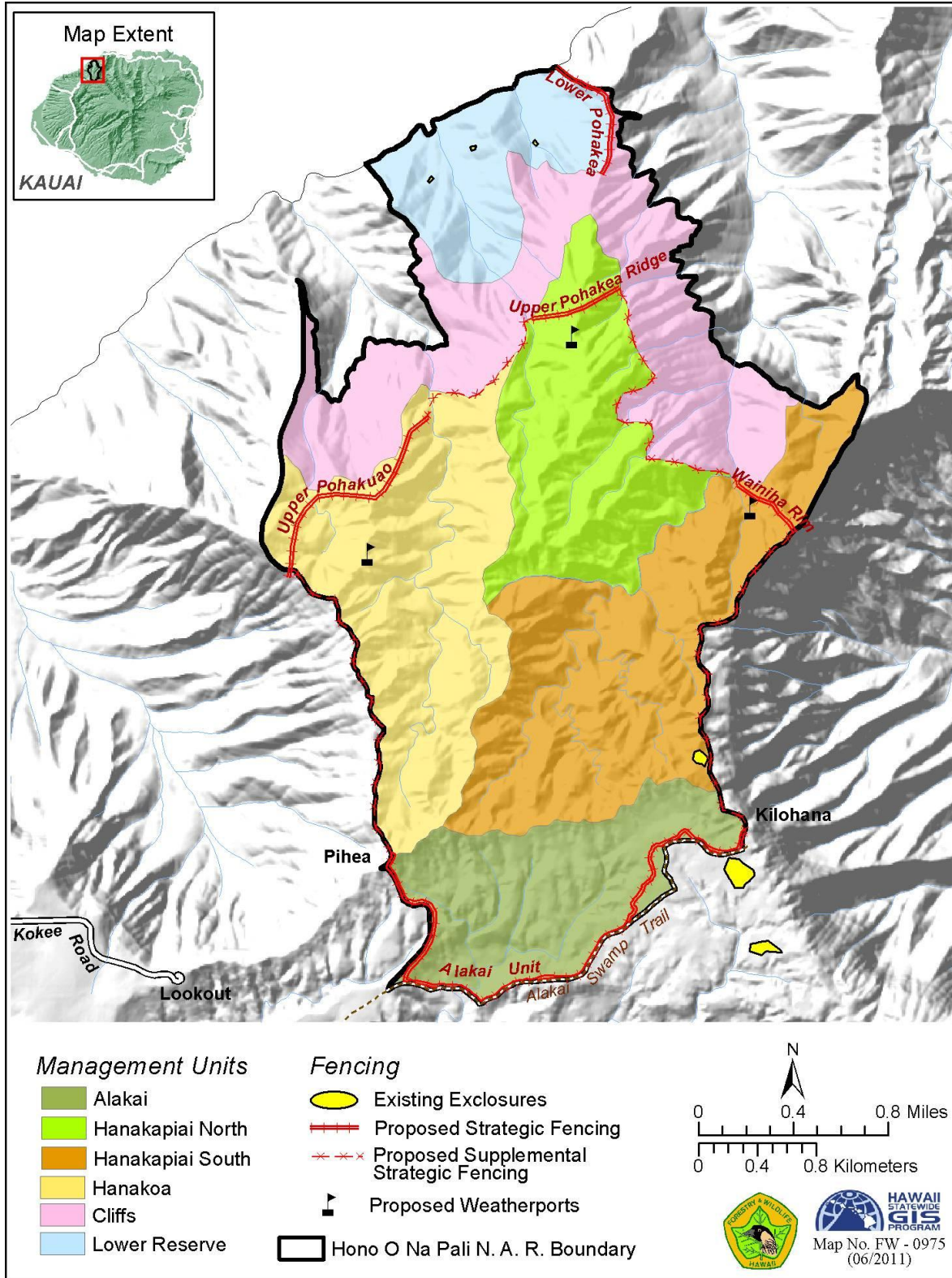
pose a threat to the Reserve's resources. Additional control methods including drives, trapping, staff control, snaring, and other approved methods (State of Hawai'i 2007), may be needed to remove all the ungulates from the remote, upper elevation portions of the Reserve. NARS staff will work with public hunters and adjacent landowners (e.g. Division of State Parks) to remove feral pigs in the lowland portions of the Reserve (Waiahuakua and Kāwelu Cliffs), prevent pig ingress into Kalalau valley (currently pig-free), and reduce goat populations. Special hunts and logistical support for volunteer hunters may be used to increase public hunting pressure in key areas. DOFAW ungulate control methods are outlined in State of Hawai'i 2007, Technical Report No. 07-01, Review of methods and approach for control of non-native ungulates in Hawaii [http://www.state.hi.us/dlnr/dofaw/pubs/Ungulate Control Methods FINAL Mar 2007.pdf](http://www.state.hi.us/dlnr/dofaw/pubs/Ungulate%20Control%20Methods%20FINAL%20Mar%202007.pdf)

Inspection and maintenance of fences and monitoring for ungulate presence will be necessary as fencing is completed and ungulates are removed to prevent reinvasion of ungulate-free areas.

Proposed Fencing (Figure 4) - In order of priority:

1. Alaka'i Unit - Approximately 2.7 mi (4,345 m) of new strategic fence along the southern side of the Reserve from the rim of Kalalau valley near Pihea lookout to the rim of Wainiha valley north of Kilohana lookout. This fence will prevent the ingress of feral pigs into the project site from the Alaka'i plateau while the steep cliffs to the west, north, and east will serve as natural barriers preventing ingress from other areas.
2. Upper Pōkākea Ridge - Approximately 0.5 miles (804 m) of new strategic fencing is needed to prevent movement of goats up the ridge into the Reserve's Hanakāpī'ai North unit.
3. Upper Pōhakuao - 1.2 mile (1,931 m) of new strategic fencing from Kalalau rim to Hanakoa rim is needed to prevent the movement of goats into the Hanaoka unit of the Reserve.
4. Lower Pōhākea - Approximately 0.5 miles (804 m) of replacement strategic fencing is needed near mile marker 2.5 on the Kalalau Trail to prevent feral pig ingress into Ho'olulu, Waiahuakua, Hanakoa, Pōhakuao and Kalalau valleys. This fence will increase the effectiveness of ungulate control efforts in 1,225 ac (496 ha) of the Reserve's lowland wet and mesic forest as well as prevent the establishment of feral pigs in Kalalau valley. The fence will have gates or step-overs to continue to allow public hiking access on the Nā Pali trail.
5. Wainiha rim to Hanakāpī'ai - 0.4 miles (643 m) of new strategic fencing is needed to prevent the movement of goats into the easternmost portions of the Reserve.
6. Proposed supplemental strategic fencing (up to 2 miles (3,218 m)) - Supplemental strategic fencing (Figure 4) may be necessary in other portions of the Reserve if natural barriers and proposed fencing described above are not effective in preventing movement of feral ungulates into the upper plateau. Supplemental strategic fencing sites will be selected, if needed, based on the movement of feral ungulates.

Figure 4. Proposed Management Actions



Weed Management

Objective: Protect intact native areas within the Reserve by eradicating or containing select high priority weeds within protected areas and eradicating incipient weeds along common invasion corridors (e.g. trails, fences).

Actions:

1. Develop a control strategy for priority weeds (Australian tree fern, kāhili ginger and other weeds) in the upper plateau portions of the Reserve based on the results of high resolution aerial imagery analysis.
2. Control Australian tree fern and kāhili ginger in the upper plateau of the Reserve using aerial spraying from helicopters and ground-based control.
3. Control weeds along invasion corridors (e.g., trails, fences) using approved methods (chemical, manual and/or biocontrol).
4. Maintain procedures to prevent introduction of new weeds (i.e., sanitation protocols).
5. Monitor management efficacy in intact native areas to determine if weed control measures are effective and whether re-visitation intervals can be lengthened.
6. Monitor weeds using additional aerial and ground surveys to detect changes in long term distribution and abundance.
7. Assess the need for invasive species management in the lower portions of the NAR.
8. Support island-wide and state-wide weed early detection and prevention programs and weed control research including new chemical, mechanical and biological control techniques, and participate, where appropriate, in experimental weed control management.

Weed control goals for the existing Hono O Nā Pali NAR include early detection and preventing the establishment of incipient, habitat modifying weeds that are not currently present in the NAR or are still localized. For priority weeds already present in the NAR, the goal is to eliminate all known occurrences within targeted control areas and/or to contain the spread of priority species. Due to limited resources for monitoring and control throughout these remote forest areas, NAR staff will focus control efforts in disturbed areas such as trails and fence lines as these often serve as corridors for weed establishment and spread. Prevention is a critical component of the weed management program, and it is important to avoid and/or reduce the inadvertent introduction and spread of weeds by researchers, managers and students working in and visiting the area. NARS staff and volunteers will follow protocols for cleaning of boots, equipment and vehicles prior to entry into the NAR.

The upper plateau portion of the Reserve is the highest priority for intensive weed control as these areas contain the most intact native ecosystems. This area is also the highest priority target for fencing and feral ungulate removal. Removal of ungulates from fenced areas is a critical step in weed control, particularly in relatively intact montane forests because it allows for the recovery of native vegetation by minimizing ground disturbance and reducing the spread of weeds by ungulates (Stone *et al.* 1992).

NARS staff will use newly developed techniques for mapping and control of Australian tree fern and kāhili ginger, currently the top two priority weeds in the upper portions of the Reserve. In 2009, The Nature Conservancy of Hawai‘i (TNC) contracted Resource Mapping Hawai‘i to collect multispectral and natural color imagery for most of the KWA management area, including the upper elevation portions of the Reserve. Imagery for portions of the KWA was analyzed and detailed maps of Australian tree fern are being used to direct aerial and ground based weed control efforts. In May 2011, Resource Mapping completed a contract to analyze high resolution imagery for the presence of Australian tree fern and kāhili ginger in the Reserve. The results of this analysis are presented in Figure 5. Resource Mapping Hawai‘i continues to refine and improve methods for imagery data collection and analysis for additional weed species. TNC also collaborated with University of Hawaii scientists and helicopter companies to develop an effective low volume, foliar aerial control method for Australian tree fern. The Kauai NARS program will utilize this technology to control these target weeds.

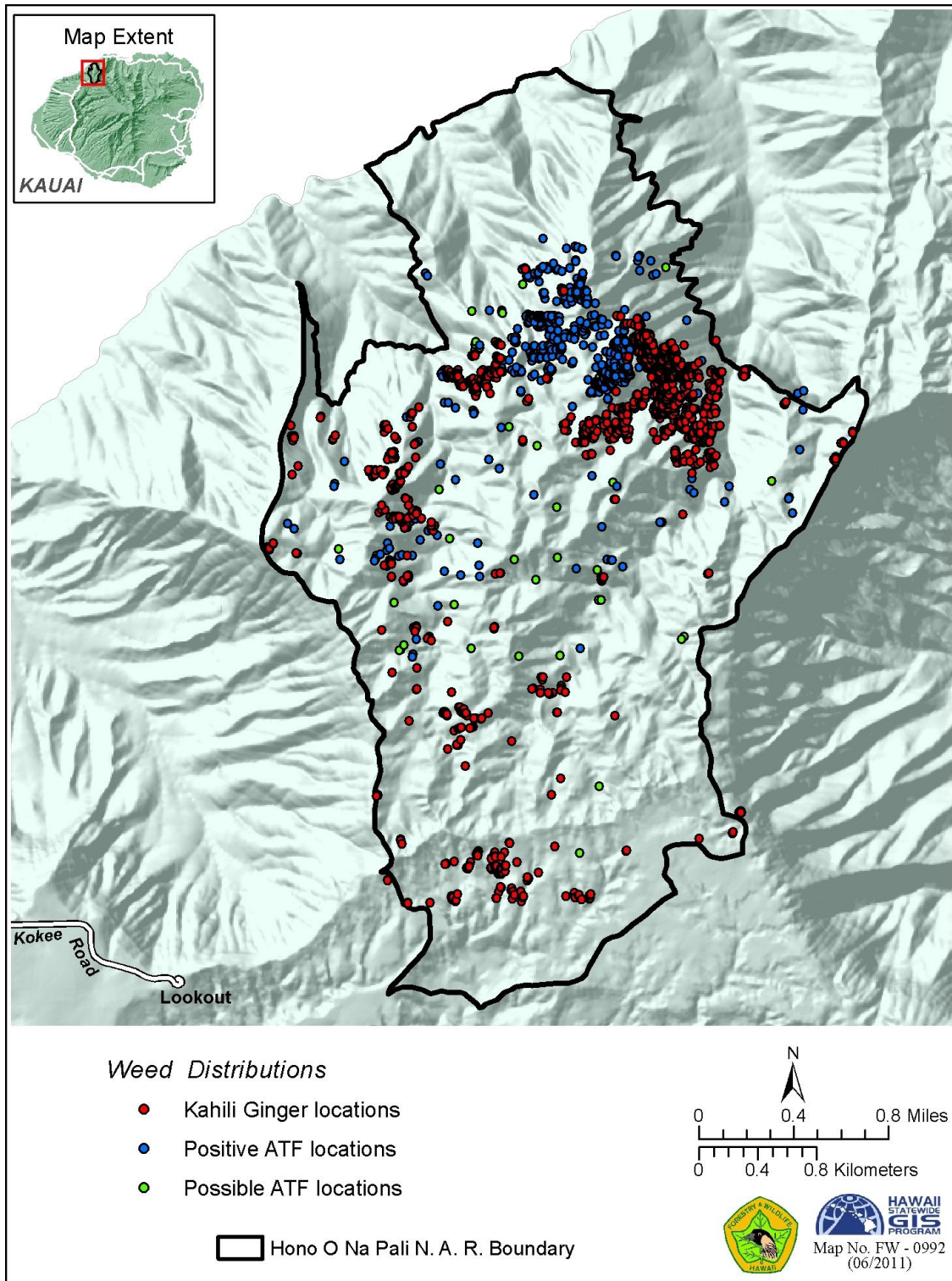
Weed mapping is essential to developing a comprehensive control strategy. Distribution mapping includes compiling data from aerial imagery, ground surveys, incidental observations and reconnaissance surveys to map the distribution and abundance of weeds. Results from surveys will then be used to better delineate the weed populations core extent and outlying individuals, and permit the development of an effective control strategy. NAR staff will also monitor weed control areas to evaluate the effectiveness of control efforts.

A combination of control techniques including manual, mechanical and herbicides are used to remove weeds. The technique used is based on the characteristics of the target species, the sensitivity of the area in which the species is found, and the effectiveness of the control technique. Weed control research into new monitoring, mapping (including remote sensing) and control methods will be integrated into the weed management program over the course of this plan as appropriate. Due to widespread and heavy infestations of certain weeds (e.g. *Clidemia hirta*, and Kahili ginger) and limited resources, NARS staff and partners intend to test the efficacy of approved biocontrol agents within the Reserve, when available.

Lowland areas have more weed problems than the upper areas currently targeted for weed control. Weed control in these areas will focus on control of incipient invasions of new species or localized control within targeted areas (e.g. rare plant restoration areas).

Weed monitoring and mapping will be conducted to detect changes in weed distribution and abundance over time as well as detect incipient invaders (additional discussion under Monitoring section).

Figure 5: Priority Weed Locations (kāhili ginger and Australian tree fern (ATF))



Habitat Protection and Rare Species Restoration Program

Objective: Manage high quality forest habitats, rare, threatened and endangered plant and animal species at sustainable community and population levels.

Actions:

1. Maintain the integrity of high quality forest habitats by maintaining existing fencing, constructing new fencing, and controlling ungulates and weeds.
2. Prevent the introduction of incipient habitat-modifying species and new threats (e.g. new weed species, coqui frogs, etc.). Remove habitat-modifying species before they become established.
3. Map, monitor and protect existing wild populations of rare and endangered species to contribute to their population stabilization and recovery.
4. Re-introduce certain species of rare and endangered plants in appropriate protected habitat through outplanting. Coordinate outplanting and other management actions with the PEPP and other agencies and organizations working on rare plant recovery.
5. Conduct predator monitoring and control near known locations of nesting seabirds in the montane wet forest of the Reserve to enhance seabird and forest bird populations.

Fencing and ungulate removal is discussed above. Fencing and the complete removal of ungulates within the strategically fenced 2,200 acre montane forest unit is critical to the long-term health and recovery of native ecosystems including rare plants, forest birds and other native species. These management actions, along with weed management and preventing the establishment of new habitat-modifying species, are the most critical actions. NAR staff may also need to implement habitat restoration and species-specific management.

In some instances, large scale habitat protection and restoration is insufficient to recover rare and endangered plants. Species with extremely limited numbers of wild individuals require additional management. These species (Table 1) will continue to be a focus for the NARS rare species program. The goal of NARS rare plant management is to remove threats to these species and ensure their long-term survival in secure and self-sustaining wild populations.

NAR staff will work cooperatively with other organizations and agencies on rare plant recovery including U.S. Fish and Wildlife Service (USFWS), KWA, the Hawai'i State Plant Extinction Prevention Program (PEPP) and National Tropical Botanical Garden (NTBG). Management actions specific to rare plant recovery includes surveys, collection, propagation and storage of genetic materials, and reintroduction through outplanting.

PEPP is focused on preventing the extinction of taxa with fewer than 50 individuals in the wild. PEPP addresses the declining trend of targeted species by monitoring and collecting the seeds, fruit, or vegetative cuttings of each individual of a PEPP species to preserve the genetic variability represented by all of the remaining individuals of the species.

NARS staff will follow rare plant collection and reintroduction guidelines recommended by the Hawaii Rare Plant Restoration Group (interagency group of rare plant experts)

<http://www.hear.org/hrprg/>. Rare and endangered species historically known from the Reserve and/or nearby will be reintroduced, as appropriate (Table 1). NARS staff and partners will tag and map the locations of all outplanted plants and monitor their survival and growth. They will do additional management of wild and/or reintroduced populations if needed (e.g. fencing wild plants that are not within fenced management units, control of damaging weeds, insects, slugs, plant disease and/or mammalian predators).

The Reserve has recently been identified by the Kaua'i Endangered Seabird Recovery Project (KESRP) as critical seabird nesting habitat (Newell's shearwaters, Hawaiian petrels and band-rumped storm-petrels). Additional surveys and monitoring of seabirds are needed to determine the extent of these species in the Reserve. Cats and rats are significant threats to these seabirds. NARS and KESRP staff members plan to conduct feral cat monitoring and control near known seabird nesting areas in the montane wet forest of the Reserve. Live cat traps will be deployed near breeding colonies and along fence corridors. Traps will only be set on overnight trips where they can be checked on a daily basis. New methods for control of predators across large conservation areas are currently being developed. NAR staff may implement predator removal using alternate methods as they are approved and offer a cost-effective way to remove predators. The Reserve has been identified as a key area for mitigation for Habitat Conservation Plans that address the take of listed seabirds.

Fire Prevention and Response

Objective: Employ appropriate fire management strategies including pre-suppression, suppression, and post-suppression rehabilitation to reduce wildfire occurrence and minimize wildfire impacts.

Actions:

1. Implement fire prevention measures, including educational outreach and signage.
2. Continue DOFAW staff training and certifications for effective and safe fire response.
3. Suppress fires safely and aggressively using appropriate means.

Strategies to prevent and minimize the impacts of fire management are incorporated into this management plan because of the impact fire can have on native communities. Fire is a risk in portions of the Reserve, particularly in the drier lowland forests, and in areas accessible to people (e.g. areas along the Kalalau Trail).

Many fires are caused by humans, so fire prevention measures will include increased educational efforts for those accessing the NAR, area closures in the event of extreme fire danger and suppression. DOFAW staff will maintain current fire response certifications by attending regular required staff trainings. In the event of fire, DOFAW will respond to fires in the Reserve. The most effective control of a fire will be through measures that result in the least amount of impact or disturbance to natural and archeological resources. The method of suppression will be determined by the on-site situation, with special regard to the potential expansion of fire damage to the resources within the Reserve. Minimum impact methods of suppression will be applied

whenever such methods are sufficient. Weed control and planting of common native species will be used to restore certain disturbed areas to prevent fire and/or following damage from fire.

Monitoring

Objective: Monitor current status and trends of natural resources throughout the NAR to assess the success of management actions and as part of a long-term monitoring program.

Actions:

1. Develop and implement monitoring programs for ungulates and weeds using available technology (e.g. aerial imagery, aerial surveys, GIS, and remote cameras) and ground surveys to measure the success of management and detect changes in abundance and distribution.
2. Identify critical gaps in natural resource inventories for the NAR; work with partners to develop appropriate monitoring protocols and implement monitoring for key community indicators that are not currently being monitored (e.g., rare plants, seabirds native vegetation communities, forest birds, invertebrates etc).

Monitoring quantifies the impact of feral ungulates and weeds on the Reserve's native ecosystems and allows the success of management actions to be tracked. Monitoring will quantify habitat characteristics, and invasive animal and invasive plant presence. Monitoring will focus on the upper portions of the preserve as the threats to this area are relatively unknown and this area is a high priority for management. However, monitoring of the lower portion of the Reserve will also be conducted.

The upper elevation portion of the Hono O Nā Pali NAR contains relatively intact native montane wet forest and cliffs. The threats to these areas are relatively unknown as the area is difficult to access due to steep terrain and dense forest. Aerial surveys of the adjacent pali have documented goats in the area although their numbers, distribution, and impact to the Reserve still need to be determined. Also, it is clear from staff observations in the immediate areas near Pihea and North bog that pigs are also present within the upper portions of the NAR. Again, their numbers, distribution, and impacts are relatively unknown. Monitoring is needed to assess current impacts and the effectiveness of management actions.

Ungulate monitoring is used in protected units that are being managed for ungulate removal to detect the presence or absence of ungulates. Units with active ungulate control programs will be monitored to assess the success of control efforts and to better direct these efforts. Ungulate free units will be regularly monitored to detect ingress in a timely fashion.

Weed monitoring is used to detect changes in weed distribution and abundance over time as well as detect incipient invaders. Weed control areas will be monitored to determine the success of management efforts.

Rare plant monitoring will be conducted to assess the survival and growth of wild and re-introduced rare plants. NAR and PEPP program staff monitor rare plants to assess their survival

and reproduction, collect propagation materials, search for additional wild individuals and determine whether additional management is necessary.

Hono O Nā Pali NAR supports six federally listed birds, although little is known about their abundance and distribution. NARS staff will continue to work with partners (KESRP and KFBRP) to develop appropriate monitoring that will allow responses to management to be detected for endangered seabirds and forest birds.

Due to the pristine nature of the montane forest in the upper plateau, monitoring transects will only be established along fences, lower elevation ridgelines where animal disturbance is already significant, and established trails such as the Alaka'i boardwalk trail. Creating transects in this pristine forest could counteract the goals of resource protection by opening up pathways for invasive species to establish and creating corridors for feral ungulates and predatory mammals such as feral cats which could damage native vegetation and predate on nesting seabirds. To minimize disturbance in this region and at the same time achieve our monitoring goals, the monitoring program will rely heavily on data acquired from aerial imagery, aerial surveys, GIS data, and the use of remote field cameras.

Aerial imagery and aerial surveys will be used to identify weed infestations and areas of high animal disturbance. In addition, staff will use GIS applications to determine potential animal routes such as ridge saddles that may serve as crossover points for animal movement or long portions of unbroken stream that may be used as travel corridors. This work will identify potential "hotspots" for animal activity. Ground crews will set up remote cameras in these areas to observe the frequency of ungulate and small predatory mammal presence. Evaluating the relative frequency of target mammal occurrences at these "hotspots" will help staff determine the best areas to concentrate control efforts.

NARS staff will also use ground reconnaissance along ridges and gulch bottoms near remote weatherports to achieve several management objectives simultaneously including rare flora and fauna surveys, invasive species monitoring and control, and feral ungulate and small predatory mammal monitoring. Feral cat monitoring will consist of the use of tracking tunnels in these areas as well as in "hotspots" identified as possible animal routes, and near known seabird nesting sites.

Monitoring in the lower Reserve will evaluate changes in levels of feral goat and pig damage, the effectiveness of the current management program in reducing damage, and the recovery of native vegetation. In the highly degraded lower portion of the Reserve, it is uncertain how effective public hunting pressure on goats is in allowing significant native plant recovery. As such the main goal of ungulate control in the lower portion of the Reserve is to prevent feral animals from moving up higher in the reserve and into pristine forest. Monitoring will be designed to evaluate the abundance of feral animals in the lower Reserve and the occurrence of animals along access points leading to the upper Reserve.

NAR staff will refine and modify existing inventory and monitoring programs (monitoring protocols, data management and analysis) for ungulates, weeds and rare plants in order to make

the program more effective. It would be valuable to expand the monitoring program as time and resources permit to include surveys and monitoring of birds and invertebrates as well as native plant communities. Establishing and implementing new long-term monitoring programs for key community indicators, especially in the face of new threats such as climate change and the introduction of new diseases and pathogens will be critical to informing future management of native ecosystems and species in the NAR. Collaboration with partners such as researchers, students and adjoining landowners may help improve and expand inventory and monitoring programs if NAR staff time and resources are limited.

Outreach and Education

Objective: Build public understanding and support for the NAR and the state's unique native resources.

Actions:

1. Maintain and expand opportunities for volunteer service trips and student internships.
2. Maintain and expand NARS staff presentations and outreach to schools and community groups.
3. Install educational signage in accessible portions of the Reserve, particularly in areas adjacent to public trails.

At Hono O Nā Pali NAR, volunteer service trips and guided hikes will be used to promote public understanding and support for conservation and provide opportunities for the public to learn more about the Reserve, its unique native species and ecosystems, threats to the NAR and ongoing management activities. Volunteer groups will assist with weed control; trail maintenance and restoration projects planting native species. Additionally, the NAR program also regularly hires interns to assist with management and provide educational and training opportunities for students. NAR staff will continue these types of programs because they provide educational opportunities for interested groups and individuals to learn more about the reserve and reserve management programs. In addition, volunteers and interns contribute useful assistance in labor-intensive activities. The upper boundary of the Reserve is accessible from Pihea and Alaka'i trails and the lower portions of the Reserve are accessible from the Kalalau trail. The proximity of these popular recreational areas provides an excellent opportunity for public education and an effective volunteer work program.

NARS staff will also regularly provide slide shows, presentations and outreach to schools, local groups and at community events. NAR staff is planning on continuing all these activities, and expanding them as resources allow.

Enforcement

Objective: Ensure effective enforcement of laws that protect the natural and cultural resources of Hono O Nā Pali NAR.

Actions:

1. Explore opportunities to collaborate with DLNR's Division of Conservation and Resource Enforcement (DOCARE) to improve voluntary compliance with laws and strategies to improve the effectiveness of enforcement.
2. Encourage DOCARE to focus on illegal taking of natural resources, illegal camping and vandalism.

The DLNR's DOCARE is responsible for enforcement of state laws at Hono O Nā Pali NAR, including laws regulating hunting and protection of resources (e.g. illegal harvesting, vandalism etc). Improved collaboration between the NAR program and DOCARE will improve the effective enforcement of laws that protect the reserve.

Partnership Collaboration

Objective: Collaborate with external partners to support NARS mission and goals.

Actions:

1. Continue partnerships with adjacent landowners through the KWA to address threats and management needs on a regional basis.
2. Continue working with other groups collaboratively to address joint management needs (e.g. invasive species management, rare plant management, seabird and forest bird recovery, education, monitoring and research).

Many of the threats to Hawaii's natural resources, such as feral ungulates, invasive weeds, fire, invasive insects, and introduced plant and animal diseases, occur across land ownership boundaries. Working with partners can increase the effectiveness and efficiency of management with limited resources. The DLNR is a member of the KWA and the Reserve is within the KWA boundary. Continued collaboration with the KWA will enhance the effectiveness of response to regional threats like feral ungulates and weeds.

Continued collaboration with other groups in addition to KWA will also assist NAR management in various areas. NAR staff will continue to work closely with the USFWS Conservation Partnerships Program in project planning as well as seeking funding to implement management projects that address rare species and critical habitat. NAR staff will continue to work with KISC and KRCP to jointly address incipient invasive species of plants and animals that threaten the reserve. NAR staff will continue to work closely with two organizations focused on rare plant recovery (NTBG and PEPP). The Kauai Endangered Seabird Recovery Project (KESRP) and the Kauai Forest Bird Recovery Project (KFBRP) are collaborative efforts between DOFAW and the Pacific Cooperative Studies Unit at the University of Hawaii. The core missions of both of these projects are to conduct research that will inform the management needed to recover federally listed birds. Both KESRP and KFBRP will assist in mapping bird distributions across the Reserve, implementing seabird and forest bird protection, and monitoring the response of birds to proposed management actions. NAR staff will also work with community groups and volunteers to assist with animal control in appropriate areas of the Reserve, prevent the spread of introduced species and to restore native habitat and species.

Management of the Reserve will also be integrated with management of surrounding state lands managed by other programs and Divisions within DLNR, especially the Alaka‘i Wilderness Preserve, Nā Pali - Kona Forest Reserve, Nā Pali Coast State Wilderness Park (Kalalau Trail) and Kōke‘e State Parks. For example, NARS plans to work with the Division of State Parks on trail management, as well as to address cultural resource management needs and to identify and manage cultural sites within the NAR. NARS will also work with the Division of State Parks and public hunters to reduce goat numbers in the Nā Pali Coast area to benefit natural, cultural resources and recreational resources. Currently, large feral goat populations are denuding the steep cliffs above the Kalalau trail resulting in erosion and subsequent trail damage. Increased hunter access and pressure on these feral goat populations will reduce this erosion and help preserve the integrity of this trail, one of the most popular hiking trails in the entire state.

The Reserve offers unique opportunities for research, and NAR staff review all research permits before they are approved. NARS staff will work with interested researchers in the academic community as well as scientists so their research can better address critical management needs.

8. BUDGET

NAR staff for the island of Kaua‘i work on two Reserves on the island, including Hono O Nā Pali NAR. In 2010, NAR staff include 3 DOFAW staff, 2 University of Hawai‘i contractors (Pacific Cooperative Studies Unit) and 2 interns. The budget below assumes current budget levels/existing staff will provide labor, materials and supplies for many of the ongoing and proposed management actions. New funding will be required to hire additional NAR staff and/or contractors to complete major new proposed projects including new fence construction and the expansion of weed management into these new fenced units.

Item	Estimated Cost (10 years)	Comments (annual cost)	Existing or New cost
Infrastructure and Facilities			
Weatherport materials and construction	\$60,000	Includes staff labor, materials, helicopter transport @ \$20K per weatherport	new cost \$60,000
Radio repeater purchase and installation	\$15,000	Includes labor, materials, and helicopter transport	new cost \$15,000
Trail maintenance	\$40,000	\$4K/year for helicopter time, staff costs, and materials	existing budget
Ungulate Management Program			
Fence Inspection/Maintenance and Monitoring	\$50,000	\$5K/year for staff, supplies/materials	existing budget

New Fence Construction (4.8 miles)	\$864,000	labor (additional staff and/or contractors), materials and helicopter @ 180K/mile	new cost \$864,000
Ungulate Control (upper plateau)	\$300,000	\$30K/year; includes materials and helicopter time to support staff and special hunts	new cost \$300,000
Ungulate Control (lower reserve)	\$150,000	\$15K/year; includes supplies and helicopter time to support staff activity and special hunts	existing budget
Weed Management program			
Weed Management (ground based control)	\$50,000	\$5K/year for staff, supplies and materials	existing budget
Weed Management (aerial based control)	\$150,000	\$15K/year for aerial spraying and reconnaissance	new cost \$150,000
Habitat Protection and Rare Species Restoration Program			
Rare species monitoring and restoration	\$50,000	\$5K/year for staff, supplies, and helicopter time to support rare plant recovery	existing budget
Non-native small mammal monitoring and control	\$120,000	\$12K/year for staff, supplies and helicopter time to support monitoring /control	new cost \$120,000
Fire Prevention and Response	\$20,000	\$2K/year for staff, training/equipment	existing budget
Monitoring (weeds/ungulates)	\$50,000	\$5K/year for staff, supplies , and helicopter time	existing budget
Outreach and Education			
Volunteer service trips , teacher workshops, general education	\$50,000	\$5K/year for staff, supplies/outreach materials	existing budget
Enforcement	\$20,000	\$2K/year for helicopter time to support investigations in remote areas of the NAR	existing budget
Partnership Collaboration	-----	no associated direct costs	-----
ESTIMATED TOTAL	\$1,989,000	\$480,000 (\$48,000/year existing budget)	new costs \$1,509,000

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10. APPENDICES

A. Checklist of Federally Listed & Rare Taxa Within The Hono O Na Pali NAR Kaua`i, Hawai`i (November 2010)

(Wood and Wysong 2010)

Note: Checklist alphabetical by genus. Symbols: C=Candidate for Listing; E=Endangered; EX=Extinct; H=Historical & no longer present; PEP=Plant Extinction Prevention; SOC=Species of Concern; T=Threatened. Flowering plants follow Wagner et al. 1999; pteridophytes follow Palmer 2003.

<i>GENUS</i>	<i>SPECIES</i>	<i>COMMON NAME</i>	<i>FEDST</i>
Acacia	koaia Hillebr.	koai'a, koai'e, koa'ohā	end, SOC
Adenophorus	periens L.E.Bishop	palai lā'au	end, E, PEP, H
Alphitonia	ponderosa Hillebr.	kauila, kauwila, o'a (Maui)	end, SOC
Anoectochilus	sandvicensis Lindl.	jewel orchid	end, SOC
Asplenium	schizophyllum C.Chr.		end, SOC
Bidens	campylotheca Sch.Bip.	ko'oko'olau, ko'olau	end, SOC
Bonamia	menziesii A.Gray		end, E
Brighamia	insignis A.Gray	'ōlulu, pū aupaka, ālula, hāhā	end, E, PEP
Canavalia	napaliensis H.St.John	'āwikiwiki, puakauhi	end, E
Canavalia	pubescens Hook. & Arn.	'āwikiwiki, puakauhi	end, C, H
Capparis	sandwichiana DC.	maiapilo, pilo, pua pilo	end, SOC
Charpentiera	densiflora Sohmer	pāpala	end, E
Cheirodendron	dominii Kraj.	'ōlapa, lapalapa	end, SOC
Cyanea	habenata (H. St. John) Lammers	hāhā	end, SOC
Cyanea	pseudofauriei Lammers		end, SOC
Cyanea	recta (Wawra) Hillebr.	hāhā	end, T
Cyanea	rivularis Rock		end, E, PEP
Cyrtandra	cyaneoides Rock	māpele, ha'iwale, kanawao ke'oke'o	end, E

<i>GENUS</i>	<i>SPECIES</i>	<i>COMMON NAME</i>	<i>FEDST</i>
Cyrtandra	heinrichii H.St.John	ha'iwale, kanawao ke'oke'o	end, SOC
Cyrtandra	kamoolaensis H. St. John	ha'iwale	end, SOC
Cyrtandra	kealiae Wawra	ha'iwale, kanawao ke'oke'o	end, T
Cyrtandra	oenobarba H.Mann	ha'iwale, kanawao ke'oke'o	end, E
Cyrtandra	pickeringii A.Gray	ha'iwale, kanawao ke'oke'o	end, SOC
Dryopteris	glabra (Brack.) Kuntze var. pusilla D.D.Palmer	kīlau, hohiu	end, SOC
Dubautia	knudsenii Hillebr. subsp. filiformis G.D.Carr	na'ena'e, kūpaoa	end, SOC
Dubautia	microcephala Skottsb.	na'ena'e, kūpaoa	end, SOC
Dubautia	waialealae Rock	na'ena'e, kūpaoa	end, E, H
Erythrina	sandwicensis O.Deg.	wiliwili	end, SOC
Euphorbia	haeleeleana D.R.Herbst		end, E
Euphorbia	remyi (A.Gray ex Boiss.) Croizat & O.Deg.	'akoko, koko, 'ekoko, kōkōmālei	end, E
Eurya	sandwicensis A.Gray	ānini, wānini	end, SOC
Exocarpos	luteolus C.N.Forbes	heau, au	end, E
Flueggea	neowawraea W.J.Hayden	mēhamehame	end, E, PEP
Hibiscus	kokio Hillebr. ex Wawra subsp. saintjohnianus (M.J.Roe) D.M.Bates	koki'o, koki'o 'ula, koki'o 'ula'ula, mākū	end, SOC
Hibiscus	waimeae A.Heller subsp. hannerae (O.Deg. & I.Deg.) D.M.Bates	koki'o ke'oke'o, koki'o kea	end, E
Hillebrandia	sandwicensis Oliv.	pua maka nui, aka'aka'awa (Kaua'i)	end, SOC
Ischaemum	byrone (Trin.) Hitchc.	Hilo ischaemum	end, E
Isodendrion	longifolium A.Gray	aupaka	end, T
Kadua	cookiana Cham. & Schltdl.	'āwiwi	end, E

<i>GENUS</i>	<i>SPECIES</i>	<i>COMMON NAME</i>	<i>FEDST</i>
Kadua	elatior (H.Mann) W. L. Wagner & Lorence	'uiwi (Moloka'i), 'āwiwi	end, SOC
Kadua	fluviatilis C. N. Forbes	kamapua'a, pilo	end, C
Kadua	flynnii (W. L. Wagner & Lorence) W. L. Wagner & Lorence		end, SOC
Kadua	tryblium (D.R.Herbst & W.L.Wagner) W. L. Wagner & Lorence		end, SOC
Keysseria	erici (C.N.Forbes) Cabrera		end, E
Labordia	lydgatei C.N.Forbes	kāmakahala	end, E, PEP
Labordia	pumila (Hillebr.) Skottsbo.	kāmakahala	end, E
Lobelia	niihauensis H.St.John		end, E
Lobelia	villosa (Rock) H.St.John & Hosaka		end, SOC
Lobelia	xkauaensis (A. Gray) A. Heller	pu'e	end, SOC
Lobelia	yuccoides Hillebr.	pānaunau	end, SOC
Lysimachia	daphnoides (A.Gray) Hillebr.	lehua makanoe, kolokolo kuahiwi, kolekole lehua, kolokolo lehua	end, E
Melicope	degeneri (B.C.Stone) T.G.Hartley & B.C.Stone	alani, alani kuahiwi	end, E, PEP
Melicope	pallida (Hillebr.) T.G.Hartley & B.C.Stone	alani, alani kuahiwi	end, E
Melicope	paniculata (H.St.John) T.G.Hartley & B.C.Stone	alani, alani kuahiwi	end, E
Melicope	puberula (H.St.John) T.G.Hartley & B.C.Stone	alani, alani kuahiwi	end, E
Munroidendron	racemosum (C.N.Forbes) Sherff		end, E
Myrsine	fosbergii Hosaka	kōlea	end, C
Myrsine	linearifolia Hosaka	kōlea	end, T

<i>GENUS</i>	<i>SPECIES</i>	<i>COMMON NAME</i>	<i>FEDST</i>
Neraudia	melastomifolia Gaudich.	ma'aloa, ma'oloa, 'oloa	end, SOC
Nesoluma	polynesianum (Hillebr.) Baill.	keahi	ind, SOC
Ochrosia	kauaiensis H.St.John	hōlei	end, SOC
Panicum	lineale H.St.John		end, SOC
Peucedanum	sandwicense Hillebr.	makou	end, T
Phyllostegia	renovans W.L.Wagner		end, E, PEP
Phyllostegia	wawrana Sherff		end, E, PEP
Phytolacca	sandwicensis Endl.	pōpolo kū mai, pōpolo	end, SOC
Pisonia	wagneriana Fosberg	pāpala kēpau, pāpala	end, SOC
Pittosporum	napaliense Sherff	hō'awa, hā'awa	end, E
Plantago	princeps Cham. & Schldl. var. longibracteata H.Mann	laukahi kuahiwi, ale	end, E
Platydesma	rostrata Hillebr.	pilo kea lau li'i	end, E
Poa	mannii Munro ex Hillebr.		end, E
Poa	sandwicensis (Reichardt) Hitc.		end, E
Pritchardia	limahuliensis H. St. John	loulu	end, SOC
Pritchardia	minor Becc.	loulu	end, SOC
Pritchardia	napaliensis H.St.John	loulu	end, E
Psychotria	wawrae Sohmer	kōpiko	end, SOC
Pteralyxia	kauaiensis Caum	kaulu	end, E
Schiedea	apokremnos H.St.John		end, E
Schiedea	lychnoides Hillebr.	kuawāwaenuhu	end, E
Tetraplasandra	kavaiensis (H.Mann) Sherff	'ohe'ohe	end, SOC

<i>GENUS</i>	<i>SPECIES</i>	<i>COMMON NAME</i>	<i>FEDST</i>
Wikstroemia	hanalei Wawra	'ākia, kauhi	end, SOC, H, EX
Wilkesia	hobdyi H.St.John	dwarf iliau	end, E
Zanthoxylum	dipetalum H.Mann	kāwa'u, kāwa'u kua kuku kapa	end, SOC

B. Checklist of Vascular Plant Taxa found within the 3,579 acre Hono O Na Pali NAR, Kaua`i, Hawai`i, November 2010

(Wood and Wysong 2010)

Note: Checklist alphabetical by genus. Symbols: C=Candidate for Listing; E=Endangered; end=Endemic Species; EX=Extinct; H=Historical & no longer present; ind=Indigenous; nat=Naturalized; PEP= Plant Extinction Prevention; pol=Polynesian Introduction; SIE=Single Island Endemic; SOC=Species of Concern; T=Threatened; V=Vulnerable. Flowering plants follow Wagner et al. 1999; pteridophytes follow Palmer 2003. This checklist represents data collected from the NTBG herbarium (PTBG) which includes specimens made by NTBG staff in addition to contributions by DLNR staff, from portions of the Hono O Na Pali Natural Area Reserve Management Plan (confirmed sightings only) prepared by the Department of Land and Natural Resources (November 1989), and from the authors field research conducted on the following dates: Hanakapiai; 3 Jul 90, 10 Feb 91, 8 Apr 94, 3–6 Jun 96, 13 Jun 96, 7 Aug 96, 19–20 Dec 98, 13–15 Oct 07, 4 Jul 08, 22 Jul 08, 25 Jul 08, 3 Nov 09, 28 Sep 10. Hanakoa = 14 Oct 91, 21 Mar 92, 1 Jan 93, 31 Jan 94, 9 Oct 94, 10 Oct 94, 24 Jan 95, 22 Oct 95, 2 Nov 95, 24 May 97, 29 Aug 98, 28 Jun 00, 13 Sep 00, 25 Sep 06, 7–9 May 08. Hono O Na Pali Summit = 23 Oct 90, 24 Jun 94, 10 Apr 96. Hoolulu = 31 May 1989, 23 Sep 90, 2 Oct 92, 8 Apr 94, 15 Jun 94, 15 Sep 94, 7 Oct 94, 10 Apr 96, 11 Mar 98, 9 Apr 98, 27 Dec 01, 23 Sep 06, 17 Oct 06. Pihea = 23 Aug 97, 1 Apr 00, 7 Oct 00, 12 Jun 07, 28 Jun 08. Waiahuakua = 23 Sep 90, 8 Nov 90, 2 Oct 92, 11 Aug 93, 15 Sep 94, 7 Oct 94, 9 Apr 98, 22 Sep 99, 24 Sep 06, 8 May 08.

<i>FAMILY</i>	<i>GENUS</i>	<i>SPECIES</i>	<i>STATUS</i>	<i>SIE</i>	<i>DRY TO MESIC CLIFF</i>	<i>COASTAL/ LOWLAND MESIC</i>	<i>LOWLAND WET</i>	<i>WET CLIFF</i>	<i>MONTANE WET</i>	<i>BOG</i>
Fabaceae	Acacia	koa A.Gray	end			1				
Fabaceae	Acacia	koaia Hillebr.	end, SOC		1	1				
Polypodiaceae	Adenophorus	abietinus (D.C.Eaton) K.A.Wilson	end						1	1
Polypodiaceae	Adenophorus	epigaeus (L.E.Bishop) W.H.Wagner	end	1					1	1
Polypodiaceae	Adenophorus	haalilioanus (Brack.) K.A.Wilson	end						1	
Polypodiaceae	Adenophorus	hymenophylloides (Kaulf.) Hook. & Grev.	end						1	

<i>FAMILY</i>	<i>GENUS</i>	<i>SPECIES</i>	<i>STATUS</i>	<i>SIE</i>	<i>DRY TO MESIC CLIFF</i>	<i>COASTAL/ LOWLAND MESIC</i>	<i>LOWLAND WET</i>	<i>WET CLIFF</i>	<i>MONTANE WET</i>	<i>BOG</i>
Polypodiaceae	Adenophorus	periens L.E.Bishop	end, E, PEP, H						1	
Polypodiaceae	Adenophorus	pinnatifidus Gaudich.	end			1	1		1	
Polypodiaceae	Adenophorus	pinnatifidus Gaudich. var. rockii (Copel.) D.D.Palmer	end						1	
Polypodiaceae	Adenophorus	tamariscinus (Kaulf.) Hook. & Grev.	end			1	1		1	1
Polypodiaceae	Adenophorus	tamariscinus (Kaulf.) Hook. & Grev. var. montanus (Hillebr.) L.E. Bishop	end						1	1
Polypodiaceae	Adenophorus	tripinnatifidus Gaudich.	end						1	1
Asteraceae	Adenostemma	viscosum J.R.Forst. & G.Forst.	ind						1	
Pteridaceae	Adiantum	capillus-veneris L.	ind		1					
Pteridaceae	Adiantum	hispidulum Sw.	nat		1	1		1		
Pteridaceae	Adiantum	raddianum C.Presl	nat		1	1	1	1	1	

<i>FAMILY</i>	<i>GENUS</i>	<i>SPECIES</i>	<i>STATUS</i>	<i>SIE</i>	<i>DRY TO MESIC CLIFF</i>	<i>COASTAL/ LOWLAND MESIC</i>	<i>LOWLAND WET</i>	<i>WET CLIFF</i>	<i>MONTANE WET</i>	<i>BOG</i>
Asteraceae	Ageratina	riparia (Regel) R.M.King & H.Rob.	nat			1	1	1	1	
Asteraceae	Ageratum	conyzoides L.	nat		1	1	1	1	1	
Poaceae	Agrostis	avenacea J.G.Gmel.	ind		1					
Euphorbiaceae	Aleurites	moluccana (L.) Willd.	pol			1	1			
Rhamnaceae	Alphitonia	ponderosa Hillebr.	end, SOC			1				
Apocynaceae	Alyxia	stellata (J. R. & G. Forst.) Roem. & Schult.	end		1	1	1	1	1	1
Thelypteridaceae	Amauropelta	globulifera (Brack.) Holtum	end				1	1	1	
Primulaceae	Anagallis	arvensis L.	nat		1	1				
Poaceae	Andropogon	glomeratus (Walt.) B.S.P.	nat		1	1	1	1	1	1
Poaceae	Andropogon	virginicus L.	nat		1	1	1	1	1	1
Orchidaceae	Anoectochilus	sandvicensis Lindl.	end, SOC						1	
Phyllanthaceae	Antidesma	platyphyllum H.Mann var. hillebrandii Pax &	end				1		1	

<i>FAMILY</i>	<i>GENUS</i>	<i>SPECIES</i>	<i>STATUS</i>	<i>SIE</i>	<i>DRY TO MESIC CLIFF</i>	<i>COASTAL/ LOWLAND MESIC</i>	<i>LOWLAND WET</i>	<i>WET CLIFF</i>	<i>MONTANE WET</i>	<i>BOG</i>
		Hoffm.								
Dryopteridaceae	Arachniodes	insularis W.H.Wagner	end						1	
Papaveraceae	Argemone	glauca (Nutt. ex Prain) Pope	end		1					
Asteraceae	Artemisia	australis Less.	end		1			1		
Aspleniaceae	Asplenium	acuminatum Hook. & Arn.	end						1	
Aspleniaceae	Asplenium	aethiopicum (Burm.f.) Bech.	ind			1				
Aspleniaceae	Asplenium	contiguum Kaulf.	end						1	1
Aspleniaceae	Asplenium	contiguum Kaulf. var. hirtulum C.Chr.	end						1	
Aspleniaceae	Asplenium	excisum C.Presl	ind				1		1	
Aspleniaceae	Asplenium	hobdyi W.H.Wagner	end						1	
Aspleniaceae	Asplenium	horridum Kaulf.	ind			1	1			
Aspleniaceae	Asplenium	insiticium Brack.	ind				1		1	1
Aspleniaceae	Asplenium	lobulatum Mett.	ind						1	

<i>FAMILY</i>	<i>GENUS</i>	<i>SPECIES</i>	<i>STATUS</i>	<i>SIE</i>	<i>DRY TO MESIC CLIFF</i>	<i>COASTAL/ LOWLAND MESIC</i>	<i>LOWLAND WET</i>	<i>WET CLIFF</i>	<i>MONTANE WET</i>	<i>BOG</i>
Aspleniaceae	Asplenium	nidus L.	ind			1				
Aspleniaceae	Asplenium	normale D.Don	ind						1	
Aspleniaceae	Asplenium	polyodon G.Forst.	ind				1		1	1
Aspleniaceae	Asplenium	schizophyllum C.Chr.	end, SOC						1	
Aspleniaceae	Asplenium	sphenotomum Hillebr.	end						1	
Aspleniaceae	Asplenium	unilaterale Lam.	ind						1	
Asteliaceae	Astelia	argyrocoma A.Heller ex Skottsbo.	end	1			1		1	1
Asteraceae	Aster	subulatus Michx. var. sandwicensis (A.Gray) A.G.Jones	nat						1	
Woodsiaceae	Athyrium	microphyllum (Sm.) Alston	end				1		1	1
Poaceae	Axonopus	fissifolius (Raddi) Kuhlm.	nat				1		1	1
Scrophulariaceae	Bacopa	monnieri (L.) Wettst.	ind			1				
Asteraceae	Bidens	campylotheca Sch.Bip.	end, SOC						1	

<i>FAMILY</i>	<i>GENUS</i>	<i>SPECIES</i>	<i>STATUS</i>	<i>SIE</i>	<i>DRY TO MESIC CLIFF</i>	<i>COASTAL/ LOWLAND MESIC</i>	<i>LOWLAND WET</i>	<i>WET CLIFF</i>	<i>MONTANE WET</i>	<i>BOG</i>
Asteraceae	Bidens	cervicata Sherff	end		1	1	1	1		
Asteraceae	Bidens	forbesii Sherff	end	1			1	1	1	
Asteraceae	Bidens	pilosa L.	nat		1	1	1	1		
Asteraceae	Bidens	sandvicensis Less.	end		1	1	1	1	1	
Blechnaceae	Blechnum	appendiculatum Willd.	nat		1	1	1	1		1
Rubiaceae	Bobea	brevipes A.Gray	end			1	1			1
Rubiaceae	Bobea	elatior Gaudich.	end			1	1			1
Urticaceae	Boehmeria	grandis (Hook. & Arn.) A.Heller	end		1	1	1	1		1
Convolvulaceae	Bonamia	menziesii A.Gray	end, E			1				
Poaceae	Bothriochloa	pertusa (L.) A.Camus	nat			1				
Poaceae	Brachiaria	subquadripara (Trin.) Hitchc.	nat			1				
Campanulaceae	Brighamia	insignis A.Gray	end, E, PEP		1					
Hydrangeaceae	Broussaisia	arguta Gaudich.	end				1		1	1
Crassulaceae	Bryophyllum	pinnatum (Lam.)	nat		1	1				

<i>FAMILY</i>	<i>GENUS</i>	<i>SPECIES</i>	<i>STATUS</i>	<i>SIE</i>	<i>DRY TO MESIC CLIFF</i>	<i>COASTAL/ LOWLAND MESIC</i>	<i>LOWLAND WET</i>	<i>WET CLIFF</i>	<i>MONTANE WET</i>	<i>BOG</i>
		Oken								
Buddlejaceae	Buddleja	asiatica Lour.	nat				1		1	
Hymenophyllaceae	Callistopteris	baldwinii (D.C.Eaton) Copel.	end				1		1	
Fabaceae	Canavalia	napaliensis H.St.John	end, E	1		1				
Fabaceae	Canavalia	pubescens Hook. & Arn.	end, C, H			1				
Cannaceae	Canna	indica L.	nat				1			
Capparaceae	Capparis	sandwichiana DC.	end, SOC		1					
Brassicaceae	Cardamine	flexuosa With.	nat			1	1			
Cyperaceae	Carex	alligata Boott	end						1	1
Cyperaceae	Carex	kauaiensis R.W.Krauss	end	1					1	1
Cyperaceae	Carex	meyenii Nees	ind		1	1	1	1		
Cyperaceae	Carex	montis-eeka Hillebr.	end							1
Cyperaceae	Carex	wahuensis C.A.Mey.	end		1	1	1	1	1	

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Caricaceae	Carica	papaya L.	nat			1				
Lauraceae	Cassytha	filiformis L.	ind			1				
Scrophulariaceae	Castilleja	arvensis Cham. & Schltld.	nat			1	1			
Casuarinaceae	Casuarina	equisetifolia L.	nat			1				
Gentianaceae	Centaurium	erythraea Raf.	nat		1	1				
Apiaceae	Centella	asiatica (L.) Urb.	nat			1	1		1	
Caryophyllaceae	Cerastium	fontanum Baumg. subsp. triviale (Link) Jalas	nat			1	1		1	
Fabaceae	Chamaecrista	nictitans (L.) Moench var. glabrata (Vogel) H. S. Irwin & Barneby	nat			1	1			
Amaranthaceae	Charpentiera	densiflora Sohmer	end, E	1		1				
Amaranthaceae	Charpentiera	obovata Gaudich.	end			1	1		1	
Araliaceae	Cheirodendron	dominii Kraj.	end, SOC	1					1	1
Araliaceae	Cheirodendron	fauriei Hochr.	end	1			1		1	1
Araliaceae	Cheirodendron	forbesii (Sherff)	end	1					1	

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		Lowry								
Araliaceae	Cheirodendron	platyphyllum (Hook. & Arn.) Seem. subsp. kauaiense (Krajina) Lowry	end	1			1		1	1
Araliaceae	Cheirodendron	trigynum (Gaudich.) A.Heller subsp. helleri (Sherff) Lowry	end	1		1	1		1	1
Chenopodiaceae	Chenopodium	oahuense (Meyen) Aellen	end		1					
Poaceae	Chloris	barbata (L.) Sw.	nat			1				
Poaceae	Chloris	virgata Sw.	nat			1				
Thelypteridaceae	Christella	cyatheoides (Kaulf.) Holttum	end				1	1	1	
Thelypteridaceae	Christella	dentata (Forssk.) Brownsey & Jermy	nat		1	1	1		1	
Thelypteridaceae	Christella	parasitica (L.) Lév.	nat			1	1		1	
Poaceae	Chrysopogon	aciculatus (Retz.) Trin.	ind?		1	1				
Cibotiaceae	Cibotium	glaucum (Sm.) Hook. & Arn.	end			1	1		1	1

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Cibotiaceae	Cibotium	menziesii Hook.	end						1	1
Cibotiaceae	Cibotium	nealiae O.Deg.	end	1		1	1		1	1
Asteraceae	Cirsium	vulgare (Savi) Ten.	nat			1	1		1	
Cyperaceae	Cladium	jamaicense Crantz	ind			1				
Euphorbiaceae	Claoxylon	sandwicense Müll.Arg.	end			1	1			
Campanulaceae	Clermontia	fauriei H.Lev.	end						1	1
Melastomataceae	Clidemia	hirta (L.) D.Don	nat			1	1		1	
Menispermaceae	Cocculus	orbiculatus (L.) DC.	ind		1	1	1			
Rubiaceae	Coffea	arabica L.	nat			1				
Poaceae	Coix	lachryma-jobi L.	nat			1				
Araceae	Colocasia	esculenta (L.) Schott	pol			1	1		1	
Commelinaceae	Commelina	diffusa Burm.f.	nat			1	1		1	
Pteridaceae	Coniogramme	pilosa (Brack.) Hieron.	end				1		1	1
Asteraceae	Conyza	bonariensis (L.) Cronquist	nat				1	1	1	1

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Rubiaceae	Coprosma	elliptica W.R.B.Oliv.	end	1					1	1
Rubiaceae	Coprosma	foliosa A.Gray	end			1	1			
Rubiaceae	Coprosma	kauensis (A.Gray) A.Heller	end	1		1	1		1	1
Rubiaceae	Coprosma	waimeae Wawra	end	1		1	1		1	1
Asparagaceae	Cordyline	fruticosa (L.) A.Chev.	pol			1	1		1	
Lauraceae	Cryptocarya	mannii Hillebr.	end			1				
Apiaceae	Cryptotaenia	canadensis (L.) DC.	nat				1		1	
Dryopteridaceae	Ctenitis	latifrons (Brack.) Copel.	end						1	
Lythraceae	Cuphea	carthagenensis (Jacq.) J.F.Macbr.	nat						1	
Campanulaceae	Cyanea	coriacea (A.Gray) Hillebr.	end	1					1	
Campanulaceae	Cyanea	fissa (H.Mann) Hillebr.	end	1			1		1	
Campanulaceae	Cyanea	habenata (H. St. John) Lammers	end, SOC	1					1	
Campanulaceae	Cyanea	hardyi Rock	end	1		1	1			

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Campanulaceae	Cyanea	hirtella (H.Mann) Hillebr.	end	1			1		1	
Campanulaceae	Cyanea	pseudofauriei Lammers	end, SOC	1					1	
Campanulaceae	Cyanea	recta (Wawra) Hillebr.	end, T	1					1	
Campanulaceae	Cyanea	rivularis Rock	end, E. PEP	1					1	
Campanulaceae	Cyanea	spathulata (Hillebr.) A.Heller	end	1					1	
Poaceae	Cynodon	dactylon (L.) Pers.	nat			1				
Cyperaceae	Cyperus	esculentus L.	nat			1				
Cyperaceae	Cyperus	meyenianus Kunth	nat			1	1		1	1
Cyperaceae	Cyperus	phleoides (Nees ex Kunth) Hillebr.	end		1	1				
Cyperaceae	Cyperus	sandwicensis Kükenth.	end						1	
Gesneriaceae	Cyrtandra	confertiflora (Wawra) C.B.Clarke	end	1		1	1			
Gesneriaceae	Cyrtandra	cyaneoides Rock	end, E	1					1	

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Gesneriaceae	Cyrtandra	heinrichii H.St.John	end, SOC	1			1		1	
Gesneriaceae	Cyrtandra	kamoolaensis H. St. John	end, SOC	1					1	
Gesneriaceae	Cyrtandra	kauaiensis Wawra	end	1		1	1		1	
Gesneriaceae	Cyrtandra	kealiae Wawra	end, T	1					1	
Gesneriaceae	Cyrtandra	longifolia (Wawra) Hillebr. ex C.B.Clarke	end	1		1	1		1	1
Gesneriaceae	Cyrtandra	oenobarba H.Mann	end, E	1					1	
Gesneriaceae	Cyrtandra	paludosa Gaudich.	end						1	
Gesneriaceae	Cyrtandra	paludosa Gaudich. var. microcarpa Wawra	end	1					1	
Gesneriaceae	Cyrtandra	pickeringii A.Gray	end, SOC	1					1	
Gesneriaceae	Cyrtandra	wainihaensis H.Lev.	end	1					1	
Gesneriaceae	Cyrtandra	wawrae C.B.Clarke	end	1			1	1	1	
Athyriaceae	Deparia	cataracticola M.Kato	end	1			1	1	1	

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Athyriaceae	Deparia	marginalis (Hillebr.) M.Kato	end				1		1	
Athyriaceae	Deparia	petersenii (Kunze) M.Kato	nat				1		1	
Athyriaceae	Deparia	prolifera (Kaulf.) Hook. & Grev.	end				1		1	
Poaceae	Deschampsia	nubigena Hillebr.	end						1	1
Fabaceae	Desmodium	triflorum (L.) DC.	nat		1	1				
Hemerocallidaceae	Dianella	sandwicensis Hook. & Arn.	ind			1	1	1	1	1
Poaceae	Dichantherium	cynodon (Reichardt) C.A.Clark & Gould	end							1
Poaceae	Dichantherium	hillebrandianum (Hitc.) C.A.Clark & Gould	end							1
Poaceae	Dichantherium	isachnoides (Munro ex Hillebr.) C. A. Clark & Gould	end							1
Gleicheniaceae	Dicranopteris	linearis (Burm.f.) Underw.	ind			1	1		1	1
Poaceae	Digitaria	ciliaris (Retz.) Koeler	nat			1	1		1	

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Poaceae	Digitaria	setigera Roth ex Roem. & Schult.	ind			1				
Dioscoreaceae	Dioscorea	alata L.	pol?			1				
Dioscoreaceae	Dioscorea	bulbifera L.	pol			1				
Ebenaceae	Diospyros	hillebrandii (Seem.) Fosberg	end			1				
Ebenaceae	Diospyros	sandwicensis (A.DC.) Fosberg	end			1	1		1	
Woodsiaceae	Diplazium	sandwichianum (C.Presl) Diels	end			1	1		1	1
Gleicheniaceae	Diplopterygium	pinnatum (Kunze) Nakai	ind				1		1	1
Sapindaceae	Dodonaea	viscosa Jacq.	ind		1	1	1		1	
Blechnaceae	Doodia	kunthiana Gaudich.	end			1	1			
Pteridaceae	Doryopteris	decepiens (Hook.) J.Sm.	end		1	1				
Droseraceae	Drosera	anglica Huds.	ind							1
Caryophyllaceae	Drymaria	cordata (L.) Willd. ex Roem. & Schult. var. pacifica M.Mizush.	nat				1		1	

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Dryopteridaceae	Dryopteris	crinalis (Hook. & Arn.) C.Chr.	end						1	
Dryopteridaceae	Dryopteris	fusco-atra (Hillebr.) W.J.Rob.	end				1		1	
Dryopteridaceae	Dryopteris	glabra (Brack.) Kuntze	end				1		1	1
Dryopteridaceae	Dryopteris	glabra (Brack.) Kuntze var. nuda Underw.	end						1	
Dryopteridaceae	Dryopteris	glabra (Brack.) Kuntze var. pusilla D.D.Palmer	end, SOC	1					1	
Dryopteridaceae	Dryopteris	mauiensis C.Chr.	end						1	
Dryopteridaceae	Dryopteris	sandwicensis (Hook. & Arn.) C.Chr.	end			1	1		1	
Dryopteridaceae	Dryopteris	unidentata (Hook. & Arn.) C.Chr. var. paleacea (Hillebr.) Herat ex Fraser-Jenk.	end						1	
Dryopteridaceae	Dryopteris	wallichiana (Spreng.) Hyl.	ind				1		1	
Asteraceae	Dubautia	knudsenii Hillebr. subsp. filiformis G.D.Carr	end, SOC	1					1	

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Asteraceae	Dubautia	knudsenii Hillebr.	end	1			1		1	
Asteraceae	Dubautia	knudsenii Hillebr. subsp. nagatae (H.St.John) G.D.Carr	end	1					1	
Asteraceae	Dubautia	laevigata A.Gray	end	1	1	1				
Asteraceae	Dubautia	laxa Hook. & Arn. subsp. hirsuta (Hillebr.) G.D.Carr	end						1	1
Asteraceae	Dubautia	microcephala Skotts.	end, SOC	1	1	1				
Asteraceae	Dubautia	paleata A.Gray	end	1					1	1
Asteraceae	Dubautia	raillardoides Hillebr.	end	1					1	1
Asteraceae	Dubautia	waialealae Rock	end, E, H	1						1
Poaceae	Ehrharta	stipoides Labill.	nat				1		1	
Elaeocarpaceae	Elaeocarpus	bifidus Hook. & Arn.	end			1	1		1	
Elaphoglossaceae	Elaphoglossum	aemulum (Kaulf.) Brack.	end						1	
Elaphoglossaceae	Elaphoglossum	crassicaule Copel.	end	1					1	1

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Elaphoglossaceae	Elaphoglossum	crassifolium (Gaudich.) W.R.Anderson & Crosby	end				1		1	1
Elaphoglossaceae	Elaphoglossum	paleaceum (Hook. & Grev.) Sledge	ind			1	1		1	1
Elaphoglossaceae	Elaphoglossum	pellucidum Gaudich.	end						1	
Elaphoglossaceae	Elaphoglossum	wawrae (Luer.) C.Chr.	end				1		1	
Cyperaceae	Eleocharis	geniculata (L.) Roem. & Schult.	nat			1	1		1	
Cyperaceae	Eleocharis	obtusa (Willd.) Schult.	ind			1	1		1	
Asteraceae	Elephantopus	mollis Kunth	nat			1	1		1	
Poaceae	Eleusine	indica (L.) Gaertn.	nat			1				
Primulaceae	Embelia	pacifica Hillebr.	end						1	
Asteraceae	Emilia	fosbergii Nicolson	nat						1	
Asteraceae	Emilia	sonchifolia (L.) DC. var. javanica (N.L.Burm.) Matf.	nat			1				
Poaceae	Eragrostis	amabilis (L.) Wight & Arn. ex Hook. &	nat			1				

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		Arn.								
Poaceae	Eragrostis	grandis W.F.Hillebr.	end				1	1	1	
Poaceae	Eragrostis	variabilis (Gaudich.) Steud.	end		1	1	1			
Asteraceae	Erechtites	valerianifolia (Wolf) DC.	nat			1	1		1	
Asteraceae	Erigeron	karvinskianus DC.	nat		1	1	1		1	
Fabaceae	Erythrina	sandwicensis O.Deg.	end, SOC			1				
Myrtaceae	Eugenia	reinwardtiana (Blume) DC.	ind			1				
Euphorbiaceae	Euphorbia	celastroides (Boiss.) Croizat & O.Deg.	end		1	1				
Euphorbiaceae	Euphorbia	celastroides (Boiss.) Croizat & O.Deg. var. hanapepensis (Sherff) O.Deg. & I.Deg.	end	1	1	1				
Euphorbiaceae	Euphorbia	haeleeleana D.R.Herbst	end, E			1				
Euphorbiaceae	Euphorbia	hirta (L.) Millsp.	nat			1				

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Euphorbiaceae	Euphorbia	remyi (A.Gray ex Boiss.) Croizat & O.Deg.	end, E	1					1	
Theaceae	Eurya	sandwicensis A.Gray	end, SOC						1	1
Santalaceae	Exocarpos	luteolus C.N.Forbes	end, E	1					1	1
Cyperaceae	Fimbristylis	cymosa R.Br. subsp. umbellato- capitata (Hillebr.) T.Koyama	ind			1				
Cyperaceae	Fimbristylis	dichotoma (L.) Vahl	ind			1				
Euphorbiaceae	Flueggea	neowawraea W.J.Hayden	end, E, PEP			1				
Pandanaceae	Freycinetia	arborea Gaudich.	ind			1	1		1	1
Asparagaceae	Furcraea	foetida (L.) Haw.	nat			1				
Cyperaceae	Gahnia	beecheyi H.Mann	end			1	1		1	1
Cyperaceae	Gahnia	vitiensis Rendle subsp. kauaiensis (Benl) T. Koyama	end	1			1		1	1
Asteraceae	Gamochaeta	purpurea (L.) Cabr.	nat			1	1		1	
Hymenophyllaceae	Gonocormus	minutus (Blume)	ind			1	1		1	

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e		Bosch								
Polypodiaceae	Grammitis	baldwinii (Baker) Copel.	end	1			1		1	1
Polypodiaceae	Grammitis	hookeri (Brack.) Copel.	ind						1	
Polypodiaceae	Grammitis	tenella Kaulf.	end			1	1		1	1
Proteaceae	Grevillea	robusta A.Cunn. ex R.Br.	nat			1				
Gunneraceae	Gunnera	kauaiensis Rock	end	1				1	1	
Zingiberaceae	Hedychium	gardnerianum Ker Gawl.	nat			1	1		1	
Poaceae	Heteropogon	contortus (L.) P.Beauv. ex Roem. & Schult.	ind?		1	1				
Malvaceae	Hibiscus	kokio Hillebr. ex Wawra subsp. saintjohnianus (M.J.Roe) D.M.Bates	end, SOC	1	1	1				
Malvaceae	Hibiscus	waimeae A.Heller subsp. hanneriae (O.Deg. & I.Deg.) D.M.Bates	end, E	1			1		1	

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Begoniaceae	Hillebrandia	sandwicensis Oliv.	end, SOC						1	
Poaceae	Holcus	lanatus L.	nat				1		1	
Lycopodiaceae	Huperzia	erubescens (Brack.) Holub	ind				1		1	
Lycopodiaceae	Huperzia	phyllantha (Hook. & Arn.) Holub	ind				1		1	
Lycopodiaceae	Huperzia	serrata (Thunb. ex Murray) Trevis.	ind				1		1	
Apiaceae	Hydrocotyle	verticillata Thunb.	nat?				1		1	
Hymenophyllaceae	Hymenophyllum	lanceolatum (Hook. & Arn.) Copel.	end						1	1
Asteraceae	Hypochoeris	radicata L.	nat			1	1		1	
Dennstaedtiaceae	Hypolepis	hawaiiensis Brownsey	end						1	1
Lamiaceae	Hyptis	pectinata (L.) Poit.	nat			1				
Aquifoliaceae	Ilex	anomala Hook. & Arn.	ind				1		1	1
Fabaceae	Indigofera	suffruticosa Mill.	nat			1				
Convolvulaceae	Ipomoea	cairica (L.) Sweet	nat?		1	1				

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Convolvulaceae	Ipomoea	obscura (L.) Ker Gawl.	nat						1	
Poaceae	Isachne	distichophylla Munro ex Hillebr.	end						1	
Poaceae	Isachne	pallens Hillebr.	end						1	
Poaceae	Ischaemum	byrone (Trin.) Hitcch.	end, E		1			1		
Violaceae	Isodendrion	longifolium A.Gray	end, T						1	
Juncaceae	Juncus	planifolius R.Br.	nat						1	1
Rubiaceae	Kadua	acuminata Cham. & Schltdl.	end			1	1		1	
Rubiaceae	Kadua	affinis DC.	end			1	1		1	1
Rubiaceae	Kadua	centranthoides Hook. & Arn.	end						1	
Rubiaceae	Kadua	cookiana Cham. & Schltdl.	end, E					1		
Rubiaceae	Kadua	cordata Cham. & Schltdl.	end		1	1	1		1	
Rubiaceae	Kadua	elatior (H.Mann) W. L. Wagner & Lorence	end, SOC					1	1	

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Rubiaceae	Kadua	fluviatilis C. N. Forbes	end, C					1	1	
Rubiaceae	Kadua	flynnii (W. L. Wagner & Lorence) W. L. Wagner & Lorence	end, SOC	1	1					
Rubiaceae	Kadua	foggiana (Fosberg) W. L. Wagner & Lorence	end	1			1		1	
Rubiaceae	Kadua	knudsenii Hillebr.	end	1		1				
Rubiaceae	Kadua	tryblium (D.R.Herbst & W.L.Wagner) W. L. Wagner & Lorence	end, SOC	1					1	
Asteraceae	Keysseria	erici (C.N.Forbes) Cabrera	end, E	1					1	1
Viscaceae	Korthalsella	complanata (Tiegh.) Engl.	ind			1	1		1	
Viscaceae	Korthalsella	latissima (van Tiegh.) Danser	end				1		1	
Viscaceae	Korthalsella	platycaula (Tiegh.) Engl.	ind			1	1		1	
Viscaceae	Korthalsella	remyana Tiegh.	end						1	1
Cyperaceae	Kyllinga	brevifolia Rottb. [may be '(Rottb.)	nat						1	

<i>FAMILY</i>	<i>GENUS</i>	<i>SPECIES</i>	<i>STATUS</i>	<i>SIE</i>	<i>DRY TO MESIC CLIFF</i>	<i>COASTAL/ LOWLAND MESIC</i>	<i>LOWLAND WET</i>	<i>WET CLIFF</i>	<i>MONTANE WET</i>	<i>BOG</i>
		Hassk.']								
Loganiaceae	Labordia	degeneri Sherff	end	1		1			1	
Loganiaceae	Labordia	hirtella H.Mann	end						1	
Loganiaceae	Labordia	lydgatei C.N.Forbes	end, E, PEP	1					1	
Loganiaceae	Labordia	pumila (Hillebr.) Skottsbo.	end, E	1					1	1
Loganiaceae	Labordia	tinifolia A.Gray	end						1	
Loganiaceae	Labordia	waialealae Wawra	end	1					1	1
Verbenaceae	Lantana	camara L.	nat		1	1				
Polypodiaceae	Lellingeria	saffordii (Maxon) A.R.Sm. & R.Morton	end						1	1
Brassicaceae	Lepidium	serra H.Mann	end	1	1					
Polypodiaceae	Lepisorus	thunbergianus (Kaulf.) Ching	ind				1		1	
Epacridaceae	Leptecophylla	tameiameiae (Cham. & Schlecht.) C.M.Weiller	ind			1	1		1	1

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Asteraceae	Lipochaeta	connata (Gaudich.) DC. var. acris (Sherff) R.C.Gardner	end		1	1	1	1	1	
Asteraceae	Lipochaeta	succulenta (Hook. & Arn.) DC.	end				1	1		
Campanulaceae	Lobelia	hypoleuca Hillebr.	end				1	1	1	
Campanulaceae	Lobelia	niihauensis H.St.John	end, E		1					
Campanulaceae	Lobelia	villosa (Rock) H.St.John & Hosaka	end, SOC	1					1	1
Campanulaceae	Lobelia	xkauaensis (A. Gray) A. Heller	end, SOC	1					1	1
Campanulaceae	Lobelia	yuccoides Hillebr.	end, SOC						1	
Caprifoliaceae	Lonicera	japonica Thunb.	nat						1	
Onagraceae	Ludwigia	octovalvis (Jacq.) P.H.Raven	pol?				1		1	
Juncaceae	Luzula	hawaiiensis Buchenau	end		1	1			1	
Lycopodiaceae	Lycopodiella	cernua (L.) Pic.Serm.	ind			1	1		1	1

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Lycopodiaceae	Lycopodium	venustum Gaudich.	ind			1	1		1	1
Primulaceae	Lysimachia	daphnoides (A.Gray) Hillebr.	end, E	1						1
Primulaceae	Lysimachia	glutinosa Rock	end	1	1	1				
Primulaceae	Lysimachia	kalalauensis Skotts.	end	1	1	1				
Primulaceae	Lysimachia	mauritiana Lam.	ind		1					
Lythraceae	Lythrum	maritimum Kunth	nat		1	1	1	1	1	
Cyperaceae	Machaerina	angustifolia (Gaudich.) T.Koyama	ind				1	1	1	1
Cyperaceae	Machaerina	mariscoides (Gaudich.) J.Kern subsp. meyenii (Kunth) T.Koyama	end			1	1		1	
Anacardiaceae	Mangifera	indica L.	nat			1				
Marattiaceae	Marattia	douglasii (C.Presl) Baker	end						1	
Hymenophyllaceae	Mecodium	recurvum (Gaudich.) Copel.	end				1		1	1
Meliaceae	Melia	azedarach L.	nat			1				

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Rutaceae	Melicope	anisata (H.Mann) T.G.Hartley & B.C.Stone	end	1		1	1		1	
Rutaceae	Melicope	clusiifolia (A.Gray) T.G.Hartley & B.C.Stone	end				1		1	1
Rutaceae	Melicope	degeneri (B.C.Stone) T.G.Hartley & B.C.Stone	end, E, PEP	1					1	
Rutaceae	Melicope	feddei (H.Lév.) T.G.Hartley & B.C.Stone	end	1			1		1	1
Rutaceae	Melicope	kavaiensis (H.Mann) T.G.Hartley & B.C.Stone	end	1					1	1
Rutaceae	Melicope	pallida (Hillebr.) T.G.Hartley & B.C.Stone	end, E	1		1				
Rutaceae	Melicope	paniculata (H.St.John) T.G.Hartley & B.C.Stone	end, E	1					1	
Rutaceae	Melicope	peduncularis (H.Lév.) T.G.Hartley & B.C.Stone	end						1	

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Rutaceae	Melicope	puberula (H.St.John) T.G.Hartley & B.C.Stone	end, E	1					1	
Rutaceae	Melicope	waialealae (Wawra) T. G. Hartley & B. C. Stone	end	1					1	1
Rutaceae	Melicope	wawraeana (Rock) T.G.Hartley & B.C.Stone	end				1		1	
Poaceae	Melinis	minutiflora P.Beauv.	nat		1	1				
Poaceae	Melinis	repens (Willd.) Zizka	nat		1	1				
Myrtaceae	Metrosideros	polymorpha Gaudich. var. dieteri J.W.Dawson & Stemmerm.	end	1					1	1
Myrtaceae	Metrosideros	polymorpha Gaudich. var. glaberrima (H.Lév.) H.St.John	end		1	1	1	1	1	1
Myrtaceae	Metrosideros	polymorpha Gaudich. var. pumila (A.Heller) J.W.Dawson & Stemmerm.	end						1	1

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Myrtaceae	Metrosideros	waialealae (Rock) Rock	end	1					1	1
Dennstaedtiaceae	Microlepia	speluncae (L.) T.Moore	ind			1				
Dennstaedtiaceae	Microlepia	strigosa (Thunb.) C.Presl	ind			1	1	1	1	
Polypodiaceae	Microsorium	spectrum (Kaulf.) Copel. var. pentadactylum (Hillebr.) D.D.Palmer	end							1
Myricaceae	Morella	faya (Ait.) Wilbur	nat							1
Rubiaceae	Morinda	citrifolia L.	pol			1				
Araliaceae	Munroidendron	racemosum (C.N.Forbes) Sherff	end, E	1	1	1				
Musaceae	Musa	x_paradisiaca L.	pol			1	1			1
Primulaceae	Myrsine	alyxifolia Hosaka	end				1			1
Primulaceae	Myrsine	denticulata (Wawra) Hosaka	end	1						1
Primulaceae	Myrsine	fernseei (Mez) Hosaka	end	1						1
Primulaceae	Myrsine	fosbergii Hosaka	end, C				1			1

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Primulaceae	Myrsine	kauaiensis Hillebr.	end	1					1	
Primulaceae	Myrsine	lanaiensis Hillebr.	end			1				
Primulaceae	Myrsine	lessertiana A.DC.	end						1	1
Primulaceae	Myrsine	linearifolia Hosaka	end, T	1					1	
Primulaceae	Myrsine	petiolata Hosaka	end	1						1
Primulaceae	Myrsine	punctata (H.Lev.) Wilbur	end						1	
Primulaceae	Myrsine	wawraea (Mez) Hosaka	end	1					1	1
Nephrolepidaceae	Nephrolepis	cordifolia (L.) C.Presl	ind						1	1
Nephrolepidaceae	Nephrolepis	exaltata (L.) Schott subsp. hawaiiensis W.H.Wagner	end			1	1		1	
Nephrolepidaceae	Nephrolepis	multiflora (Roxb.) F.M.Jarrett ex C.V.Morton	nat			1				
Urticaceae	Neraudia	melastomifolia Gaudich.	end, SOC		1	1				
Rubiaceae	Nertera	granadensis (Mutis) Druce	ind				1		1	1

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Sapotaceae	Nesoluma	polynesianum (Hillebr.) Baill.	ind, SOC			1				
Oleaceae	Nestegis	sandwicensis (A.Gray) O.Deg., I.Deg. & L.A.S.Johnson	end			1				
Solanaceae	Nothocestrum	longifolium A.Gray	end						1	
Dryopteridaceae	Nothoperanema	rubiginosa (Brack.) A.R.Sm. & D.D.Palmer	end						1	
Amaranthaceae	Nototrichium	sandwicense (A.Gray) Hillebr.	end		1	1				
Apocynaceae	Ochrosia	kauaiensis H.St.John	end, SOC	1		1				
Poaceae	Oplismenus	hirtellus (L.) P.Beauv.	nat			1	1		1	
Cyperaceae	Oreobolus	furcatus H.Mann	end							1
Rosaceae	Osteomeles	anthyllidifolia (Sm.) Lindl.	ind		1	1				
Oxalidaceae	Oxalis	corniculata L.	pol?		1	1	1	1	1	
Pandanaceae	Pandanus	tectorius Parkinson ex Z	ind			1				
Poaceae	Panicum	lineale H.St.John	end,	1	1			1	1	

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			SOC							
Poaceae	Paspalum	conjugatum P.J.Bergius	nat				1		1	
Poaceae	Paspalum	dilatatum Poir.	nat			1				
Poaceae	Paspalum	scrobiculatum L.	ind?			1				
Poaceae	Paspalum	urvillei Steud.	nat				1		1	
Passifloraceae	Passiflora	edulis Sims	nat			1				
Passifloraceae	Passiflora	tarminiana Coppens & Barney	nat						1	
Piperaceae	Peperomia	blanda Humb., Bonpl. & Kunth var. floribunda (Miq.) Huber	ind		1	1				
Piperaceae	Peperomia	cookiana C.DC.	end						1	1
Piperaceae	Peperomia	hesperomannii Wawra	end	1					1	1
Piperaceae	Peperomia	hirtipetiola C.DC.	end						1	
Piperaceae	Peperomia	kokeana Yunck.	end	1			1		1	
Piperaceae	Peperomia	latifolia Miq.	end						1	

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Piperaceae	Peperomia	membranacea Hook. & Arn.	end						1	
Piperaceae	Peperomia	oahuensis C.DC.	end						1	
Piperaceae	Peperomia	tetraphylla (G.Forst.) Hook. & Arn.	ind		1	1	1		1	
Celastraceae	Perrottetia	sandwicensis A.Gray	end				1		1	
Celastraceae	Perrottetia	sp nov (rugose/pubescent)	end	1			1		1	
Apiaceae	Peucedanum	sandwicense Hillebr.	end, T		1					
Orchidaceae	Phaius	tankarvilleae (Banks ex L'Hér.) Blume	nat						1	
Polypodiaceae	Phlebodium	aureum (L.) J.Sm.	nat			1	1		1	
Phyllanthaceae	Phyllanthus	distichus Hook. & Arn.	end			1				
Lamiaceae	Phyllostegia	electra C.N.Forbes	end	1					1	
Lamiaceae	Phyllostegia	renovans W.L.Wagner	end, E, PEP	1					1	
Lamiaceae	Phyllostegia	wawrana Sherff	end, E, PEP	1					1	

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Solanaceae	Physalis	peruviana L.	nat				1			
Phytolaccaceae	Phytolacca	sandwicensis Endl.	end, SOC						1	
Urticaceae	Pilea	peplodes (Gaudich.) Hook. & Arn.	ind						1	
Piperaceae	Piper	methysticum G.Forst.	pol			1	1			
Urticaceae	Pipturus	albidus (Hook. & Arn.) A.Gray	end		1	1	1	1	1	
Urticaceae	Pipturus	kauaiensis A.Heller	end	1	1	1	1	1	1	
Urticaceae	Pipturus	ruber A.Heller	end	1					1	1
Nyctaginaceae	Pisonia	sandwicensis Hillebr.	end			1	1			
Nyctaginaceae	Pisonia	umbellifera (G.Forst.) Seem.	ind			1				
Nyctaginaceae	Pisonia	wagneriana Fosberg	end, SOC	1		1	1			
Pittosporaceae	Pittosporum	gayanum Rock	end	1					1	1
Pittosporaceae	Pittosporum	glabrum Hook. & Arn.	end			1	1		1	

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Pittosporaceae	Pittosporum	kauaiense Hillebr.	end	1		1	1		1	
Pittosporaceae	Pittosporum	napaliense Sherff	end, E	1		1				
Pteridaceae	Pityrogramma	austroamericana Domin	nat		1	1				
Plantaginaceae	Plantago	lanceolata L.	nat		1	1				
Plantaginaceae	Plantago	major L.	nat			1				
Plantaginaceae	Plantago	pachyphylla A.Gray	end						1	1
Plantaginaceae	Plantago	princeps Cham. & Schtdl. var. longibracteata H.Mann	end, E					1	1	
Rutaceae	Platydesma	rostrata Hillebr.	end, E	1					1	
Rutaceae	Platydesma	spathulata (A.Gray) B.C.Stone	end						1	
Lamiaceae	Plectranthus	parviflorus Willd.	ind		1					
Asparagaceae	Pleomele	aurea (H.Mann) N.E.Br.	end	1		1				
Asteraceae	Pluchea	carolinensis (Jacq.) G.Don	nat		1	1	1	1	1	1
Thelypteridaceae	Pneumatopteris	pendens	end					1		

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		D.D.Palmer								
Thelypteridaceae	Pneumatopteris	sandwicensis (Brack.) Holttum	end				1	1	1	
Poaceae	Poa	mannii Munro ex Hillebr.	end, E	1	1			1		
Poaceae	Poa	sandwicensis (Reichardt) Hitchc.	end, E	1	1			1	1	
Polypodiaceae	Polypodium	pellucidum Kaulf.	end				1		1	
Poaceae	Polypogon	interruptus Kunth	nat		1			1		
Sapotaceae	Pouteria	sandwicensis (A.Gray) Baehni & O.Deg.	end			1	1			
Arecaceae	Pritchardia	limahuliensis H. St. John	end, SOC	1			1		1	
Arecaceae	Pritchardia	minor Becc.	end, SOC	1					1	
Arecaceae	Pritchardia	napaliensis H.St.John	end, E	1		1	1		1	
Thelypteridaceae	Pseudophegopteris	keradreniana (Gaudich.) Holttum	end						1	
Myrtaceae	Psidium	cattleianum Sabine	nat			1				

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Myrtaceae	Psidium	guajava L.	nat			1				
Psilotaceae	Psilotum	complanatum Sw.	ind						1	1
Psilotaceae	Psilotum	nudum (L.) P.Beauv.	ind		1	1	1			
Rubiaceae	Psychotria	greenwelliae Fosberg	end	1		1	1		1	
Rubiaceae	Psychotria	hexandra H.Mann	end	1			1		1	
Rubiaceae	Psychotria	kaduana (Cham. & Schltdl.) Fosberg	end			1	1		1	
Rubiaceae	Psychotria	mariniana (Cham. & Schltdl.) Fosberg	end			1	1		1	1
Rubiaceae	Psychotria	wawrae Sohmer	end, SOC	1					1	
Rubiaceae	Psydrax	odorata (G.Forst.) A.C.Sm. & S.P.Darwin	ind			1				
Apocynaceae	Pteralyxia	kauaiensis Caum	end, E	1		1				
Dennstaedtiaceae	Pteridium	aquilinum (L.) Kuhn var. decompositum (Gaudich.) R.M.Tryon	end			1				
Pteridaceae	Pteris	cretica L.	ind			1				

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Pteridaceae	Pteris	excelsa L.	ind						1	
Pteridaceae	Pteris	irregularis Kaulf.	end			1				
Apocynaceae	Rauvolfia	sandwicensis A.DC.	end			1				
Cyperaceae	Rhynchospora	chinensis Nees & Meyen subsp spiciformis (Hillebr.) T.Koyama	ind						1	1
Cyperaceae	Rhynchospora	rugosa (Vahl) Gale subsp. lavarum (Gaudich.) T.Koyama	ind						1	1
Cyperaceae	Rhynchospora	sclerioides Hook. & Arn.	ind				1		1	
Rosaceae	Rubus	argutus Link	nat			1	1		1	1
Rosaceae	Rubus	hawaiensis A.Gray	end						1	
Rosaceae	Rubus	rosifolius Sm.	nat			1	1		1	1
Polygonaceae	Rumex	albescens Hillebr.	end						1	
Poaceae	Sacciolepis	indica (L.) Chase	nat				1		1	1
Blechnaceae	Sadleria	cyatheoides Kaulf.	end			1	1		1	1

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Blechnaceae	Sadleria	pallida Hook. & Arn.	end			1	1		1	1
Blechnaceae	Sadleria	souleyetiana (Gaudich.) T.Moore	end						1	1
Blechnaceae	Sadleria	squarrosa (Gaudich.) T.Moore	end				1	1	1	1
Blechnaceae	Sadleria	wagneriana D.D.Palmer & T.Flynn	end	1					1	
Santalaceae	Santalum	ellipticum Gaudich.	end			1				
Santalaceae	Santalum	freycinetianum Gaudich. var. pyrularium (A.Gray) Stemmerm.	end	1		1	1		1	
Sapindaceae	Sapindus	oahuensis Hillebr. ex Radlk.	end			1				
Goodeniaceae	Scaevola	glabra Hook. & Arn.	end						1	1
Goodeniaceae	Scaevola	mollis Hook. & Arn.	end						1	
Goodeniaceae	Scaevola	procera Hillebr.	end			1	1		1	
Caryophyllaceae	Schiedea	apokremnos H.St.John	end, E	1	1					
Caryophyllaceae	Schiedea	lychnoides Hillebr.	end, E	1					1	

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Poaceae	Schizachyrium	condensatum (Kunth) Nees	nat		1			1	1	
Schizaeaceae	Schizaea	robusta Baker	end						1	1
Selaginellaceae	Selaginella	arbuscula (Kaulf.) Spring	end		1	1	1	1	1	
Selaginellaceae	Selaginella	deflexa Brack.	end							1
Poaceae	Setaria	palmifolia (J.Koenig) Stapf	nat			1	1			
Poaceae	Setaria	parviflora (Poir.) Kerguelen	nat			1	1		1	
Malvaceae	Sida	fallax Walp.	ind		1	1				
Smilacaceae	Smilax	melastomifolia Sm.	end			1	1		1	1
Orchidaceae	Spathoglottis	plicata Blume	nat			1				
Cyatheaceae	Sphaeropteris	cooperi (Hook. ex F.Muell.) R.M.Tryon	nat				1		1	
Lindsaeaceae	Sphenomeris	chinensis (L.) Maxon ex Kramer	ind			1	1		1	1
Poaceae	Sporobolus	africanus (Poir.) Robyns & Tournay	nat			1				
Poaceae	Sporobolus	indicus (L.) R.Br.	nat			1				

<i>FAMILY</i>	<i>GENUS</i>	<i>SPECIES</i>	<i>STATUS</i>	<i>SIE</i>	<i>DRY TO MESIC CLIFF</i>	<i>COASTAL/ LOWLAND MESIC</i>	<i>LOWLAND WET</i>	<i>WET CLIFF</i>	<i>MONTANE WET</i>	<i>BOG</i>
Verbenaceae	Stachytarpheta	cayennensis (Rich.) Vahl	nat			1				
Verbenaceae	Stachytarpheta	jamaicensis (L.) Vahl	nat			1				
Lamiaceae	Stenogyne	purpurea H.Mann	end	1					1	1
Gleicheniaceae	Sticherus	owhyhensis (Hook.) Ching	end						1	1
Myrtaceae	Syzygium	cumini (L.) Skeels	nat			1				
Myrtaceae	Syzygium	malaccense (L.) Merr. & L.M.Perry	pol			1				
Myrtaceae	Syzygium	sandwicensis (A.Gray) Nied.	end			1	1		1	1
Tectariaceae	Tectaria	gaudichaudii (Mett.) Maxon	end			1	1		1	
Araliaceae	Tetraplasandra	kavaiensis (H.Mann) Sherff	end, SOC						1	
Araliaceae	Tetraplasandra	oahuensis (A.Gray) Harms	end				1		1	
Araliaceae	Tetraplasandra	waialealae Rock	end	1					1	1
Urticaceae	Touchardia	latifolia Gaudich.	end				1		1	
Campanulaceae	Trematolobelia	kauaiensis (Rock) Skottsbo.	end	1					1	1

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Cyperaceae	Uncinia	uncinata (L.f.) Kük.	ind						1	
Urticaceae	Urera	glabra (Hook. & Arn.) Wedd.	end				1		1	
Ericaceae	Vaccinium	calycinum Sm.	end				1		1	1
Ericaceae	Vaccinium	dentatum Sm.	end			1	1		1	1
Ericaceae	Vaccinium	reticulatum Sm.	end						1	1
Hymenophyllaceae	Vandenboschia	cyrtotheca (Hillebr.) Copel.	end				1		1	
Hymenophyllaceae	Vandenboschia	davallioides (Gaudich.) Copel.	end				1		1	
Hymenophyllaceae	Vandenboschia	tubiflora F.S.Wagner	end	1					1	
Violaceae	Viola	kauaensis A.Gray	end						1	1
Violaceae	Viola	wailenalenae (Rock) Skottsb.	end	1					1	1
Verbenaceae	Vitex	rotundifolia L.f.	ind			1				
Poaceae	Vulpia	bromoides (L.) S.F.Gray	nat		1					
Sterculiaceae	Waltheria	indica L.	ind?			1				

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Thymelaeaceae	Wikstroemia	hanalei Wawra	end, SOC, H	1		1				
Thymelaeaceae	Wikstroemia	oahuensis (A.Gray) Rock var. palustris (Hochr.) B. Peterson	end	1					1	1
Thymelaeaceae	Wikstroemia	oahuensis (A.Gray) Rock	end			1	1		1	
Asteraceae	Wilkesia	gymnoxiphium A.Gray	end	1	1					
Asteraceae	Wilkesia	hobdyi H.St.John	end, E	1	1					
Flacourtiaceae	Xylosma	hawaiiense Seem.	end			1	1		1	
Asteraceae	Youngia	japonica (L.) DC.	nat		1	1	1	1	1	
Rutaceae	Zanthoxylum	dipetalum H.Mann	end, SOC			1	1			
Rutaceae	Zanthoxylum	kauaense A.Gray	end						1	
Zingiberaceae	Zingiber	zerumbet (L.) J.E.Sm.	pol				1			