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Technical Report 73
DESCRIPTION AND MAP OF THE PLANT COMMUNITIES OF KALOKO-HONOKOHAU NATIONAL CULTURAL PARK

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Kaloko-Honokohau National Historical Park

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ABSTRACT

Two lichens, three ferns, and 69 flowering plants are recorded from Kaloko-Honokohau National Cultural Park. Thirty-nine species (53%) are alien (introduced since 1778). Eleven species have been declared noxious by the State of Hawai'i. Eight species pose a threat to archaeological sites. Two grasses constitute a fire hazard.

Eight major and four lesser plant communities are distinguished and mapped on the basis of dominant growth form, species composition, and substrate:

I. nearly barren 'a'a,
II. four types of strand vegetation (low, scrub, shrub, and forest),
III. anchialine ponds,
IV. marsh and mangrove forest,
V. grassland,
VI. inland scrub,
VII. savanna, and
VIII. predominantly inland forest.

Nine of the 11 communities are usually dominated by alien species. Only the low strand vegetation and strand scrub are typically native-dominated. A total of 78 localized plant associations are distinguished within the 11 communities.

Management recommendations concerning alien plants are to eradicate mangroves, critical species disturbing archaeological sites, and species with very limited populations. More common aliens can be replaced in part with culturally significant or endemic species. Feral animals do not appear to pose a major threat at present. Proposed Park facilities should have little impact on the native vegetation, except insofar as construction activity promotes the introduction and spread of alien species.

INTRODUCTION

This study of the vegetation of the Kaloko-Honokohau National Cultural Park was undertaken to address several objectives outlined by the National Park Service (1974) and the Honokohau Study Advisory Commission (National Park Service and Honokohau Study Advisory Commission 1974). Their proposals call for research on and management of Park resources in order to protect the Park's remnant Hawaiian ecosystems and restore native vegetation and endemic plant species.

STUDY AREA

Location and General Description

The Kaloko-Honokohau National Cultural Park is located on the North Kona coast of the island of Hawai'i, 6 km (4 mi) north of Kailua-Kona and 7 km (5 mi) south of Keahole Airport. Ownership of its 750 acres of land is currently split between the National Park Service (45%), the Lanihau Corporation (43%), and the State of Hawai'i (12%). Five hundred fifty acres of offshore water (State-owned) comprise the reminder of the Park. The Park extends from Wawahi wa'a Point to Noio Point, with most of the land area comprising the ahupua'as of Kaloko and Honokohau, makai (seaward) of Queen Ka-'ahu-manu Highway.

The pahoehoe and 'a'a flows covering the Park date from the Recent or late Pleistocene. These prehistoric flows from Hualalai are much younger than one million years (MacDonald *et al.* 1983). Topographically, the park slopes very gradually from 21-24 m (70-80 ft) elevation along the mauka (inland) border to sea level (Figure 1). The character of the lava flows makes the surface extremely rough, however.

The Park's primary purpose is to preserve Hawaiian culture at a location which abounds in archaeological and historic sites (National Park

Service and Honokohau Study Advisory Commission 1974).

Climate

Climatic conditions at the Park are largely determined by its location at the base of the leeward slopes of Hualalai volcano. The leeward coastal position contributes to the hot, dry climate. Kona's wind patterns feature afternoon onshore breezes caused by the Hualalai updraft. These alternate with light trade winds at night. Since precipitation occurs as a result of the convectional updraft, rainfall is highest during the summer, a pattern unique to Kona within the State (Blumenstock and Price 1967).

The temperature is quite constant, with an average annual maximum of 28°C (83°F) and minimum of 19°C (67°F) at the former Kona Airport, 4 km (2 mi) southeast of the Study area (Hawai'i Department of Land and Natural Resources 1983). In January the temperature averages 22°C (72°F) and in July, 25°C (76°F). The average diurnal range in temperature is 9°C (17°F).

Rainfall is quite low, averaging 627 mm (25 inches) annually at Kona Airport (Hawai'i Department of Land and Natural Resources 1983). Precipitation is lowest between October and May, averaging 41 mm (2 inches) in January. The average for July is 61 mm (2 inches). Several summer months each average twice the monthly precipitation between October and May; the rainfall pattern is thus truly kona. Relative humidity is fairly high and stable, averaging 71-77% throughout the year (National Park Service and Honokohau Study Advisory Commission 1974).

Soils and Substrate

The study area includes four soil types, as defined by the USDA Soil Conservation Service (Sato et al. 1973). "'A'a lava flows" cover the central third of the Park, from about the jeep road to Kaloko Fishpond south to just north and east of 'Ai'makapa Fishpond. Another 'a'a flow covers the southeastern corner of the Park along the Highway. The mauka part of the Park north of the jeep road to Kaloko Fishpond is mapped as "Punalu'u extremely rocky peat," underlain by pahoehoe and used for pasture. "Beaches" form narrow strips just mauka of coastal basalt along most of the Park's coast, extending mauka of Kaloko-and 'Ai'makapa Fishponds. The remainder of the Park is considered "pahoehoe lava flows." This includes the southeastern third of the Park, both fishponds, and such of the extreme coast in Kohana-iki, Honokohau, and Kealakehe ahupua'as.

The present study found nothing resembling rocky peat in the area so designated, many areas of pahoehoe within the section mapped as 'a'a in Kaloko ahupua'a, and pahoehoe rather than "beach" substrate mauka of the fishponds. In addition, many beaches, some too small to be mapped by the Soil Survey, but including almost the entire coastline of Honokohau ahupua'a, occur within coastal areas mapped as pahoehoe and 'a'a flows. Also, the marshes around the fishponds have a thin layer of organic muck underlain by pahoehoe. In any event, the Park clearly contains very little soil development.

Past Hawaiian Activity

Evidence of past Hawaiian activity at the Park is ubiquitous. The two large fishponds and fishtrap attest to the considerable labor and maintenance required for these sources of food. Archaeological remains abound: five heiaus, a large holua, many stone platforms, tall rock pillars, stone planters, petroglyphs -- 234 archaeological sites catalogued to date. Burial grounds of many ali'i, reportedly including King Kamehameha I, are located within the Park. Clearly the area was long a center of Hawaiian activity.

Of interest to the National Park Service and Honokohau Study Advisory Commission is the character of the vegetation before foreign introductions. It was probably similar to the present

vegetation in large part. Both coastal and recent lava substrates support a rather limited flora. Without such introduced trees and shrubs as kiawe (*Prosopis*), mangrove (*Rhizophora*), and koa-haole (*Leucaena*), the area must have had a more open appearance. Strictly speaking, introductions by aboriginal Hawaiians probably had nearly as great an impact on the native vegetation. Without milo (*Thespesia*), coconut (*Cocos*), noni (*Morinda*), and kou (*Cordia*), the coastline's appearance would certainly be altered. After Hawaiian settlement, these and other species (e.g., hala (*Pandanus*)) were likely cultivated in the Park area, and were probably far more abundant than today.

Native species likely to have been more abundant before European or Polynesian introductions include naio (*Myoporum*), hala, and perhaps alahe'e (*Canthium*), pua-kala (*Argemone*) 'ilima (*Sida*), and *Bidens hawaiensis*. Species formerly at the site probably included 'ohi'a (*Metrosideros*), 'iliahialo'e (*Santalum*), a'ali'i (*Dodonaea*), a'mau'mau (*Sadleria*), nehe (*Lipochaeta*), 'emoloa (*Eragrostis*), and *Ischaemum*. Less likely but potential original components are lo'ulu (*Pritchardia*), wiliwili (*Erythrina*), hao (*Reynoldsia*), pukiawe (*Styphelia*), and 'ohai (*Sesbania*).

Grazing of alien herbivores in the area has likely affected the vegetation, although not nearly as much as elsewhere in Hawai'i. The rough terrain and naturally sparse vegetation must have discouraged grazing. Hovever, as late as 1974, grazing at the Park's mauka boundary was reported (National Park Service and Honokohau Study Advisory Commission 1974).

The low level of human habitation within the Park in recent years, now limited to several families near 'Ai'opio Fishtrap, indicates relatively little human impact on the site. While bathers and fishermen frequent the coast, and Honokohau Boat Harbor is certainly a high density area, the Park appears little disturbed. Leveling of a large area of the 'a'a flow mauka of 'Ai'makapa Fishpond is the most obvious sign of habitat disruption.

METHODS AND MATERIALS

Kaloko-Honokohau National Cultural Park was surveyed in June 1987. Plants were identified in the field or from voucher specimens. Plant nomenclature follows St. John (1973) and Wagner and Herbst (pers. comm.).

The local abundance of species was recorded at 100 locations using the Braun-Blanquet cover-abundance scale (Mueller-Dombois and Ellenberg 1974). To characterize each species more generally, the following abundance classification was also used: abundant (25% cover), common (5-25% cover), occasional (1-5% cover), uncommon (% cover), and rare (1 to a few individuals).

Non-native plants were separated into two types. Polynesian introductions refer to those species introduced by the aboriginal Hawaiians prior to 1778. Historic introductions refer to all subsequent introductions.

Common names of plants are taken from St. John (1973), Neal (1965), and Porter (1975). The source of ethnobotanical information is Neal (1965).

The plant community map was made with the aid of the 1959 and 1982 Keahole Point quadrangle USGS 1:24000 topographic maps and portions of two USGS Keahole Point orthophotoquads obtained from the Pacific Area Office of the National Park Service and from the Draft Environmental Statement for the Park (National Park Service and Honokohau Study Advisory Commission 1974).

RESULTS

Plant Species

Two lichen species from two families, three ferns from three families, and 69 flowering plants from 38 families were found in the study area (Appendix). Fifty-three percent of the flora of the study area is alien, i.e., introduced since

1778 (Table 1). Thirty-one percent of the flora is indigenous, 9% endemic, and 7% of Polynesian introduction.

Table 1. Summary of the status of Kaloko-Honokohau flora.

Status	Number of species	Percent
Endemic	7	9
Indigenous	23	31
Historical intro.	39	53
Polynesian intro.	5	7

Eleven of the historic introductions are considered noxious by the Hawai'i State Department of Agriculture (Table 2). Eight species pose a potential threat to archaeological sites (Table 3). Red mangrove has clearly already damaged Kaloko Fishpond and adjacent remains. Because of their frequency in areas with many archaeological sites, it is quite likely that kiawe, Christmas berry (*Schinus*), koa-haole, pluchea, and noni have also disrupted some sites. Two grass species (fountaingrass (*Pennisetum*) and Natal redtop (*Rhynchelytrum*)) produce a fine fuel that constitutes a very serious fire hazard.

It might be noted that several species mentioned in the National Park Service's (1974) and Commission's (1974) proposals were not found in this survey. They are the following:

kauna'oa	(*Cuscuta sandwiciana*)
'akia	(*Wikstroemia* sp.)
pili grass	(*Heteropogon contortus*)
ulei	(*Osteomeles anthyllidifolia*)

While kauna'oa would be expected on the coast, which was thoroughly surveyed, the other three species could occur in the inland scrub or savanna, which was not surveyed exhaustively. Those three species may thus possibly be rare components of the mauka vegetation.

Table 2. Plants of Kaloko-Honokohau declared noxious by Hawai'i State Department of Agriculture.

Scientific name	Common name
Acacia farnesiana	klu
Buddleja asiatica	dogtail
Commelina benghalensis	hairy honohono
Indigofera suffruticosa	indigo
Lantana camara	lantana
Pennisetum setaceum	fountaingrass
Pithecellobium dulce	'opiuma
Pluchea odorata	pluchea
Rhizophora mangle[1]	red mangrove
Schinus terebinthifolius	christmas berry
Tribulus terrestris	puncture vine

1 Declared a prioritized weed rather than noxious plant by HDOA

Plant Communities

Eight major communities and four subcommunities were distinguished at Kaloko-Honokohau.

BARREN 'A'a or nearly barren, alien-dominated 'a'a (community I) covers about 25% of the Park. It occupies the south-western third of Kaloko ahupua'a. It continues above 40 feet elevation in northeastern Honokohau ahupua'a, and occupies the extreme southeastern corner of that ahupua'a and the eastern third of Kealakehe ahupua'a within the Park boundary.

STRAND VEGETATION (community II) covers perhaps 10% of the Park. Occupying a narrow belt along the coastline, it is comprised of four subcommunities. LOW STRAND VEGETATION (community IIA) is usually native dominated, growing on pahoehoe or less often sand just above the tidal zone. This subcommunity is most common in Kaloko and Kealakehe ahupua'as.

Table 3. Plants of Kaloko-Honokohau with the potential to disrupt archaeological sites.

Scientific name	Common name
Acacia farnesiana	klu
Leucaena leucocephala	koa-haole
Morinda citrifolia	noni
Pithecellobium dulce	'opiuma
Pluchea odorata	pluchea
Prosopis pallida	kiawe
Rhizophora mangle	red mangrove
Schinus terebinthifolius	Christmas berry

STRAND SCRUB (community IIB) is native-dominated and found on sand at scattered sites along the entire coastline.

SHRUBBY STRAND (community IIC) vegetation is alien-dominated, on sand on upper beaches or just back (mauka) of the strand proper. This vegetation type extends along most of the coastline of Kohana-iki and Kaloko ahupua'as.

STRAND FOREST (community IID) is alien-dominated and usually found back of the strand on sand. Its primary locality is along the coastline of Kaloko and Honokohau ahupua'as.

The third major community, occupying <1% of the Park, is found on pahoehoe flows at ANCHIALINE PONDS (community III). This mostly alien-dominated community occurs at small coastal ponds at the north and south corners of Kaloko ahupua'a and in Kealakehe ahupua'a.

MARSH AND MANGROVE FOREST (community IV) covers about 5% of the Park. The mostly alien-dominated vegetation grows on thin organic muck overlying pahoehoe. It surrounds and has invaded both fishponds, plus 'Ai'opio Fishtrap north of Maliu Point.

Alien-dominated GRASSLAND (community V) occupies perhaps 20% of the Park, primarily inland. It is found on pahoehoe growing intermixed with scrub and savanna vegetation in central Kaloko ahupua'a, both north and south of 'Ai'makapa Fishpond, and in Kealakehe ahupua'a,

Alien-dominated INLAND SCRUB (community VI) grows on pahoehoe or 'a'a in about 10% of the Park, primarily in the southeastern third of the Park.

Alien-dominated SAVANNA (community VII) occurs on pahoehoe and 'a'a on about 25% of the Park, especially inland. Its primary site is the northeastern two-thirds of Kaloko ahupua'a.

The last major community, alien-dominated FOREST (community VIII) on pahoehoe, occupies about 5% of the Park. Found primarily inland, it surrounds marsh and mangrove vegetation at the fishponds and extends across southern Honokohau ahupua'a mauka of the strand vegetation.

More complete descriptions of these 11 communities, including more localized plant associations, are given below. The abundance of each species in each community is given in Table 4.

I. BARREN LAVA

1. Barren inland 'a'a

Rough lava fields (including some very clinkery pahoehoe) devoid of vegetation except minimal amount (% cover) of *Stereocaulon vulcani* in protected cracks.

Southern third of Kaloko ahupua'a (makai half more nearly pahoehoe), and mauka section of Honokohau ahupua'a, above 40 foot contour east and northeast of 'Ai'makapa Fishpond, and in the mauka third of Kealakehe ahupua'a.

2. Fountaingrass on barren 'a'a

Rough lava fields (including some very clinkery pahoehoe) with very low cover of predominantly alien grasses and few subshrubs.

Table 4. Species list of Kaloko-Honokohau plant communities. Average Braun-Blanquet cover-abundance ratings[1] are given for each species in each of the 11 communities.
Nomenclaure follows St. John (1973) and Wagner and Herbst (pers. comm.). See Figure 1 legend for complete community names.

		Plant Community										
		I Brn	IIA LSt	IIB StS	IIC ShS	IID StF	III Anc	IV Msh	V Grs	VI ISc	VII Sav	VII For
PTERIDOPHYTA												
STEREOCAULACEAE	*Stereocaulon vulcani*	+										
PARMELIACEAE	*Parmelia* sp.											+
LICHENES												
DAVALLIACEAE	*Nephrolepis exaltata*								+			
POLYPODIACEAE	*Polypodium pellucidum*								+			
PSILOTACEAE	*Psilotum nudum*						+					
MONOCOTYLEDONES												
COMMELINACEAE	*Commelina benghalensis*										+	
CYPERACEAE	*Cyperus laevigatus*		+				+	2	+			
	Fimbristylis dichotoma		+	+		+	+		+			
	Scirpus maritimus var. *paludosus*							2				
GRAMINEAE	*Cynodon dactylon*	+	+	1	+	+			+			
	Eragrostis tenella				+							
	Panicum nubigenum	+										
	Paspalum distichum							5				
	Pennisetum setaceum	1	1	1	+	+	1		2	2	2	1
	Rhynchelytrum repens								+		+	
	Sporobolus virginicus		2	1		2	3	2	1			
LILIACEAE	*Aloe vera*								+			
PALMAE	*Cocos nucifera*		+	1		1			+		+	1
	Phoenix sp.					r						

[1]5 = 75-100% cover, 3 = 25-50% cover, 2 = 5-25% cover, + = <1% cover with numerous individuals, r = one to several individuals.

		Plant Community										
		I Brn	IIA LSt	IIB StSc	IIC ShSt	IID StF	III Anc	IV Msh	V Grs	VI ISc	VII Sav	VIII For
PANDANCEAE	*Pandanus tectorius*						r					
RUPPIACEAE	*Ruppia maritima*							1				
DICOTYLEDONES												
AIZOACEAE	*Sesuvium portulacastrum*		2	+		2	1	1				
AMARANTHACEAE	*Amaranthus lividus* ssp *polygonoides*			+								
ANACARDIACEAE	*Schinus terebinthifolius*				1	2	1	+	1	2	2	1
APOCYNACEAE	*Catharanthus roseus*			+	+	+			r		+	
BATIDACEAE	*Batis maritima*		2	1		+	3	2				1
BORAGINACEAE	*Cordia subcordata*				1	r	+					
	Heliotropium anomalum var. *argenteum*			r		+						
	Heliotropium curassavicum					+						
	Tournefortia argentea		1	1	2	2						
CACTACEAE	*Opuntia megacantha*								+			
CAPPARACEAE	*Capparis sandwichiana*			+	1	+			+		+	2
CHENOPODIACEAE	*Chenopodium ambrosioides*								+			
	Chenopodium murale		+	+	+	+						
COMPOSITAE	*Ageratum conyzoides*								+			
	Bidens hawaiensis								+			
	Pluchea odorata			1	1	1	1		+	+	1	+
	Reichardia picroides								+			
	Tridax procumbens								+		+	
CONVOLVULACEAE	*Ipomoea brasiliensis*		1	1	+	+						
	Ipomoea congesta								+		1	
	Jacquemontia sandwicensis		+	+	+	+						
CRASSULACEAE	*Bryophyllum tubiflorum*										+	
EUPHORBIACEAE	*Euphorbia hirta*		+	+	+							
	Euphorbia prostrata								+			
	Phyllanthus debilis								+			

		Plant Community										
		I Brn	IIA LSt	IIB StSc	IIC ShSt	IID StF	III Anc	IV Msh	V Grs	VI ISc	VII Sav	VIII For
GOODENIACEAE	*Scaevola taccada*		+	1	3	2			1			
GUTTIFERAE	*Clusea rosea*					+						
LEGUMINOSAE	*Acacia farnesiana*			+	+	+					1	
	Cassia leschenaultiana								+		+	
	Indigofera suffruticosa								+		+	
	Leucaena leucocephala	+	+	+	+	+	+		+	2	1	+
	Pithecellobium dulce								+			
	Prosopis pallida			1	1	1	1		1	1	2	3
	Tephrosia purpurea								+			
LOGANIACEAE	*Buddleja asiatica*								+			
MALVACEAE	*Sida fallax*			+		+			+	+	+	
	Thespesia populnea		1	+	+	3	+	1	+			2
MORACEAE	*Ficus benjamina*								+			
MYOPORACEAE	*Myoporum sandwicense*		+	r	r	+					+	+
NYCTAGINACEAE	*Boerhavia diffusa*		+	+	+	+			+		+	
PAPAVERACEAE	*Argemone glauca*										r	
PASSIFLORACEAE	*Passiflora foetida*								+		+	
PORTULACACEAE	*Portulaca lutea*		+									
	Portulaca oleracea		+		+							
	Portulaca pilosa		+	+	+	+			+	+	+	
RHIZOPHORACEAE	*Rhizophora mangle*		+			3	+	4				
RUBIACEAE	*Canthium odoratum*								+		+	
	Morinda citrifolia			+	+	+			+	r	+	+
SCROPHULARIACEAE	*Bacopa monnieria*		+				+	3				
SOLANACEAE	*Lycium sandwicense*		3				1					
STERCULIACEAE	*Waltheria americana*	+	+	+	+				+	1	+	
VERBENACEAE	*Lantana camara*				+				+		+	1
ZYGOPHYLLACEAE	*Tribulus terrestris*		+	+					+			

Includes endemic *Panicum nubigenum*. Cover highest in bulldozed area. Vegetation height <0.5 m. Localized associations include:

Fountaingrass/hi'a-loa (*Waltheria americana*) (5% cover)

Fountaingrass/koa-haole (20% cover)

Around Queen's Bath (small pond at southwest corner of Kaloko ahupua'a), mauka of strand just south of Kaloko-Honokohau ahupua'a boundary, and bulldozed area in 'a'a flow mauka of 'Ai'makapa Fishpond.

II. STRAND

A. LOW STRAND VEGETATION

3. ' Akulikuli (*Sesuvium portulacastrum*)

Low vegetation on coastal pahoehoe Mostly native herbs and subshrubs just above rocky coastline on pahoehoe boulders and rubble or outcrops (including some 'a'a and one sandy site). Cover variable, highest in association with 'akulikuli-kai (*Batis*) or 'aki'aki (*Sporobolus virginicus*). Vegetation height to 3 m, but primarily 0.5 m. Localized associations include;

'Akulikuli/'ohelo-kai (*Lycium sandwicense*)/'akulikuli-kai(80% cover)

'Ohelo-kai/'akulikuli/'aki'aki (50% cover)

'Akulikuli/'aki'aki (80% cover)

'Akulikuli-kai (90% cover)

'Akulikuli/native yellow portulaca (*Portulaca lutea*) (20% cover)

Pohuehue/'akulikuli (10% cover)

Pohuehue/naupaka (*Scaevola taccada*) (20% cover)

'Akulikuli on sandy strand (20% cover)

Scattered along coast: Kohana-iki ahupua'a, just south of Kaloko Fishpond, just south of Kaloko-Honokohau ahupua'a boundary, and south of Honokohau Boat Harbor.

4. Fountaingrass low vegetation on sandy strand

Mostly alien shrubs and herbs on and above sandy beaches. Vegetation cover low; vegetation height typically <0.5 m. Localized associations include:

Fountaingrass/tree heliotrope (*Tournefortia argentea*) (20% cover)

Fountaingrass/koa-haole (15% cover)

Milo/fountaingrass (10% cover)

In coast roadway just south of Kaloko Point and at two small beaches south of Honokohau Boat Harbor.

5. Mangrove seedlings on coastal pahoehoe

Scattered seedlings in the intertidal and immidiately above high tide in pahoehoe boulders and rubble. Very low cover (%) with no associated terrestrial species. Vegetation height <1 m.

At northern end of mouth of Kaloko Fishpond and along coast south of Kaloko-Honokohau ahupua'a boundary.

B. STRAND SCRUB

6. Naupaka scrub on sandy strand

Mostly native shrubs and herbs on sandy strand (one site on pahoehoe flow). Low cover; vegetation height typically to 1 m. Localized associations include:

Naupaka/pohuehue (10% cover)

Naupaka/'akulikuli (15% cover)

Naupaka/pa'u-o-'Hi'i'aka (*Jacquemontia sandwicensis*) (30% cover)

Pohuehue/naupaka (50% cover)

Naupaka/fountaingrass/'akulikuli-kai on pahoehoe (30% cover)

Naupaka/kiawe on pahoehoe (60% cover)

Scattered along coastline: at large beach south of Wawahi wa'a Point, just north of Kaloko Fishpond mouth, on long beach south of 'Ai'makapa Fishpond, and on both sides of entrance to Honokohau Boat Harbor.

C. SHRUBBY STRAND

7. Shrubby naupaka on sandy back of strand

Mostly alien stunted trees, shrubs, and herbs on sandy ground at and above strand. Vegetation cover very high; vegetation height usually 2 m. Localized associations include:

Naupaka/tree heliotrope/Christmas berry (90% cover)

Kiawe/naupaka/Christmas berry (80% cover)

Along coast road on either side of Kaloko-Kohana-iki ahupua'a boundary.

8. Shrubby tree heliotrope on sandy strand

Mostly alien stunted trees, shrubs, and herbs on narrow or upper sandy beaches. Vegetation cover high; vegetation height usually 2-3 m. Localized associations include:

Tree heliotrope/naupaka (60-90% cover)
Naupaka/tree heliotrope (80% cover)

Throughout coastline north of Honokohau ahupua'a: just south of Wawahi wa'a Point, just south of Kaloko-Kohana-iki ahupua'a boundary, just south of Kaloko Fishpond, and at and south of Kaloko Point.

9. Shrubby pluchea (*Pluchea odorata*) on sandy back of strand

Mostly alien shrubs and herbs on sandy ground back of strand. Vegetation cover 40%; vegetation height 2-3 m. Pluchea/kiawe association.

One site along Huehue Ranch Road (coast road) just south of Kaloko Point.

D. STRAND FOREST

10. Low tree heliotrope forest or scattered trees on coastal lava

Mostly alien trees, shrubs, and herbs on pahoehoe flows (plus some 'a'a and coastal pahoehoe rubble) on and just above the coast. Forms forest where mauka of strand: vegetation cover fairly high and higher inland. Vegetation height usually 3-4 m. Localized associations include:

Tree heliotrope/naupaka (50-90% cover)
Tree heliotrope/kiawe/naupaka (50% cover)
Tree heliotrope/kiawe/Christmas berry (80% cover)
Tree heliotrope/milo/naupaka (90% cover)

Forming extensive area on and above strand to mauka of Huehue Ranch Road, from south of Kaloko Fishpond to Kaloko Point. Another extended area on strand and along coast trail south of Kaloko-Honokohau ahupua'a boundary.

11. Milo forest on sandy back of strand

Nearly entirely alien trees, shrubs, and herbs on sandy ground just above and sometimes on the strand. Vegetation cover high: often a dense closed forest; more open at edge of marsh. Vegetation height usualiy 4 m. Localized associations include:

Milo (40-100% cover)
Milo/kiawe (80-100% cover)
Milo/naupaka/kiawe (100% cover)
Milo/mangrove (60% cover)
Milo/'aki'aki (70-100% cover)

Extensive area on and above strand nearly throughout Kaloko ahupua'a.

12. Kiawe forest on sandy back of strand

Exclusively alien trees and shrubs on sandy ground on mauka side of sandy beaches. Vegetation cover fairly high (50-80%); vegetation height 3-4 m. Kiawe/Christmas berry/pluchea association.

On mauka side of coast road north of Kaloko-Honokohau ahupua'a boundary and at south end of long beach south of 'Ai'makapa Fishpond.

13. Christmas berry scrub forest on sandy back of strand

Open scrub forest of mostly alien stunted trees, shrubs, and herbs on sandy ground along or just mauka of coast road. Vegetation cover fairly high; vegetation 3-4 m. Localized associations include:

Christmas berry/tree heliotrope (70% cover)
Christmas berry/naupaka/kiawe (60% cover)

Just mauka of coast halfway between Wawahi wa'a Point and Kaloko-Kohana-iki ahupua'a boundary. Also along and just mauka of Huehue Ranch Road at Kaloko Point.

14. Coconut grove on recently inhabited sandy ground

Open forest of alien and native (equal numbers) trees, shrubs, and herbs on sandy ground above the strand. Vegetation cover 70%; vegetation height 6 m. Coconut/Christmas berry/naupaka association.

Surrounding former dwellings just south of Kaloko Fishpond.

III. ANCHIALINE PONDS

15. 'Akulikuli-kai on pahoehoe at anchialine ponds.

Mostly alien stunted trees, shrubs, and herbs on pahoehoe flows surrounding small anchialine ponds near coast. Vegetation cover variable; vegetation height under 3 m and mostly 1 m. Localized associations include:

'Akulikuli-kai/'akulikuli (90% cover)
'Akulikuli-kai fountaingrass (30% cover)
'Akulikuli-kai/Christmas berry (50% cover)
'Akulikuli-kai/kiawe (50-90% cover)

Just north of Kaloko fishpond and both north and south of entrance to Honokohau Boat Harbor.

16. 'Aki'aki on pahoehoe in anchialine ponds

Native herbs on pahoehoe in anchialine ponds near coast. Vegetation cover 50%; vegetation height 0.2 m. 'Aki'aki/'akulikuli association,

At north side of entrance to Honokohau Boat Harbor.

17. Fountaingrass on pahoehoe at anchialine ponds

Mostly alien shrubs and herbs on pahoehoe flow surrounding small anchialine pond near coast. Vegetation cover 20%; vegetation height m. Fountaingrass/Christmas berry association.

Halfway between Honokohau Boat Harbor and Noio Point.

18. Christmas berry on pahoehoe at anchialine ponds

Mostly alien shrubs and herbs on very clinkery pahoehoe surrounding anchialine ponds near coast. Vegetation cover very low; vegetation height to 2 m. Localized associations include:

Christmas berry/milo (5% cover)
Christmas berry/fountaingrass (30% cover)

Queen's Bath and another pond at southwest corner of Kaloko ahupua'a.

IV. MARSH AND MANGROVE

19. Knottgrass (*Paspalum distichum*) marsh and meadow

Nearly entirely alien graminoids and other herbs, sometimes with scattered shrubs, on thin organic muck overlying pahoehoe. Marsh surrounding fishponds, with some meadow at drier outer margin. Vegetation cover 100%; vegetation height m except for scattered shrubs. Localized associations inciude:

Knottgrass (100% cover)
Knottgrass/makai (*Scirpus maritimus*) (100% cover)
Knottgrass/makaloa (*Cyperus laevigatus*)/water hyssop (*Bacopa monnieria*) (90% cover)
Knottgrass/'akulikuli-kai (100% cover)
Knottgrass/'akulikuli (100% cover)
Knottgrass/milo (100% cover)

On all sides of 'Ai'makapa Fishpond, at 'Ai'opio Fishtrap (just north of Maliu Point), and small marsh just south of 'Ai'opio Fishtrap.

20. Water hyssop marsh and meadow

Mostly native herbs with a few scattered shrubs on thin organic matter overlying pahoehoe. Tidally influenced wet meadow adjacent to fishpond. Vegetation cover rather high; vegetation height 0.3 m. Localized associations include:

Water hyssop/knottgrass (100% cover)
Water hyssop/makai (50% cover)
Water hyssop/makaloa/makai (70% cover)

Halfway between 'Ai'makapa Fishpond and Kaloko-Honokohau ahupua'a boundary inside strand: northern extension of meadow from 'Ai'makapa.

21. Milo shrubs in marshy meadow

Alien shrubs and herbs in thin organic matter overlying pahoehoe. Wet meadow near fishpond. Vegetation cover 100%; vegetation height to 3 m. Milo/knottgrass association.

Makai of north end of 'Ai' makapa Fishpond, in area marked as swamp on topographic map. Also beyond southern edge of 'Ai'makapa Fishpond.

22. Mangrove forest on organic muck

Alien trees and herbs on organic muck overlying pahoehoe, mostly slightly inundated by brackish water. Vegetation cover very high; vegetation height 5-6 m. Localized associations include:

Mangrove (100% cover)
Mangrove/'akulikuli-kai (95% cover)

Surrounding Kaloko Fishpond, and extending northeast of pond on low marshy pahoehoe.

V. GRASSLAND

23. Fountaingrass grassland on pahoehoe

Mostly alien shrubs and herbs on pahoehoe (some 'a'a), mostly mauka of coastal vegetation. Vegetation cover variable, often rather low; vegetation height 0.5 m except for occasional scattered shrubs to 2 m. Localized associations include;

Fountaingrass/kiawe (50-80% cover)
Fountaingrass/Christmas berry (60-80% cover)
Fountaingrass (20-30% cover)
Fountaingrass/'aki'aki (15% cover)
Fountaingrass/naupaka/Christmas berry on coast (60% cover)
Fountaingrass/naupaka on coast (20% cover)

Widespread in mauka part of study area: on both sides of jeep road to Kaloko Fishpond; on both sides of Kaloko-Honokahau ahupua'a boundary extending nearly to north side of 'Ai'makapa Fishpond; from mauka of southeast corner of 'Ai'makapa to mauka side of Honokohau Boat Harbor. Also on raised pahoehoe on coast just northwest of Kaloko Fishpond outlet, and south of Boat Harbor mouth to Noio Point.

VI. INLAND SCRUB

24. Koa-haole inland scrub on pahoehoe

Mostly alien shrubs and herbs on pahoehoe, mauka of coastal vegetation. Vegetation cover moderate; vegetation height mostly to 1.5 m. Localized associations include:

Koa-haole/fountaingrass (50% cover)
Fountaingrass/koa-haole (70% cover)

Widespread in southeast section of study area, covering most of mauka two-thirds of Honokohau and Kealakehe ahupua'as within Park boundary.

25. Christmas berry inland scrub on basalt

Mostly alien shrubs and subshrubs on 'a'a or pahoehoe mauka of coastal vegetation, Vegetation cover fairly high; vegetation height to 2 m. Localized associations include:

Christmas berry/pluchea (60% cover)
Christmas berry (80% cover)

Between coastal vegetation and barren 'a'a from just south of Kaloko-Honokohau ahupua'a boundary to near northern tip of 'Ai'makapa Fishpond.

VII. SAVANNA

26. Fountaingrass savanna on pahoehoe

Mostly alien stunted trees, shrubs, and herbs on pahoehoe, mostly mauka of coastal vegetation. Vegetation cover moderate; vegetation height to 3 m. Localized associations include:

Fountaingrass/kiawe (50-70% cover)
Fountaingrass/kiawe/koa-haole (50-80% cover)
Fountaingrass/kiawe/Christmas berry (50-70% cover)

Widespread in north half of study area. Mauka of coast road north of Kaloko Fishpond, halfway to Wawahi wa'a Point. Covering most of northeastern half of Kaloko ahupua'a within Park boundary. Also along coast just north of entrance to Honokohau Boat Harbor, and north of Harbor area.

VIII. FOREST

27. Kiawe inland forest on pahoehoe

Mostly alien trees, shrubs, and herbs formingopen forest on pahoehoe ('a'a at one site), mostly mauka of coastal vegetation. Vegetation cover high; vegetation height usually 4 m. Localized associations include:

Kiawe/fountaingrass (70-80% cover)
Kiawe/milo (100% cover) -
Kiawe/milo/maiapilo (*Capparis sandiwichiana*) (100% cover)
Kiawe/Christmas berry (90% cover)
Kiawe/coconut (100% cover)

Widespread mauka of strand vegetation and around fishponds, especially in Kaloko ahupua'a. At northeast corner of study area; on north, east, and south sides of Kaloko and 'Ai'makapa Fishponds (beyond mangroves at Kaloko); and forming a band between strand and 'savanna/grassland across Kaloko ahupua'a. Also small patch mauka of strand at southernmost beach south of Honokohau Boat Harbor.

28. Milo inland forest on pahoehoe

Alien trees, shrubs, and grass on pahoehoe at mauka edge of fishpond. Vegetation cover 100%; vegetation height 3 m. Milo/kiawe association.

Narrow band of forest along east side of 'Ai'makapa Fishpond.

MANAGEMENT RECOMMENDATIONS

Control of Alien Plants

1.THREATS TO ARCHEOLOGICAL SITES

A number of exotic plant species pose a direct and immediate threat to the Park's resources and should be eradicated.

Foremost is red mangrove, which has taken over much of Kaloko Fishpond and its surroundings in just eight years. In that time the original population of a half dozen seedlings has exploded into a dense forest over 6 m. in height (Hannah Springer, pers. comm.). Besides this primary site, seedlings occur regularly in the intertidal zone of Kaloko and Kealakehe ahupua'as. Ideally, the source population up the coast at Puhili Point should also be eradicated.

The ideal method for eradication of the Kaloko population would be cutting the trunks near waterline. If the trees resprout, a topical herbicide should be considered. However, before its application, research regarding the most effective chemical and potential effects on the pond's flora and fauna is imperative. Once the Kaloko population is under control, inquiry into jurisdiction over the source population can follow. The prompt implementation of a program to eliminate mangroves from the Park cannot be emphasized strongly enough!

Other plants disturbing the Park's archaeological sites should also be targeted for control. A survey should be carried out by an archaeologist botanist team to determine which species are actually impacting the sites. Kiawe, Christmas berry, and koa-haole are almost certainly already a problem, and pluchea and noni likely candidates as well. The remaining two species listed in Table 3, klu (*Acacia farnesiana*) and 'opiuma (*Pithecellobium*), are far less common in the Park but may be affecting some archaeological sites.

Following the survey of archaeological sites, cutting and/or poisoning of these species at the

sites can be carried out. Great care must of course be taken to avoid damaging the sites in the process. If one or two species are found to be particular problems, then programs to eradicate them from the entire Park should be considered.

2. PLANTS CONSTITUTING A FIRE HAZARD

Foremost among plants producing fine fuel at the Park is fountaingrass, the dominant member of four of the eight plant communities described in this study, and frequent in all communities except the marsh. One means of containing its spread is by preventing wildfires. While its eradication is highly desirable, its ubiquitous presence, abundance, and ready capacity for re-establishment from neighboring land argue against successful eradication. Consultation with managers at Hawai'i Volcanoes National Park (HAVO) should be maintained, should they find a successful means of controlling fountaingrass.

Natal redtop is the other incendiary grass in the Park. It is rather infrequent, but sufficiently widespread that eradication would be quite labor-intensive.

Non-grass species high in volatile oils or otherwise readily burned also deserve mention. Christmas berry, lantana, and kiawe are most significant in this respect. Consultation with other local land managers (e.g., HAVO) should precede any efforts to control these plants on the basis of fire risk.

3. CONTROL OF OTHER ALIEN SPECIES

The Honokohau Study Advisory Commission (1974) recommends eradication of the "exotic vegetation that dominates the Park." Even as a long-term objective, this is not practical, nor altogether desirable. Tree heliotrope, for example, is an alien species of considerable shade and esthetic value along the Park coast. Even the eradication of all noxious species may not be a worthwhile objective, until such time as the State develops biological or other specific controls for those species.

On the other hand, the Commission's stated objective of replacing exotic vegetation with species of cultural significance may be an effective route. For exanple, replacing kiawe forest and Christmas berry with plantings of milo, coconut, hala, kou, noni, and 'ilima would serve many purposes. An active planting program by employees of the Cultural Park would prevent re-establishment of alien species as well as provide materials for cultural demonstrations. It should be noted that noni should not be allowed to spread to archaeological sites, because of its potential to disrupt them.

Replacing aliens with local endemic species, also recommended by the Commission (1974), would also fit in well. Such species as naio, maiapilo, pa'u-o-Hi'i-'aka, *Bidens hawaiensis*, and pua-kala might prosper with good horticultural advice and care.

A number of potentially invasive exotics are currently so restricted in number that their immediate eradication is urged. Eliminating the problem before it grows out of control is the easiest, most economical alternative. In this category are the following;

pa-nini (*Opuntia*)
: One individual planted on coastal pahoehoe immediately south of entrance to Honokohau Boat Harbor

weeping fig (*Ficus*)
: One individual planted at same site as above

autographtree(*Clusea*)
: One individual planted just south of Kaloko Fishpond in yard of former dwelling

More abundant, but still relatively confined are the following:

puncture vine (*Tribulus*)
: Uncommon, confined to coast road just south of Kaloko Point and three coastal sites just south of entrance to Honokohau Boat Harbor

dogtail (*Buddleja*)
: Uncommon, confined to inland grassland Along deep road to Kaloko Fishpond

klu

Uncommon, confined to northern Kaloko ahupua'a and coast of Ka-hanaiki ahupua'a

lantana

Relatively uncommon, although fairly widespread: most abundant in inland forest, but also in grassland, savanna, and shrubby strand

Finally, the future spread of other alien plant species in the Park should be mentioned. This study cannot predict which of the 39 alien species might become a greater problem. A follow-up botanical survey in one or two years could aid in this regard.

Feral Animals

No evidence of feral animals (except rat damage to fallen coconuts) was noted during this study. Mongoose probably inhabit the Park, although no evidence of them was found. As mentioned previously, the rough lava terrain and sparse vegetation must discourage feral herbivores from frequenting the Park. The Draft Environmental Statement (National Park Service and Honokohau Study Advisory Commission 1974) refers to occasional grazing at the mauka edge of the Park. The traffic flow on the Highway probably serves as a reasonably effective barrier to ungulates venturing makai. At this stage, periodic monitoring for the presence of feral animals would be adequate. Personnel from Pu'uhonua o Honaunau National Historical Park who check Kaloko Fishpond weekly and commute past Kaloko-Honokohau could carry out this function very well.

Eradication of alien animals is a stated long-term management objective of the Commission's proposal. If such animals are found to be damaging Park vegetation, then further steps should be taken. Because of its expense, fencing should not be considered until such time as feral animals are found to be a significant problem.

Impact of Park Facilities on vegetation

The Draft Environmental Statement for the Park (National Park Service and Honokohau Study Advisory Commission 1974) states that a total of 20 acres would be directly disturbed by construction of visitor facilities, trails, etc. It appears that relativeiy little native vegetation would be directly impacted. However, disturbance provides a vector for new alien plant invasions. This should be monitored at all construction sites.

The main orientation and interpretive center will be located makai of the Highway, on already partially bulldozed barren 'a'a. This is quite acceptable, so long as the facility does not extend to the flow's makai edge, where the endemic maiapilo grows abundantly on the slope above 'Ai'makapa Fishpond. Trails leading down to the pond should avoid the maiapilo. Small structures around the pond will probably have little adverse impact on native vegetation, assuming none of the marsh is filled.

The location of the live-in cultural center is more problematic. While its location is not finalized in the environmental statement, it is mapped just mauka of Kaloko Point. The strand and back of strand vegetation is particularly well developed at this location. Care should be taken to construct facilities in areas of alien vegetation, or perhaps slightly mauka on the barren 'a'a. Since the proposed use of this area is modeled on traditional Hawaiian customs and ethics, the impact on native vegetation would presumably be minimized.

The maintenance facility is slated to be located at the southern edge of the Park, mauka of Honokohau Boat Harbor. Its construction will destroy a minimum of native vegetation in the scrub and grassland: 'ilima, 'alena (Boerhavia), hi'aloa, and other rather common species. This facility should not be located farther northeast, where it could destroy part of the population of Bidens hawaiensis, a striking endemic ko'oko'olau uncommon in the Park.

Finally, general visitor use will cause some trampling of vegetation, particularly on the strand. While the Environmental Statement projects a capacity of 500,000 visitors per year, most visitors would remain near the main orientation and interpretive center. The strand vegetation does not appear to be suffering markedly under the influence of the current visitor load, which is fairly heavy in Honokohau and Kohanaiki ahupua'as. If the coast trail is maintained and well-marked, and signs are posted requesting sensitivity to the strand flora, the impact should not be intolerable. It is worth noting that the strand vegetation of this rugged coastline faces considerable physical disturbance from the ocean. Many of Hawai'i's more fragile strand species are absent because of those natural conditions. Thus the vegetation is relatively well suited for visitor use.

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APPENDIX

PLANT SPECIES OF KALOKO-HONOKOHAU NATIONAL CULTURAL PARK

LICHENS

STEREOCAULACEAE

Stereocaulon vulcani (Bory) Ach.

Indigenous

n.c.n.

Common in crevices and protected surfaces of 'a'a.

PARMELIACEAE

Parmelia sp.

Indigenous

n.c.n.

Locally common under kiawe trees at makai edge of 'a'a flow above 'Ai'makapa Fishpond.

FERNS AND FERN ALLIES

DAVALLIACEAE
(Davallia Fern Family)

Nephrolepis exaltata (L.) Schott

Indigenous

ni'ani'au, kupukupu, common swordfern

Uncommon in cracks of pahoehoe in sparsely vegetated fountaingrass coastal grassland just north of Noio Point.

POLYPODIACEAE
(Polypody Fern Family)

Polypodium pellucidum Kaulf.

Endemic

'ae, 'ae-lau-nui

Uncommon in cracks of pahoehoe in sparsely vegetated fountaingrass grassland upland in central Kaloko ahupua'a and just north of Noio Point.

PSILOTACEAE
(Whisk Fern Family)

Psilotum nudum (L.) Beauv.

Indigenous

moa, pipi

Rare in Park; only seen in pahoehoe overhanging one anchialine pond halfway between Honokohau Boat Harbor and Noio Point.

Used for tea and leis; spores used for talcum.

FLOWERING PLANTS

Monocotyledones

COMMELINACEAE
(Spiderwort Family)

Commelina benghalensis L.

Historic intro.

hairy honohono

Rare creeping herb on pahoehoe in kiawe/fountaingrass savanna northeast of Kaloko Fishpond.

Declared noxious by Hawaii Department of Agriculture (HDOA).

CYPERACEAE
(Sedge Family)

Cyperum laevigatus L.

Indigenous

makaloa, 'ehu'awa, makaloa sedge, smooth flatsedge

Abundant and sometimes codominant herb in knottgrass and water hyssop marsh northwest of 'Ai'makapa Fishpond. Locally common on 'ohelo-kai or 'akulikuli-dominated 'a'a and pahoehoe strand, especially in low microsite, just south of Kaloko Fishpond and at Kaloko-Honokohau ahupua'a boundary. Uncommon on pahoehoe at one 'akulikuli-kai-dominated anchialine pond northweat of 'Ai'makapa Fishpond. Occasional on

pahoehoe in fountaingrass grassland on Kaloko-HonoKohau ahupua'a boundary. Uncommon on pahoehoe at on 'akulikuli-kai-dominated anchialine pond northwest of 'Ai'makapa fishpond. Occasional on pahoehoe in fountaingrass grassland on Kaloko-Honokohau boundary, southeast of 'Ai'makapa Fishpond, and near Noio Point. In grassland, growth form is extremely stunted (5 rather than 15-20 cm height).

Stems used for woven mats and clothing and to strain 'awa.

Fimbristylis dichotoma (L.) Vahl

Indigenous

tall fringe rush

Widespread herb in all ahupua'as at Kaloko, usually where cover is sparse along coast. Occasional at makai edge of rocky strand with low vegetation dominated by 'akulikuli, 'ohelo-kai, or pohuehue. Occasional in naupaka-dominated scrub on sandy beaches. Occasional in strand forest, on Christmas berry-dominated sand or tree heliotrope-dominated pahoehoe. Occasional on pahoehoe around 'akulikuli-kai-dominated anchialine ponds. Uncommon on pahoehoe in coastal fountaingrass grassland.

Scirpus maritimus var. *paludosus* (A. Nels.) Kuk.

Indigenous

makai

Locally abundant herb at wettest sites in marsh: at edge of pond and along channels. In knottgrass-dominated community, or codominant with water hyssop, northwest of and at southeast edge of 'Ai'makapa Fishpond.

GRAMINEAE
(Grass Family)

Cyndon dactylon (L.) Pers.

Historic intro.

Bermuda grass, manienie, mahiki

Uncommon low herb in dry open habitats: on barren inland 'a'a, fountaingrass grassland on pahoehoe, and strand. On sand beaches or coastal pahoehoe and back of strand in low scrub, shrub and scrub forest vegetation, all with very low cover. Scattered along Kohanaiki coast, near Kaloko-Honokohau boundary, southern Kaloko, and just south of Honokohau Boat Harbor.

Used for lawns.

Eragrostis tenella (L.) Beauv. ex R. & S.

Historic intro.

Japanese lovegrass

Rare herb on sandy ground along Huehue Ranch Road just southeast of Kaloko Point.

Panicum nubigenum Kunth

Endemic

n.c.n.

Rare herb on barren 'a'a near Queen's Bath at southwest corner of Kaloko ahupua'a.

Paspalum distichum L.

Historic intro.

knottgrass, saltgrass, knottweed

Abundant herb in marshes, dominating marsh vegetation with dense cover (usually 75%) wherever found. Surronding 'Ai'makapa Findpond, extending northwest of pond in drier marshy area, and at 'Ai'opia Fishtrap, and just south of Fishtrap.

Pennisetum setaceum (Forsk.) Chiov.

Historic intro.

fountaingrass

Herb dominant in most inland habitats and throughout Park in all habitats except marsh. Dominant and abundant on pahoehoe in grassland on Ko-hanai-ki and Ke-ala-kehe coast, along jeep road to Kaloko Fishpond, and northwest and southeast of 'Ai'makapa Fishpond to Honokohau Boat Harbor. Codominant and abundant on pahoehoe in inland kiawe savanna in northeast half of Kaloko ahupua'a and just north of Harbor. Dominant and common on pahoehoe and common on pahoehoe at several anchialine ponds halfway between Harbor and Noio Point. Codominant and common on pahoehoe in inland koa-haole scrub east and northeast of Harbor. Occasional and sometimes codominant on pahoehoe in kiawe or milo forest just south of Kaloko Fishpond, just east of 'Ai'makapa Fishpond, and halfway between Harbor and Noio Point. Uncommon to codominant in naupaka scrub on sand or coastal pahoehoe in Ko-hanai-ki ahupua'a, just west of Kaloko fishpond,

and at north edge of entrance to Harbor. Uncommon on sand in shrubby strand along coast road near Wawahi wa'a Point, at northwest corner of Kaloko Point. Uncommon on sand in forested strand along coast road just south of Kaloko Fishpond.

Used as an ornamental. Declared noxious by HDOA.

Rhynchelytrum repens (Willd.) C.E. Hubb.

Historic intro.

Natal redtop

Uncommon but widespread herb in sparse fountaingrass grassland and kiawe/fountaingrass savana on pahoehoe. On southeast side of Kaloko Fishpond. Also just south of entrance to Honokohau Boat Harbor and near Noio Point.

Used for forage and as an ornamental

Sporobolus virginicus (L.) Kunth

Indigenous

'aki'aki, beach dropseed, seashore rushgrass, manienie-maoli, anienie-'aki'aki

Common herb along coastline in south half of Park. Dominant on pahoehoe at one anchialine pond just north of entrance to Honokohau Boat Harbor. Abundant in sandy back of strand at makai edge of 'Ai'makapa Fishpond and northwest extension of marsh. At one such site, growing to height of 2 m. in milo trees, presumably lifted up by wave action during storm. Common on pahoehoe at northwest limit of marshy meadow northwest of 'Ai'makapa Fishpond. Common on 'a'a and pahoehoe strand at extreme northwest corner of Honokohau ahupua'a. Occasional on sandy strand southwest of 'Ai'makapa Fishpond. Occasional in weedy low vegetation on pahoehoe just south of entrance to Honokohau Boat Harbor.

LILIACEAE
(Lily Family)

Aloe vera L.

Historic intro.

panini'awa'awa, aloe, star cactus

Rare succulent herb: one individual planted on pahoehoe just south of entrance to Honokohau Boat Harbor. Used as an ornamental. Used medicinally for burns, athlete's foot, and arthritis.

PALMAE
(Palm Family)

Cocos nucifera L.

Polynes. intro.

coconut, niu, coco palm

Occasional tree along coastline near sites of habitation. Dominant on sand around former dwellings just south of Kaloko Fishpond. Occasional on pahoehoe at south edge of 'Ai'makapa Fishpond and just north of entrance to Honokohau Boat Harbor. Uncommon on sandy strand at south end of 'Ai'makapa Fishpond and south of entrance to Harbor. A few individuals planted in pahoehoe just south of entrance to Harbor.

Used as an ornamental. Wood used for spears, posts, and furniture. Leaves used for thatch and woven baskets, fans, brooms, and clothing. Buds used for food, sugar, and distilled drink. Nuts used for food, fuel, ointment, and containers. Husks used for cordage.

Phoenix sp.

Historic intro.

n.c.n.

Rare: one 1.5 m tall individual just behind strand on sandy soil at edge of milo strand forest halfway between Kaloko-Honokohau ahupua'a boundary and 'Ai'makapa Fishpond.

PANDANACEAE
(Screw Pine Family)

Pandanus tectorius Parkinson ex Z.

Indigenous

hala, pu-hala, pandanus, screw pine

Rare: one sapling at small anchialine pond on coastal pahoehoe halfway between Honokohau Boat Harbor and Noio Point. Used as an ornamental. Leaves used for thatch and woven mats, baskets, fans, sandals, pillows, and balls.

Aerial roots used medicinally, both externally and internally. Flowers used in India for perfume and medicine. Fruit used for leis, brushes, and food.

RUPPIACEAE
(Ruppia Family)

Ruppia maritima var. *pacifica* St. John & Fosb.

Indigenous

sea tassel, widgeon grass

Rare aquatic herb: occasional on pahoehoe in one tiny pond in knottgrass/water hyssop marshy meadow back of strand halfway between 'Ai'makapa Fishpond and Kaloko-Honokohau ahupua'a boundary.

Dicotyledones

AIZOACEAE
(Carpetweed Family)

Sesuvium portulacastrum (L.) L.

Indigenous

'akalikuli, sea purslane

Succulent low herb dominant in low strand vegetation and widespread in coastal habitats. Occasional to abundant and often dominant on rather sparsely vegetated sandy or basalt strand north and south of Kaloko Fishpond, at northwest corner of Honokohau ahupua'a, and halfway between Honokohau Boat Harbor and Noio Point. Uncommon to common on pahoehoe at anchialine ponds. Occasional near makai edge of knottgrass-dominated marsh at south of 'Ai'makapa Fishpond and northwest limit of associated marshy meadow. Occasional on sandy strand in naupaka scrub in Ko-hanai-ki ahupua'a and south end of long beach in Honokohau Bay. Uncommon on sand or basalt in forested strand between Kaloko Fishpond and Kaloko Point and along north half of coast of Honokohau ahupua'a.

AMARANTHACEAE
(Amaranthus family)

Amaranthus lividus ssp. *polygonoides* (Mog.) Probst

Historic intro.

n.c.n.

Rare herb: uncommon on sparsely vegetated sandy beach halfway between Wahahi wa'a Point and Ko-hanai-ki-Kaloko ahupua'a boundary.

ANACARDIACEAE
(Mango family)

Schinus terebinthifolius Raddi

Historic intro.

Christmas berry, Brazilian peppertree, nani-o-Hilo, wilelaiki

Common and widespread shrub in almost all habitats and a dominant of inland scrub. Dominant and abundant on pahoehoe and 'a'a in inland scrub at northwest corner of Honokohau ahupua'a; uncommon in koa-haole-dominated inland scrub in southeast third of Honokohau ahupua'a. Occasional to common and sometimes dominant on sand or basalt along coast road or at back of strand in strand forest in Ko-hanai-ki ahupua'a, from south end of Kaloko Fishpond to northwest corner of Honokohau ahupua'a, and at south end of long beach at Honokohau Bay. Occasional and sometimes dominant on pahoehoe at sparsely vegetated anchialine ponds at southwest corner of Kaloko ahupua'a, and in Kealakehe ahupua'a. Occasional on pahoehoe in kiawe/fountaingrass savanna in northeast half of Kaloko ahupua'a and just north of Honokohau Boat Harbor. Occasional on pahoehoe in fountaingrass grassland along deep road to Kaloko Fishpond, northwest and southeast of 'Ai'makapa Fishpond to Harbor, and just south of Harbor. Occasional in shrubby sandy strand near Ko-hanai-ki-Kaloko ahupua'a boundary and Kaloko Point. Occasional on pahoehoe in dense inland forest on mauka edge of 'Ai'makapa Fishpond and just north of entrance to Harbor. Uncommon in knottgrass marsh at southwest end of 'Ai'makapa Fishpond.

Red fruit clusters used in leis and wreaths. Heavy infestations could disturb archaeological sites. Declared noxious by HDOA.

APOCYNACEAE
(Periwinkle Family)

Catharanthus roseus (L.) G. Don

Historic intro.

kihapai, red periwinkle, Madagascar periwinkle

Uncommon but widespread herb in Kaloko and Honokohau 'ahupua'as. Along sandy coast road at back of shrubby strand north of Kaloko fishpond and near Kaloko Point. On coastal pahoehoe just north and just south of Kaloko Fishpond and just

north of entrance to Honokohau Boat Harbor. In kiawe/fountaingrass inland savanna on pahoehoe near jeep road to Kaloko Fishpond. In fountaingrass grassland on pahoehoe northwest and soatheast of 'Ai'makapa Fishpond.

Used as an ornamental. Said to be medicinal, but injurious to cattle.

BATIDACEAE
(Batis family)

Batis maritima L.

Historic intro.

'akulikuli-kai, saltwort, pickleweed

Succulent herb dominant at anchialine ponds and common in coastal habitats from Kaloko Fishpond southward. Dominant and abundant on pahoehoe at most anchialine ponds in Park: just northwest of Kaloko Fishpond, just north of entrance to Honokohau Boat Harbor, and halfway between Harbor and Noio Point. Common and occasionally dominant in knottgrass or milo-dominated marsh just northwest of Kaloko Fishpond, northwest of 'Ai'makapa Fishpond to limit of marshy meadow, and at southwest edge of 'Ai'makapa Fishpond. Common and occasionally dominant on pahoehoe in 'akulikuli-dominated low strand vegetation just south and southwest of Kaloko Fishpond and near northwest corner of Honokohau ahupua'a. Occasional and sometimes co-dominant on coastal pahoehoe in naupaka scrub northwest of Kaloko Fishpond and just north of entrance to Harbor. Uncommon to occasional on pahoehoe or sand in coastal forest just south of Kaloko Fishpond, northeast of Kaloko Point, halfway between 'Ai'makapa Fishpond and Kaloko-Honokohau ahupua'a boundary, near mouth of 'Ai'makapa Fishpond, and halfway between Harbor and Noio Point.

Used in West Indies in soap and glassmaking; leaves used for food and medicine.

BORAGINACEAE
(Heliotrope Family)

Cordia subcordata Lam.

Polynes. intro.

Uncommon tree in densely vegetated coastal habitats in northern Kaloko ahupaa'a. Locally common on shrubby tree heliotrope-dominated sandy beach just south of Kaloko-Ko-hanai-ki ahupua'a bonndary; uncommon on pahoehoe at 'akulikuli-kai-dominated anchialine pond northwest of Kaloko Fishpond; in sandy vicinity of former dwellings just southwest of Kaloko Fishpond; and uncommon on pahoehoe in tree-heliotrope-dominated forest back of strand southwest of those dwellings.

Used as a shade tree and for leis. Wood used for dishes and calabashes.

Heliotropium anomalum var. *argenteum* Gray

Indigenous

hinahina-ku-kahakai

Rare herb: one individual at sparsely vegetated sandy beach halfway between Wawahi wa'a Point and Ko-hanai-ki-Kaloko ahupua'a boundary, and one small clustser of plants on sandy ground in opening in milo strand forest at Kaloko-Honokohau boundary.

Used for leis and for tea.

Heliotropium curassavicum L.

Indigenous

nena, kipukai, hinahina, seaside heliotrope

Rare prostrate herb: uncommon in open sandy ground near former dwellings just south of Kaloko Fishpond.

Used for tea.

Tournefortia argentea L. f.

Historic intro.

tree heliotrope, velvet leaf

Dominant tree in strand forest and shrubby strand and found in all strand communities. Dominant and abundant on sand, pahoehoe, and 'a'a in strand forest and occasional on sand in milo, kiawe, and Christmas berry-dominated strand forest between Kaloko Fishpond and Kaloko Point, between Kaloko-Honokohau ahupua'a boundary and 'Ai'makapa Fishpond, and at south end of long beach at Honokohau Bay. Dominant and abundant in shrubby sandy strand and common in naupaka and kiawe-dominated shrubby sandy strand between Wawahi wa'a Point and Kaloko Fishpond, and southeast of Kaloko Point. Occasional in coastal naupaka scrub on pahoehoe or sand just northwest of Kaloko Fishpond and just south of 'Ai' makapa Fishpond. Occasional on 'a'a, pahoehoe, or

sand with low strand vegetation just southwest of Kaloko Fishpond, at Kaloko-Honokohau ahupua'a boundary, and south of Honokohau Boat Harbor,

Used for shade, greens.

CACTACEAE
(Cactus Family)

Opuntia megacantha Salm-Dyck

Historic intro.

pa-nini, papipi, prickly pear

Rare: one individual planted in pahoehoe just south of entrance to Honokohau Boat Harbor.

Fruits used for food and fermented drink.

CAPPARACEAE
(Caper Family)

Capparis sandwichiana DC.

Endemic

maiapilo, pua-pilo, native caper

Uncommon but widespread sprawling shrub. Locally common on pahoehoe slope on mauka Side of 'Ai'makapa Fishpond. Uncommon on pahoehoe in fonntaingrass grassland in Ko-hanai-ki ahupua'a, northwest and southeast of 'Ai'makapa Fishpond to Honokohau Boat Harbor, and just south of entrance to Harbor. Uncommon on pahoehoe in inland kiawe/fountaingrass savanna in northeast half of Kaloko ahupua'a. Uncommon on sand or pahoehoe in coastal naupaka scrub or shrub vegetation just south of Wawahi wa'a Point and just northwest of Kaloko Fishpond. Uncommon on sand or pahoehoe in strand forest between Kaloko Fishpond and Kaloko Point.

Used medicinally for broken bones.

CHENOPODIACEAE
(Goosefoot Family)

Chenopodium ambrosioides L.

Historic intro.

Mexican tea

Rare herb: uncommon in sparsely vegetated coastal fountaingrass grassland on pahoehoe just south of entrance to Honokohau Boat Harbor.

Used elsewhere for greens, tea, and medicine.

Chenopodium murale L.

Historic intro.

nettle-leaved goosefoot

Widespread but uncommon herb in sandy coastal habitats. On sandy beaches north of Kaloko Fishpond, at Kaloko Point and south of Honokohau Boat Harbor. Along coast road on sandy ground back of strand near Wawahi wa'a Point and south of Kaloko Fishpond. On coastal pahoehoe halfway between Harbor and Noio Point.

COMPOSITAE
(Sunflower family)

Ageratum conyzoides L.

Historic intro.

maile-hohono, ageratum

Rare herb: uncommon in sparsely vegetated coastal fountaingrass grassland on pahoehoe just south of entrance to Honokohau Boat Harbor.

Used ornamentally for greens, tea, and medicine.

Bidens hawaiensis (Gray) Pilger

Endemic

n.c.n.

Rare herb: occasional in fountaingrass grassland on pahoehoe southeast of 'Ai'makapa Fishpond. Growing to height of 2 m.

Pluchea odorata(L.)Cass.

Historic intro.

pluchea, shrubby fleabane, sour bush

Occasional and widespread shrub, occuring in most Park habitats. Occasional in forest along coast road on sand or pahoehoe in Kohanaiki ahupua'a, south of Kaloko Fishpond in Kaloko ahupua'a, and at south end of long beach in Honokohau Bay. Occasional on pahoehoe at sparsely vegetated anchialine ponds in Kealakehe ahupua'a. Occasional along sandy coast road with shrub or scrub vegetation at Wawahi wa'a Point, Kaloko Point, in northwest Honokohau ahupua'a, and at north side of entrance to Honokohau Boat Harbor. Occasional on pahoehoe in kiawe/fountaingrass savanna northwest and southeast of Kaloko Fishpond. Uncommon on pahoehoe in sparsely vegetated fountaingrass grassland in Kohanaiki ahupua'a, along jeep road to Kaloko Fishpond, at

southwest corner of Kaloko ahupua'a, and in Kealakehe ahupua'a. Uncommon on pahoehoe in kiawe forest north of Harbor.

Flowers used for leis and dry arrangements. Declared noxious by HDOA. Heavy infestations could disturb archaeological sites.

Reichardia picroides (L.) Roth

Historic intro.

picridium

Rare herb: a few plants at one site in sparsely vegetated coastal fountaingrass grassland on pahoehoe just south of entrance to Honokohau Boat Harbor.

Tridax procumbens L,

Historic intro.

coat buttons, hierba del torro

Uncommon low herb on pahoehoe in inland kiawe/fountaingrass savanna along jeep road to Kaloko Fishpond and in scarcely vegetated fountaingrass grassland at northwest corner of Honokohau ahupua'a and southeast of 'Ai'makapa Fishpond.

Leaves used in Central America as an insecticide.

CONVOLVULACEAE
(Morning-glory family)

Ipomoea brasiliensis (L.) Sweet

Indigenous

pohuehue, beach morning glory

Uncommon but widespread trailing herb in all strand communities. Uncommon but sometimes abundant and dominant on sandy strand with naupaka scrub just northwest of Kaloko Fishpond, at south end of long beach at Honokohau Bay, and south of Honokohau Boat Harbor. Uncommon but sometimes dominant on sparsely vegetated sand or pahoehoe with low strand vegetation in south Kohanaiki ahupua'a and south of Harbor. Uncommon on sand or 'a'a in forested strand just southwest of Kaloko Fishpond, at Kaloko Point, at northwest corner of Honokohau ahupua'a and at south of and southwest of 'Ai 'makapa Fishpond. Uncommon along sandy coast road in shrubby vegetation from Wawahi wa'a Point to south of Kaloko Point.

Roots and stems used as famine food, although poisonous in quantity. Vines used in fishing; seeds used medicinally as a cathartic.

Ipomoea congesta R. Br.

Indigenous

koali-'awahia, koali-'awa, morning glory

Uncommon herbaceous vine on pahoehoe in inland kiawe/fountaingrass savanna along jeep road to Kaloko Fishpond and in fountaingrass grassland at northwest corner of Honokohau ahupua'a and southeast of 'Ai'makapa Fishpond. Stems and roots used medicinally externally for bruises and broken bones. Vines used as swings.

Jacquemontia sandwicensis Gray

Endemic

pa'u-o-Hi'i-'aka

Widespread but uncommon trailing herb in fairly sparsely vegetated sandy coastal communities of Kohanaiki, Kaloko, and Kealakehe ahupua'as. On sandy beaches in Kaloko and Kohanaiki ahupua'as. Along sandy Huehue Ranch Road east and south of Kaloko Point. In sandy vicinity of former dwellings just south of Ka-ioko Fishpond. Also on coastal pahoehoe just north of entrance to Honokohau Boat Harbor.

CRASSULACEAE
(Orpine Family)

Bryophyllum tubiflorum Harv.

Historic intro.

Rare succulent herb: a few plants on pahoehoe in kiawe/fountaingrass savanna just north of entrance to Honokohau Boat Harbor.

Used as an ornamental.

EUPHORBIACEAE
(Spurge Family)

Euphorbia hirta L.

Historic intro.

garden spurge, hairy spurge, old blood, golondina, koko-kahiki

Uncommon low herb on sand along coast road or on beach in spurse naupaka dominated strand vegetation northwest of Kaloko Fishpond and near Kaloko Point.

Euphorbia prostrata Ait.

Historic intro.

prostrate spurge

Rare low herb: a few individuals on pahoehoe in fountaingrass grassland northwest of 'Ai'makapa Fishpond.

Phyllanthus debilis Klein ex Willd.

Historic intro.

phyllanthus weed

Rare herb: a few individuals in sparsely vegetated fountaingrass grassland on pahoehoe just south of entrance to Honokohau Boat Harbor.

GOODENIACEAE
(Naupaka Family)

Scaevola taccada (Gaertn.) Roxb.

Indigenous

naupaka-kahakai, huahekili

Extremely common and widespread shrub in coastal communities; dominant in strand scrub and shrub. Common and dominant at all strand scrub sites, on fairly sparsely vegetated sand and pahoehoe north of Kaloko Fishpond, at south end of long beach in Honokohau Bay, and on both sides of entrance to Honokohau Boat Harbor. Common to abundant and usually codominant with tree heliotrope on sand at most shrubby strand sites from Wawahi wa'a Point to south of Kaloko Point. Common on sand or basalt at most forested strand sites, in Kohanaiki ahupua'a, between Kaloko Fishpond and Kaloko Point, and from Kaloko-Honokohau ahupua'a boundary to 'Ai'makapa Fishpond. Occasional on coastal pahoehoe in fountaingrass grassland in Kohanaiki ahupua'a and south of Harbor. Occasional on coastal pahoehoe with low strand vegetation at Kohanaiki-Kaloko ahupua'a boundary and northwest corner of Honokohau ahupua'a.

Leaves used medicinally to treat indigestion, and used for poultices. Leaves cooked for greens.

GUTTIFERAE
(Mangosteen Family)

Clusea rosea Jacq.

Historic intro.

copey, scotch attorney, autograph tree

Rare: one sapling planted in sandy ground near former dwellings just south of Kaloko Fishpond.

Leaves, bark, and sap used medicinally. Leaves used in West Indies for playing cards.

LEGUMINOSAE
(Pea family)

Acacia farnesiana (L.) Willd.

Historic intro.

klu, kolu, aroma, popinac

Uncommon but widespread shrub in fairly densely vegetated areas of north half of Park. Occasional on pahoehoe in kiawe/fountaingrass inland savanna in northeast half of Kaloko ahupua'a, Uncommon on sandy shrubland back of strand halfway between Wawahi wa'a Point and Kaloko-Kohanaiki ahupa'a boundary and north of Kaloko Fishpond to ahupua'a boundary. Flowers yield perfume, stems produce a glue. Declared noxious by HDOA. Heavy infestations could disturb archaeological sites.

Cassia leschenaultiana DC.

Historic intro.

partridge pea, lauki

Uncommon subshrub on pahoehoe in more densely vegetated fountaingrass grassland are kiawe/fountaingrass savanna on mauka side of Honokohau ahupua'a and southeast of 'Ai' makapa Fishpond.

Roots used medicinally in India for stomach trouble.

Indigofera suffruticosa Mill.

Historic intro.

kolu, 'iniko, 'inikoa, indigo

Occasional and widespread subshrub on pahoehoe in fountaingrass grassland along jeep road to Kaloko Fishpond, northwest and southeast of 'Ai' makapa Fishpond, and near Noio Point. Also

on pahoehoe in kiawe/fountaingrass savanna on southeast side of Kaloko ahapua'a.

Used elsewhere for dye and fertilizer. Declared noxious by HDOA.

Leucaena leucocephala (Lam.) de Wit

Historic intro.

koa-haole, ekoa, false koa, ipilipil, wild tamarind, lead tree, aroma blanca

Generally uncommon shrub, but widespread and present in all communities except marsh. Codominant and common on pahoehoe in inland scrub in southeastern third of Park. Occasional on pahoehoe in inland kiawe savanna along jeep road to Kaloko Fishpond, at mauka corner of Kaloko-Honokohau ahupua'a boundary, and just north of Honokohau Boat Harbor. Uncommon on pahoehoe in fountaingrass grassland northwest and southeast of 'Ai'makapa Fishpond to Harbor, and just south of entrance to Harbor. Uncommon on sand in sparsely vegetated low strand vegetation along Huehue Ranch Road just south of Kaloko Point and south of Harbor. Uncommon in coastal scrub or shrub vegetation on pahoehoe or sand in Kohanaiki ahupua'a, northwest of Kaloko Fishpond, and southeast of Kaloko Point. Uncommon along sandy coastal road in forested strand between Kaloko Fishpond and Kaloko Point and at southwest corner of Kaloko ahupua'a. Uncommon on pahoehoe in forest at mauka edge of 'Ai'makapa Fishpond and halfway between Harbor and Noio Point. Uncommon on pahoehoe at 'akulikuli-kai-dominated anchialine pond halfway between Harbor and Noio Point. Uncommon on bulldozed 'a'a mauka of 'Ai'makapa Fishpond.

Used for fodder, but can cause hair loss. Seeds used for leis and mats, in West Indies for food. This species could disturb archaeological sites.

Pithecellobium dulce (Roxb.) Benth.

Historic intro.

'opiuma, Madras thorn, Manila tamarind

Rare shrub: uncommon on pahoehoe in sparsely vegetated fountaingrass grassland along jeep road to Kaloko Fishpond.

Used as an ornamental. Wood used for lumber, posts, and fuel. Bark used in Mexico for dye and adhesive glue. Seeds used for leis, Declared noxious by HDOA. This species could disturb archaeological sites.

Prosopis pallida (Humb. & Bonpl. ex Willd.) HBK.

Historic intro.

kiawe, algaroba, mesquite

Dominant tree in inland forest and savanna and common and widespread in nearly all park communities. Dominant and abundant in nearly all inland forest sites, on pahoehoe on south and east sides of Kaloko Fishpond, along northeast border of Kaloko ahupua'a, northwest of and on north, east, and south sides of 'Ai'makapa Fishpond to Honokohau Boat Harbor, and south of Harbor. Dominant and common at all savanna sites, on pahoehoe in northeast half of Kaloko ahupua'a, and just north of Harbor. Occasional and sometimes dominant in forested strand on sand in Kohanaiki ahupua'a and between Kaloko Fishpond and 'Ai'makapa Fishpond. Occasional and sometimes dominant in scrub or shrubby strand vegetation on sand or pahoehoe from south end of Kohanaiki ahupua'a to Kaloko Fishpond, just south of Kaloko Point, and on north side of entrance to Harbor. Occasional on pahoehoe in inland koa-haole scrub in southeast third of Park. Occasional on pahoehoe in fountaingrass grassland at southwest corner of Kaloko ahupua'a, southeast of 'Ai'makapa Fishpond to Harbor, and south of Harbor to Noio Point. Occasional on pahoehoe at 'Akulikuli-kai-dominated anchialine ponds just northwest of Kaloko Fishpond and halfway between Harbor and Noio Point.

Pods used for fodder, wood for fuel, flowers for honey, trees for reforestation. This species could disturb archaeological sites.

Tephrosia purpurea (L.) Pers.

Polynes. intro.

'ahuhu, 'auhuhu, 'auhola, hola, fish poison

Uncommon subshrub on pahoehoe in fountaingrass grassland along jeep road to Kaloko Fishpond and northwest and southeast of 'Ai'makapa Fishpond.

Used to poison fish; used in India as fodder.

LOGANIACEAE
(Strychnine Family)

Buddleja asiatica Lour.

Historic intro.

huelo-'ilio, dogtail, Asiatic butterfly bush, talicnono

Rare shrub: few individuals on pahoehoe in sparsely vegetated fountaingrass grassland along jeep road to Kaloko Fishpond.

Declared noxious by HDOA.

MALVACEAE
(Hibiscus Family)

Sida fallax Walp.

Indigenous

'ilima

Uncommon but widespread small shrub in predominantly inland habitats. Uncommon on pahoehoe in inland fountaingrass grassland along jeep road to Kaloko Fishpond, at southwest corner of Kaloko ahupua'a, and southeast of 'Ai'makapa Fishpond to Honokohau Boat Harbor. Uncommon on pahoehoe in koahaole inland scrub northwest of 'Ai'makapa Fishpond and in southeast third of Park, Uncommon on pahoehoe in kiawe savanna in northeast half of Kaloko ahupua'a. Uncommon in coastal scrub and scrub forest between Wawahi wa'a Point and Kaloko Fishpond.

Used for leis; some forms used medicinally.

Thespesia populnea (L.) Soland. ex Correa

Polynes. intro.

milo, portia-tree

Dominant tree in forested strand and widespread in all coastal communities. Common to abnndant in most forested strand sites and often dominant, on sand or sometimes pahoehoe between Kaloko Fishpond and Kaloko Point and from Kaloko-Honokohau ahupua'a boundary to south end of long beach at Honokohau Bay. Occasional in shrub form in marsh on all sides of 'Ai'makapa Fishpond, extending northwest to end of wet meadow halfway to Kaloko ahupua'a. Common and sometimes dominant on forested pahoehoe northwest and just mauka of 'Ai'makapa Fishpond. Occasional on sand or pahoehoe with low coastal vegetation just south of Kaloko Fishpond and south of Honokohau Boat Harbor. Uncommon on sand or pahoehoe back of strand in scrubby or shrubby strand vegetation at northwest corner of Kaloko ahupua'a and on north side of entrance to Harbor. Uncommon on pahoehoe at sparsely vegetated anchialine pond at northwest corner of Honokohau ahupua'a.

Used for shade. Wood used for calabashes, tannin, dye, medicine, oil, and gum. Young leaves edible.

MORACEAE
(Fig Family)

Ficus benjamina L.

Historic intro.

benjamin tree, weeping fig, waringin

Rare: one sapling planted in sparsely vegetated fountaingrass grassland just south of entrance to Honokohau Boat Harbor.

Used as an ornamental.

MYOPORACEAE
(Naio Family)

Myoporum sandwicense (DC.) Gray ssp. *sandwicense* var. *sandwicense*

Endemic

naio, bastard sandalwood

Uncommon but fairly widespread shrub on strand and in more densely vegetated inland communities in northern half of Park. Occasionally on pahoehoe in kiawe savanna and open forest in northeast half of Kaloko ahupua'a. Uncommon in forested strand along sandy coast road just south of Kaloko Fishpond and at southwest corner of Kaloko ahupua'a. Uncommon on pahoehoe in sparsely vegetated low strand community at northwest corner of Kaloko ahupua'a. Rare on sandy strand with scrub or shrub vegetation in Kohanaiki ahupua'a and southeast of Kaloko Point.

Wood used for house timbers and in the sandalwood trade.

NYCTAGINACEAE
(Four o'clock family)

Boerhavia diffusa L.

Indigenous

alena

Uncommon creeping herb in coastal communities in all ahupua'as but Honokohau and in inland savanna in Kaloko ahupua'a. Uncommon on sandy strand and along coast road in strand scrub, shrub, and forest vegetation north of Kaloko Fishpond, at Kaloko Point, and just south of Honokohau Boat Harbor. Uncommon on pahoehoe in fairly densely vegetated inland kiawe savanna in northeast half of Kaloko ahupua'a. Uncommon on coastal pahoehoe in fountaingrass grassland just south of Harbor.

Roots used medicinaliy. Used as food in Western Pacific.

PAPAVERACEAE
(Poppy Family)

Argemone glauca Pope

Endemic

pua-kala, kala, pokalakala, naule, prickly poppy

Bare herb: a few individuals on pahoehoe in open kiawe/fountaingrass savanna south of Kaloko Fishpond.

Juice used medicinally for toothache, neuralgia, and ulcers.

PASSIFLORACEAE
(Passionflower family)

Passiflora foetida L.

Historic intro.

pohapoha, scarlet-fruited passionflower, love-in-a-mist, running pop

Uncommon herbaceous vine on pahoehoe in fountaingrass grassland and kiawe/fountaingrass savanna along jeep road to Kaloko Fishpond and northwest of 'Ai'makapa Fishpond.

PORTULACACEAE
(Purslane Family)

Portulaca lutea Soland. ex Forst. f.

Indigenons

'ihi, native yellow portulaca

Rare low succulent herb: few individuals on sparsely vegetated coastal pahoehoe halfway between Honokohau Boat Harbor and Noio Point.

Portulaca oleracea L.

Historic intro,

'ihi, 'ihi-'ai, 'akulikuli-lau-li'i, 'akulikuli-kula, common purslane, wild portulaca, pigweed

Uncommon low succulent herb along sandy coast road in open to shrubby strand vegetation dominated by naupaka or pluchea. On Huehue Ranch Road near Kaloko Point.

Used as an ornamental. Used elsewhere as food and fodder.

Portulaca pilosa L.

Historic intro.

'ihi

Uncommon but widespread succulent prostrate herb. Uncommon on pahoehoe in fountaingrass grassland northwest of 'Ai'makapa Fishpond and just south of entrance to Honokohau Boat Harbor. Uncommon on pahoehoe in kiawe savanna in northeast half of Kaloko ahupua'a. Uncommon on pahoehoe in inland koa-haole scrub in southeast quarter of Park. Uncommon along sandy coast road in strand scrub, shrub, and forest vegetation in Kohanaiki ahupua'a and southeast of Kaloko Point.

RHIZOPHORACEAE
(Mangrove Family)

Rhizophora mangle L.

Historic intro.

red mangrove, American mangrove

Dominant tree on marshy border of ponds and occasionally along coastline.

Forming dense 6 m high forest surrounding Kaloko Fishpond and extending northwest of pond. Dominant and forming small patch of forest on sandy strand halfway between 'Ai'makapa Fishpond and Kaloko-Honokohau ahupua'a boundary, Oc-

casional in knottgrass marsh at south of 'Ai'makapa Fishpond. Uncommon on pahoehoe at 'akulikuli-kai-dominated anchialine ponds northwest of Kaloko Fishpond and halfway between Honokohau Boat Harbor and Noio Point. Uncommon at seedling or sapling stage on basalt strand in 'akulikuli-dominated low vegetation or makai of all vegetation just south of Kaloko Fishpond and in northwest corner of Honokohau ahupua'a.

Used elsewhere for fuel, building, tannin, dye, and famine food. Declared a prioritized weed by HDOA. This species could disturb archaeological sites.

RUBIACEAE
(Coffee Family)

Canthium odoratum (Forst. f.) Seem.

Indigenous

alahe'e, walahe'e, plectronia

Uncommon shrub on more densely vegetated inland pahoehoe in kiawe/fountaingrass savanna on southeast side of Kaloko ahupua'a and in fountaingrass grassland southeast of 'Ai'makapa Fishpond.

Morinda citrifolia L.

Polynes. intro.

noni, Indian mulberry

Uncommon but widespread shrub. Occasional on pahoehoe in fountaingrass grassland southeast of 'Ai'makapa Fishpond to Honokohau Boat Harbor and near Noio Point. Uncommon on pahoehoe in inland scrub northwest of 'Ai'makapa Fishpond and along central mauka border of Honokohau ahupua'a. Uncommon on pahoehoe in kiawe savanna along jeep road to Kaloko Fishpond and at Maliu Point. Uncommon on pahoehoe in inland milo and kiawe forest at mauka edge of 'Ai'makapa Fishpond and north of Harbor. Uncommon in sandy milo and kiawe strand forest at Kaloko-Honokohau ahupua'a boundary and at south end of long beach at Honokohau Bay. Uncommon on sandy strand in scrub or shrub vegetation northwest of Kaloko Fishpond and along beach south of 'Ai'makapa Fishpond.

Bark and root used for dye; fruit used as famine food. Bark, leaves, and fruit used medicinally. this species could disturb archaeological sites.

SCROPHULARIACEAE
(Figwort Family)

Bacopa monnieria (L.) Wettst.

Indigenous

water hyssop, herpestis

Abundant and often dominant herb in drier marsh areas on thin organic matter overlying pahoehoe. Dominant or in knottgrass-dominated marsh halfway between Kaloko-Honokohau ahupua'a boundary and 'Ai'makapa Fishpond. Also uncommon on pahoehoe at 'akulikuli-kai-dominated anchialine pond northwest of Kaloko Fishpond and in 'akulikuli-dominated native low coastal vegetation on pahoehoe just southwest of Kaloko Fishpond.

SOLANACEAE
(Nightshade Family)

Lycium sandwicense Gray

Indigenous

'Ohelo-kai, 'ae'ae, 'akulikuli-'ae'ae, 'akulikuli-'ohelo

Locally common subshrub with low vegetation on coastal basalt in northern half of Park. Dominant on 'a'a strand just south of Kaloko-Honokohau ahupua'a boundary, common in 'akulikuli-dominated pahoehoe strand just southwest of Kaloko Fishpond, and occasional at 'akulikuli-kai-dominated anchialine pond northwest of Kaloko Fishpond.

STERCULIACEAE
(Cocoa Family)

Waltheria americana L.

Indigenous

hi'a-loa, 'uha-loa, kanaka-loa

Uncommon but widespread subshrub, especially in grassland, savanna, and coastal scrub. Occasional on pahoehoe in inland koa-haole scrub southeast of 'Ai'makapa Fishpond. Uncommon on pahoehoe in fountaingrass grassland in Kohanaiki ahupua'a, northwest and southeast of 'Ai'makapa Fishpond to Honokohau Boat Harbor, and in Kealakehe ahupua'a. Uncommon on pahoehoe in inland kiawe savanna in northeast half of Kaloko ahupua'a. Uncommon on sand and pahoehoe in rather sparsely vegetated coastal scrub and shrub

vegetation in Kohanaiki ahupua'a, just northwest of Kaloko Fishpond, near Kaloko Point, and at north side of entrance to Harbor. Also uncommon on nearly barren 'a'a at northwest corner of Honokohau ahupua'a.

Juice of root used medicinally as pain reliever, e.g., sore throats.

VERBENACEAE
(Verbena Family)

Lantana camara L.

Historic intro.

lantana, lakana, mikinolia-hihiu

Uncommon but widespread low shrub on pahoehoe in central half of Park. Occasional in rather dense kiawe and milo forests at northeast edge of 'Ai'makapa Fishpond. Uncommon in fountaingrass grassland along jeep road to Kaloko Fishpond and in northwest quarter of Honokohau ahupua'a. Uncommon in kiawe/fountaingrass savanna on southeast side of Kaloko ahupua'a. Also along sandy Huehue Ranch Road southeast of Kaloko Point.

Used as an ornamental. Declared noxious by HDOA.

ZYGOPHYLLACEAE
(Tribulus Family)

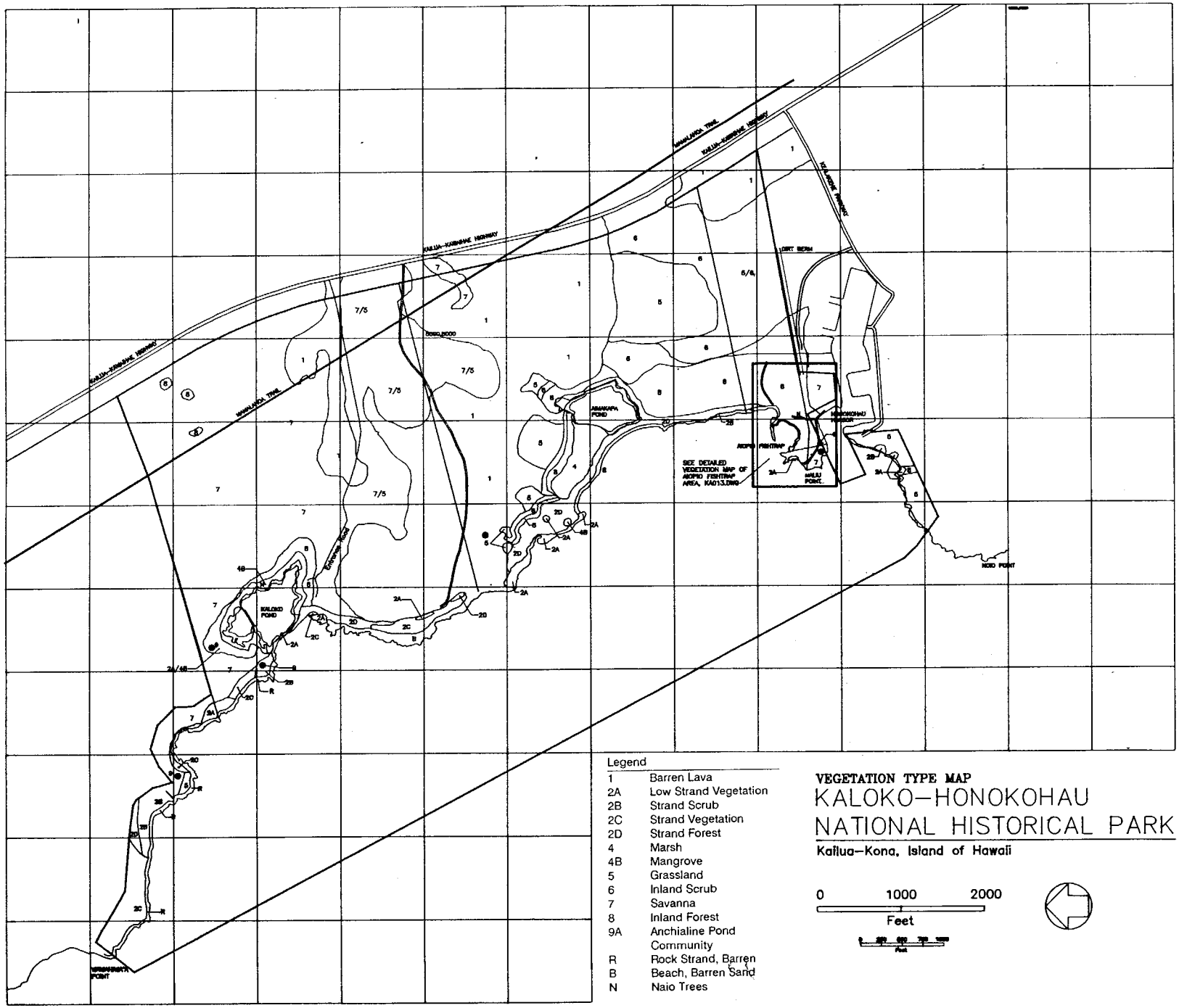
Tribulus terrestris L.

Historic intro.

puncture vine

Uncommon prostrate herb in sparsely vegetated coastal habitats: on sandy Huehue Ranch Road just south of Kaloko Point and on weedy pahoehoe and two small sand beaches just south of entrance to Honokohau Boat Harbor.

Declared noxious by HDOA.



Legend

1	Barren Lava
2A	Low Strand Vegetation
2B	Strand Scrub
2C	Strand Vegetation
2D	Strand Forest
4	Marsh
4B	Mangrove
5	Grassland
6	Inland Scrub
7	Savanna
8	Inland Forest
9A	Anchialine Pond Community
R	Rock Strand, Barren
B	Beach, Barren Sand
N	Naio Trees

VEGETATION TYPE MAP

KALOKO–HONOKOHAU NATIONAL HISTORICAL PARK

Kailua–Kona, Island of Hawaii

0 1000 2000

Feet