

Botanical Survey of Proposed Facilities and Access Roads Hawai`i Experimental Tropical Forest, Laupāhoehoe, Hawai`i

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INTRODUCTION

A botanical survey of areas proposed for the educational and science facilities and access roads of the Hawai`i Experimental Tropical Forest, Laupāhoehoe, Hawai`i Island, was conducted during four site visits, September-November, 2010. The survey included an inventory of native and non-native vascular plants with a primary focus to detect endangered, threatened, candidate, or species of concern. Because of the low diversity and abundance of native plant species in the project area, locally significant native plant species and their locations are described for their protection during construction and development of facilities and roads.

METHODS

A pre-field review was conducted to reveal historical collections or observations of threatened, endangered, or candidate plant species, as well as U.S. Fish and Wildlife Service (FWS) and Hawai`i state species of concern, potentially found in the target survey areas. The pre-field review was also carried out to locate critical habitat for listed species, relative to proposed facility locations and road alignments. References consulted were the November 3, 2010 U.S. Fish and Wildlife Service list of federal threatened, endangered, candidate, and species of concern plants for Hawai`i, the Hawai`i Department of Land and Natural Resources website (<http://www.state.hi.us/dlnr/dofaw/pubs/TEplant.html>) for state listed species, the Hawai`i State Natural Heritage database for historic plant locations and critical habitat, and a 1982 Hawai`i Division of Forestry and Wildlife report, "A Botanical Survey of the Proposed Laupāhoehoe Natural Area Reserve, Hawai`i."

A level-5 survey of vascular plants was conducted on September 3, 2010 in the development area and along the access road (10-25 m on either side of from the flagged center line) to the development area from Blair Road. A level-5 survey was also conducted on stream drainages of Parcels 14, 16, and 82 on October 30, 2010 because of the occurrence of native plant species and thus habitat for listed species. Level-3 and level-4 surveys were conducted in the abandoned cane field sections of Parcels 14, 16, and 82 adjacent to the drainages because of the extreme paucity of native plant species and thus, by inference, suitable habitat for native species and listed species. Planted ornamentals at the buildings on these parcels were not included in the survey. A level-4 survey was conducted of one of the proposed access roads (Alternative 3 on the FEFT Laupāhoehoe—Infrastructure Planning Map Revised 9-16-20101 jwc) on November 4 and 14, 2010, 10-25 m on either side of from the flagged center line, depending on topography and adjacent property boundaries.

Flowering plant nomenclature followed that W.L. Wagner, D.R. Herbst, and S.H. Sohmer, 1999, *Manual of the Flowering Plants of Hawai`i, Revised Edition*, University of Hawai` Press.

Fern and fern ally nomenclature followed that of D.D. Palmer, 2003, *Hawai'i's Ferns and Fern Allies*, University of Hawai'i Press.

RESULTS

Pre-field Review

No threatened, endangered, or candidate plant species are known from the project area. However, there are historical records of seven endangered species from nearby areas including the Kapili drainage (*Phyllostegia parviflora* var. *gabriuscula*) and the state Laupāhoehoe Natural Area Reserve (NAR) (*Clermontia peleana*, *Cyanea platyphylla*, *Cyrtandra giffardii*, *C. tintinnabula*, *Huperzia manni*, and *Phyllostegia warshaueri*). In addition, four candidate endangered species (*Joinvillea ascendens*, *Phyllostegia floribunda*, *P. brevidens*, and *Platydesma remy*) were observed in the NAR. All of the above listed species in the NAR except *Clermontia peleana* were found as recently as 1982.

One US Fish and Wildlife species of concern (*Deparia ka'ala'ana*) was historically found near the project area and outside the NAR. Eight other Fish and Wildlife Service or Hawai'i state species of concern were found in Laupāhoehoe NAR in 1982: *Asplenium schizophyllum*, *Cyanea tritomantha*, *Embelia pacifica*, *Phyllostegia vestita*, *Phytolacca sandwicensis*, *Stenogyne macrantha*, *S. scrophularioides*, and *Trematolobelia grandifolia*.

Critical habitat does not overlay any part of the project area. However, there is critical habitat in the Laupāhoehoe NAR adjacent to the development area for *Clermontia peleana*, *Cyrtandra giffardii*, *C. tintinnabula*, *Cyanea platyphylla*, and *Phyllostegia warschaueri*.

Field Survey

Listed species and species of concern

No federal or state threatened, endangered, or candidate plant species were observed in the development area, access alignment in the state leased land leading to the development area, parcels 14, 16, 82, and Alternate 3 access alignment. In addition, no federal or state species of concern were found in these areas.

Fifteen of the 21 listed and rare species historically found near the area are members of six speciose genera with complex and still unfolding systematic treatments, a likely context for uncertain identification or misidentification. These include the genera *Asplenium*, *Clermontia*, *Cyanea*, *Cyrtandra*, *Phyllostegia*, and *Stenogyne*. The possibility of misidentification was very low in these systematically difficult genera during the survey because these taxa were rarely encountered. No individuals of *Cyanea*, *Cyrtandra*, *Phyllostegia*, or *Stenogyne* were found (Table 1). The one individual of *Asplenium* found in the project area, *Asplenium contiguum*, is highly distinct morphologically from *A. schizophyllum*, a species of concern. One individual plant of *Clermontia* was found during survey work, *Clermontia parviflora*, probably the most common *Clermontia* species on the windward side of Hawai'i Island. Diagnostic flowers and fruits were present.

Vegetation and Plant Species

Development area. This degraded, lowland *Metrosideros polymorpha*/*Acacia koa* rain forest site of approximately 1.5 acres is characterized by scattered native trees (*M. polymorpha* and occasional *A. koa*), tree ferns (*Cibotium* spp.), dense stands of planted and invasive trees and shrubs (*Toona ciliata*, *Ficus microphylla*, *Psidium cattleianum*, and *Clidemia hirta*), and open areas dominated by alien grasses, forbs, and ferns. There is very little or no regeneration of native tree species. *T. ciliata*, *P. cattleianum*, and *C. hirta* are noticeably regenerating and undoubtedly spreading. Native ferns and shrubs occur largely as epiphytes or on nurse logs or large, moss-covered rocks.

A total of 22 native vascular plants were found including six woody plant species, 12 fern or fern ally species, and one sedge (Table 1). Thirty-nine alien trees, shrubs, and herbaceous plant species were observed.

Parcels 14, 16, and 82. The three contiguous parcels are former sugar cane fields; cane farming was discontinued in Hāmākua in 1993. Alien grasses dominate the level, formerly cultivated area of the parcels, with, nearly monospecific stands of the tall alien grass *Panicum maximum* in some areas and mixed stands of mostly *Schizachyrium condensatum* and *Panicum repens* in other areas. The only native plants observed in the former cane fields were a few individuals of *M. polymorpha*, the fern *Pteridium aquilinum*, and planted *A. koa*. The deeply dissected stream courses (locally called gullies) were forested with scattered, emergent *M. polymorpha* and a dense understory of *Psidium cattleianum*, *P. guajava*, *Syzygium jambos*, *Clidemia hirta*, and other alien plant species.

Fifteen native vascular plant species were inventoried including five woody plants, nine ferns or fern allies, and one sedge (Table 1). Nearly all the native plant species found on the parcels were located in the drainages as scattered individuals typically growing epiphytically or on wet, rock faces. A total of 69 alien vascular plant species were found.

Access alignment in leased state land. The proposed access between Blair Road and the development area passes through degraded *M. polymorpha*/*A. koa* rain forest with scattered *M. polymorpha* trees and dense stands of invasive trees and shrubs, particularly guava (*Psidium* spp.), as well as small gaps with alien herbaceous pasture vegetation.

Eight native vascular plants were encountered. The abundance and diversity of native plant species is lower than in the adjacent development area because of the density of non-native understory woody vegetation and the paucity of nurse logs and host *M. polymorpha* and *C. glaucum* tree ferns as substrates for epiphytes. Eighteen non-native species were also inventoried.

Access alignment, Alternative 3. This alignment passed through *Eucalyptus* plantations with little understory, open cattle pastures dominated by non-native grasses and forbs, and gulches dominated by alien trees but with an admixture of scattered native trees, tree ferns, and nurse logs supporting native scattered native epiphytes. Because of its much greater length and habitat diversity, the access for Alternative 3 supported a much higher number of plant species than the access between Blair Road and the development area: 21 native plant species including six tree and

shrub species, 12 native fern/fern allies, and one native sedge. There were 12 non-native woody plants including plantation plantings and 43 alien herbaceous species.

DISCUSSION

Although no threatened, endangered, or candidate species or species of concern were found in the proposed facility and access locations, scattered native plants were encountered. Some of these are uncommon or rare species, at least locally in the Hāmākua area. These species are described below for their protection during development and construction of facilities and access roads. In the development area, most native species were found on nurse logs under closed canopy forest. Several individuals of an uncommon tree species, *Pisonia umbellifera*, are found on the makai (coastal) periphery of the development area. Older trees support a rich flora of epiphytic native ferns. In the deepest gulch of the proposed alignment for Alternative 3, the flagged center line lies on top of a cluster of native trees including *Psychotria hawaiiensis*, *Acacia koa*, and the uncommon *Antidesma platyphyllum*.

Table 1. Presence of vascular plant species located in botanical surveys, September 3, October 30, November 4, and November 19, 2010, HETF facility\y sites and access road alignments.

SPECIES BINOMIAL	COMMON NAME	DEVELOPMENT AREA	PARCELS 14,16, 82	ACCESS ALT. 3	ACCESS (LEASED LAND)
Native Woody Plants					
<i>Acacia koa</i>	koa	X	X	X	
<i>Antidesma platyphyllum</i>	hame			X	
<i>Freycinetia arborea</i>	`ie`ie			X	
<i>Clermontia parviflora</i>	`ōha wai	X			
<i>Coprosma pubens</i>	pilo	X			
<i>Metrosideros polymorpha</i>	`ōhi`a lehua	X	X	X	X
<i>Perottetia sandwicensis</i>	olomea	X			
<i>Pisonia umbellifera</i>	pāpala kēpau		X		
<i>Psychotria hawaiiensis</i>	kōpiko	X	X	X	
<i>Rhus sandwicensis</i>	neleau		X		
<i>Vaccinium calycinum</i>	`ōhelo			X	
Native Ferns, Herbs, and Sedges					
<i>Adneophorus tamariscinus</i>	wahine noho mauna	X	X	X	
<i>Asplenium contiguum</i>		X		X	X
<i>Cibotium glaucum</i>	hāpu`u pulu	X	X	X	X
<i>Cibotium menziesii</i>	hāpu`u `i`i	X			
<i>Cyperus polystachyos</i>		X	X	X	X
<i>Dicranopteris linearis</i>	uluhe	X	X	X	X
<i>Elaphoglossum wawrae</i>	hoe a Māui	X	X		X
<i>Fimbrystilis dichotoma</i>		X			
<i>Gnaphalium sandwicensium</i>	`ena`ena		X		
<i>Lepisorus thunbergiana</i>	pākahakaha		X	X	
<i>Mecodium recurvum</i>	`ōhi`a kū	X			
<i>Lycopodiella cernua</i>	wāwae`ioloe			X	
<i>Microlepia strigosa</i>	palapalai		X	X	
<i>Nephrolepis cordifolia</i>		X		X	X
<i>Nephrolepis exaltata</i>	`ōkupukupu	X		X	X
<i>Peperomia cookiana</i>	`ala`ala wainui	X			
<i>Peperomia membranaceum</i>	`ala`ala wainui	X			
<i>Psilotum complanatum</i>	moa	X			
<i>Psilotum nudum</i>	moa	X	X	X	
<i>Pteridium aquilinum var. decompositum</i>	kīlau		X		
<i>Sphaerocionium lanceolatum</i>	palai hinahina	X		X	
<i>Sphenomeris chinensis</i>	pala`ā		X	X	

SPECIES BINOMIAL	COMMON NAME	DEVELOP- MENT AREA	PARCELS 14,16, 82	ACCESS ALT. 3	ACCESS (LEASED LAND)
Non-native Woody Plants					
<i>Aleurites moluccana</i> (Polynesian introduction)	kukui		X	X	
<i>Archontophoenix alexandrae</i>	Alexander palm		X		
<i>Buddleja asiatica</i>	butterfly bush			X	
<i>Casuarina equisetifolia</i>	ironwood			X	
<i>Clidemia hirta</i>	Koster's curse	X	X	X	X
<i>Cordyline fruticosa</i> (Polynesian introduction.)	tī		X		
<i>Eucalyptus spp.</i>			X	X	
<i>Ficus macrophylla</i>	Moreton Bay fig	X			X
<i>Grevillea robusta</i>	silky oak	X	X		
<i>Melaleuca quinquenervia</i>	paperbark		X		
<i>Macadamia integrifolia</i>	macnut		X		
<i>Melastoma candidum</i>	malabar melastome			X	
<i>Mimosa pudica</i>	sleeping grass		X	X	
<i>Pluchea carolinensis</i>	sourbush		X		
<i>Psidium cattleianum</i>	strawberry guava	X	X	X	X
<i>Psidium guajava</i>	common guava	X	X		X
<i>Rubus rosifolius</i>	thimbleberry	X	X	X	X
<i>Syzygium jambos</i>	rose apple		X		
<i>Tibouchina herbacea</i>	cane tibouchina	X	X	X	
<i>Tibouchina urvilleana</i>	princess flower		X		
<i>Toona ciliata</i>	Australian red cedar	X			
<i>Verbena littoralis</i>	`ōwī	X	X	X	
<i>Unidentified bamboo</i>				X	
Non-native Ferns, Herbs, Sedges, and Grasses					
<i>Adiantum hispidulum</i>	rough maidenhair	X	X		X
<i>Adiantum raddianum</i>			X	X	
<i>Ageratina riparia</i>	Hāmāka pāmakani		X	X	
<i>Ageratum conyzoides</i>	maile honohono		X	X	X

SPECIES BINOMIAL	COMMON NAME	DEVELOPMENT AREA	PARCELS 14,16, 82	ACCESS ALT. 3	ACCESS (LEASED LAND)
Non-native Ferns, Herbs, Sedges, and Grasses (continued)					
<i>Axonopus fissifolius</i>	carpet grass	X	X	X	X
<i>Andropogon virginicus</i>	broomsedge		X	X	
<i>Arundina graminifolia</i>	bamboo orchid			X	
<i>Begonia hirtella</i>	pīkonia		X	X	
<i>Bidens pilosa</i>	Spanish needle				
<i>Blechnum appendiculatum</i>		X	X	X	X
<i>Chamaecrista nictitans</i>	partridge pea		X	X	
<i>Chamaesyce hyssopifolia</i>			X		
<i>Christella dentata</i>	pai`i`ihā	X	X		X
<i>Christella parasitica</i>		X	X	X	
<i>Commelina diffusa</i>	honohono	X	X	X	X
<i>Conyza canadensis</i>	horseweed		X		
<i>Crassocephalum crepidoides</i>			X		
<i>Crotularia pallida</i>	smooth rattlepod		X		
<i>Crocsmia x croscomiiflora</i>	monbretia			X	
<i>Cuphea carthagenesis</i>	tarweed	X	X	X	X
<i>Cynodn dactylon</i>	Bermuda grass			X	
<i>Cymbidium cf. dayanum</i>	cymbidium orchid	X	X	X	
<i>Cyperus haspan</i>		X	X	X	X
<i>Cyperus brevifolius</i>		X	X	X	X
<i>Desmodium incanum</i>	Spanish clover		X	X	
<i>Desmodium intortum</i>					
<i>Desmodium triflorum</i>			X	X	
<i>Digitaria ciliaris</i>	Henry's crab grass	X		X	X
<i>Digitaria setigera</i> (possibly indigenous cf Wagner et all 1999?)	kūkae pua`a		X		
<i>Drymaria cordata</i>	pipili	X	X	X	X
<i>Ehrharta stipoides</i>	meadow ricegrass	X			X
<i>Emelia coccinea</i>	Flora's paintbrush		X		
<i>Erechtites valerianifolia</i>	fireweed		X		
<i>Geranium carolinianum</i>	Carolina crane's bill	X			
<i>Gnaphalium japonicum</i>	cudweed		X		
<i>Hedychium coronarium</i>	white ginger		X	X	

SPECIES BINOMIAL	COMMON NAME	DEVELOP- MENT AREA	PARCELS 14,16, 82	ACCESS ALT. 3	ACCESS (LEASED LAND)
Non-native Ferns, Herbs, Sedges, and Grasses (continued)					
<i>Hedychium gardnerianum</i>	kahili ginger	X			
<i>Hedychium flavescens</i>	yellow ginger		X		
<i>Hydrocotyle sibthorpioides</i>	marsh pennywort	X		X	X
<i>Hypericum mutilum</i>	St John's wort	X			X
<i>Hypochoeris radicata</i>	hairy cat's ear	X	X		
<i>Ludwigia palustris</i>	marsh purslane	X	X	X	
<i>Melinis minutiflora</i>	molasses grass		X	X	
<i>Melinis repens</i>	Natal redtop				
<i>Nephrolepis multiflora</i>	scaly sword fern	X	X	X	X
<i>Oplismenus hirtellus</i>	basket grass	X	X		
<i>Oxalis corniculata</i> (Polynesian introduction?)	yellow wood sorrel	X	X	X	
<i>Panicum maximum</i>	guinea grass		X	X	
<i>Panicum repens</i>	quack grass		X	X	
<i>Paspalum conjugatum</i>	Hilo grass	X	X		X
<i>Paspalum urvillei</i>	Vasey grass		X	X	
<i>Pennisetum clandestinum</i>	Kikuyu grass		X	X	
<i>Persicaria punctata</i>	water martweed	X	X	X	
<i>Phlebodium aureum</i>	laua`e haole	X	X	X	
<i>Plantago major</i>	common plantain			X	
<i>Polygala punctata</i>	milkwort	X	X	X	
<i>Sacciolepis indica</i>	Glenwood grass	X	X	X	X
<i>Saccharum officinarum</i>	sugar cane, kō		X	X	
<i>Schizachyrium condensatum</i>	beardgrass		X	X	
<i>Senecio madagascariensis</i>	Madagascar fireweed			X	
<i>Setaria gracilis</i>	yellow foxtail	X	X	X	X
<i>Setaria palmifolia</i>	palm grass		X	X	
<i>Solanum americanum</i> (possibly indigenous)	glossy nightshade		X		
<i>Sphagnetocola trilobata</i>				X	
<i>Spathoglottis plicata</i>	Philippine ground orchid			X	
<i>Sporobolus indicus</i>	West Indian dropseed		X		

SPECIES BINOMIAL	COMMON NAME	DEVELOP- MENT AREA	PARCELS 14,16, 82	ACCESS ALT. 3	ACCESS (LEASED LAND)
Non-native Ferns, Herbs, Sedges, and Grasses (continued)					
<i>Torenia asiatica</i>	`Ōla`a beauty	X	X		X
<i>Youngia japonica</i>	oriental hawksbeard	X			X

Survey conducted by Tim Tunison, Botanist (1982-1995) and Chief of Resource Management (1996-2006) (retired), Hawai`i Volcanoes National Park; currently, Director, Big Island Natural Resource Assistance, LLC, P.O. Box 754, Volcano, Hawai`i, 96785. Federal Employer Identification Number: 16-1738187; Hawai`i State General Excise Tax #: W00912702-01

