BOTANICAL SURVEY OF

THE HALE PŌHAKU MID-ELEVATION FACILITIES

CONSTRUCTION STAGING AREA

Prepared for

The Outrigger Telescopes Project
National Aeronautics and Space Administration

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By

PACIFIC ANALYTICS, LLC
P.O. Box 219
Albany, OR 97321
(541) 926-0117
www.statpros.com

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EXECUTIVE SUMMARY

The Mauna Kea Science Reserve is located on the summit of Mauna Kea, the tallest mountain in Hawai'i. Within the reserve are the world's two largest optical telescopes, constituting the W. M. Keck Observatory (WMKO). Current plans call for adding four to six Outrigger Telescopes on the WMKO site. The Outrigger Telescopes would be placed strategically around the existing Keck Telescopes. If approved, the Hale Pōhaku Mid-Elevation Facilities will be used during construction of the proposed Outrigger Telescopes.

Palila make their home in the māmane forests of Mauna Kea.

The Hale Pōhaku Mid-Elevation Facilities are located at the 2,804 m (9,200 ft) elevation on the southwestern slope of Mauna Kea. The facilities are located within the designated critical habitat of the endangered Hawaiian bird, *palila*. The *palila* (*Loxioides bailleui*) is a small bird of the Hawaiian honeycreeper subfamily that has been Federally listed as an endangered species since 1966.

One of the areas proposed for use is the existing 0.2 ha (0.5 ac) construction staging area at the lower limit of the mid-elevation facility. Because the facility lies within the *palila* critical habitat, the National Aeronautics and Space Administration (NASA) was concerned about potential impacts of the Outrigger Telescopes Project. NASA contracted Pacific Analytics, LLC, a natural resource consulting firm with expertise in Hawaiian native ecosystems, to conduct a botanical survey of the construction staging area that would be used by the proposed Outrigger Telescope project and of the resources surrounding this area. The survey would be provided to the U.S. Fish and Wildlife Service to assist them in rendering an opinion about the potential impacts of the proposed Outrigger Telescopes Project on *palila* and their habitat.

The botanical survey was conducted on May 22, 2004. No *māmane* (*Sophora chrysophylla*) trees were found within the existing construction staging area boundaries. The area within the Hale Pōhaku Mid-Elevation Facilities boundaries within 31 m (100 ft) of the existing construction staging area was found to contain twelve *māmane* trees growing in a groundcover composed of a mixture of low growing introduced plants and grasses. The area within 31 m (100 ft) surrounding the construction staging area but outside of the Hale

Pōhaku Mid-Elevation Facilities boundaries contained thirteen additional *māmane* trees growing amongst a similar groundcover. Besides the *māmane* trees, no other native plants were observed, except some scattered individual native grasses.

The existing Construction Staging Area is about 0.2 ha (0.5 ac) of gravel and dirt surrounded by a sparse māmane forest.

INTRODUCTION

The Mauna Kea Science Reserve is located on the summit of Mauna Kea, the tallest mountain in Hawai'i. Within the reserve are the world's two largest optical telescopes, constituting the W.M. Keck Observatory (WMKO). Current plans call for adding four to six Outrigger Telescopes on the WMKO site. The Outrigger Telescopes would be placed strategically around the existing Keck Telescopes. If approved, the Hale Pōhaku Mid-Elevation Facilities will be used during construction of the proposed Outrigger Telescopes.

The Hale Pōhaku Mid-Elevation Facilities are located at the 2,804 m (9,200 ft) elevation on the southwestern slope of Mauna Kea. These facilities provide sleeping accommodations, offices, eating and lounge areas, and a place for scientists, support staff and construction workers to acclimatize before proceeding to the summit for work.

The facilities are located within the designated critical habitat of the endangered Hawaiian bird, *palila*. The *palila* (*Loxioides bailleui*) is a small bird of the Hawaiian honey-creeper subfamily that has been Federally listed as an endangered species since 1966.

The Hale Pōhaku Mid-Elevation Facilities

One of the areas proposed for use during the Outrigger Telescopes Project is the existing approximately 0.2 ha (0.5 ac) construction staging area at the lower limit of the mid-elevation facility. Because the facility lies within the *palila* critical habitat, the National Aeronautics and Space Administration (NASA) was concerned about potential impacts of the Outrigger Telescopes Project. NASA contracted Pacific Analytics, LLC, a natural resource consulting firm with expertise in Hawaiian native ecosystems, to conduct a botanical survey of the construction staging area that would be used by the proposed Outrigger Telescope project and of the resources surrounding this area. The survey would be provided to the U.S. Fish and Wildlife Service to assist them in rendering an opinion about the potential impacts of the proposed Outrigger Telescopes Project on *palila* and their habitat.

Palila eat the seeds and flowers of māmane trees and also nest in their branches.

There have been four previous botanical surveys of the Hale Pōhaku Mid-Elevation Facility. The first was by Gerrish (1979) when the facilities were first proposed for construction. The second was by Char (1985), who surveyed the botanical resources for the construction camp site and staging area. The third botanical survey was completed in 1990 (Char 1990) to assess the area for the Japan National Large Telescope dormitory. The fourth botanical survey was conducted in 1999 (Char 1999) for the updated Mauna Kea Science Reserve Master Plan Environmental Impact Statement (UH 1999).

The use of the construction staging area has been approved for all observatory-related projects since 1990. The staging area is also used by tourists and residents for recreation, and is an overflow parking area for the Onizuka Center for International Astronomy -- Visitor Information Station.

Visitors and residents use the construction staging area for parking and recreation.

DESCRIPTION OF THE BOTANICAL RESOURCES

Historic Description of the Botanical Resources near the Hale Pōhaku Mid-Elevation Facilities

The following description is taken largely from the previous botanical surveys of the Hale Pōhaku Mid-Elevation Facilities (Gerrish 1979, Char 1985, Char 1990, Char 1999).

The subalpine dry forest in which the Hale Pōhaku Mid-Elevation Facilities are located extends from below the lower boundary of MKSR to the Saddle Road (Char 1999). This open-canopied forest predominantly comprises *māmane* trees (*Sophora chrysophylla*). *Māmane* trees intercept fog that provides understory plant species with the small amounts of moisture they need to survive (Gerrish 1979). Below 2,377 m (7,800 ft), *naio* (*Myoporum sandwicense*) is co-dominant with *māmane*, with occasional scattered stands of *akoko* (*Euphorbia olowaluana*) and individual *ʻiliahi* (*Santalum paniculatum*) trees in very low abundance (Van Riper 1975; Wagner and others 1990).

Māmane forest covers the western slopes of Mauna Kea below about 2,804 m (9,200 ft).

The understory of the Māmane Subalpine Forest is comprised largely of native shrubs. *ʻAweoweo*, also called *ʻaheahea*, (*Chenopodium oahuense*) is found occasionally among the more abundant *pūkiawe* (*Styphelia tameiameiae*) and *ʻaʻaliʻi* (*Dodonaea viscose*). Less abundant are *naʻenaʻe* (*Dubautia ciliolata*) and an attractive woody geranium, *nohoanu* (*Gernium cuneatum*), found in more rocky areas of the forest. Two native mints, *Stenogyne microphylla* and *maʻohiʻohi* (*Stenogyne rugosa*), are fairly common, growing in dense tangles in *māmane* trees (Wagner and others 1990).

The native Hawaiian pili uka grass

Clumps of the native grasses *pili uka* (*Trisetum glomeratum*) and hairgrass (*Deschampsia nubigena*) are the most abundant ground cover. Several introduced grasses and herbs have become established at low densities in undisturbed areas but are more dominant around the Hale Pōhaku Mid-Elevation Facilities (Char 1999).

The *māmane* forest is made up of only about 20 plant species. The paucity of species is due to the harsh conditions found there (Char 1999). Annual rainfall averages 30 to 40 inches and most precipitation falls during the winter. The thin soils are composed primarily of weathered lava and ash, and hold little moisture. Plants must collect water from low-lying clouds and fog to survive the hot, dry summers. The average annual temperature is 4.4 to 10°C (40 to 50°F), and frost is common at night.

Except in a special area enclosing endangered silverswords, no threatened and endangered plant species or USFWS species of concern have been found near the Hale Pōhaku Mid-Elevation Facilities (Char 1999; USFWS 2002). Much of the *māmane* forest has been damaged by cattle grazing, feral animals, fire, alien species, and increased visitor traffic (Stone and Pratt 1994; Hess and others 1999).

Cattle grazing has degraded much of the forest along the Mauna Kea Access Road. The vegetation of the open pastures is largely introduced grasses and forbs including orchid grass (*Dactylis glomerata*), Kentucky bluegrass (*Poa pratensis*), kikuyu (*Pennistum clandestinum*), mullein (*Verbascum thapsus*), sweet vernal (*Anthoxanthum odoratum*), wallaby grass (*Danthonia semiannularis*), velvet grass (*Holcus lanatus*), sheep sorrel (*Rumex acetosella*), and gosmore (*Hypochaeris radicata*) (Char 1985).

Description of the Botanical Resources at the Construction Staging Area

The entire construction staging area and the surrounding region within 31 m (100 ft) of the area boundaries were surveyed on May 22, 2004. The locations of all *māmane* trees were mapped (Figure 1). The identity of the vegetation was established using field guides and previous botanical knowledge. Samples and voucher specimens were not collected because almost all of the species could be identified in the field.

The dominant grass at the construction staging area is ripgut grass, Bromus diandrus

No *māmane* trees were found within the existing construction staging area boundaries. The area within the Hale Pōhaku Mid-Elevation Facilities boundaries within 31 m (100 ft) of the existing construction staging area was found to contain twelve *māmane* (*Sophora chrysophylla*) trees growing in a groundcover composed of mixture of low growing introduced plants and grasses. The area with 31 m (100 ft) surrounding the construction staging area but outside of the Hale Pōhaku Mid-Elevation Facilities boundaries contained thirteen additional *māmane* trees growing amongst a similar groundcover. Besides the *māmane* trees, no other native plants were observed, except some scattered individual native grasses.

The ground cover of the site and surrounding area consists of a mixture of grasses, dominated by ripgut grass (*Bromus diandrus*), but with occasional occurrences of native grasses, *Descampsia nubigena* and *Trisetum glomeratum* (*pili* grass), and the introduced needlegrass, *Stipa cernus*,.

The other species that make up the ground cover include common groundsel (*Senecio vulgaris*), pin clover (*Erodium cicutarium*), woolly mullein (*Verbascum thapsus*), and evening primrose (*Epilobium billardierianum ssp. cinereum*).

The introduced evening primrose, Epilobium billardierianum ssp. cinereum, is common in the construction staging area

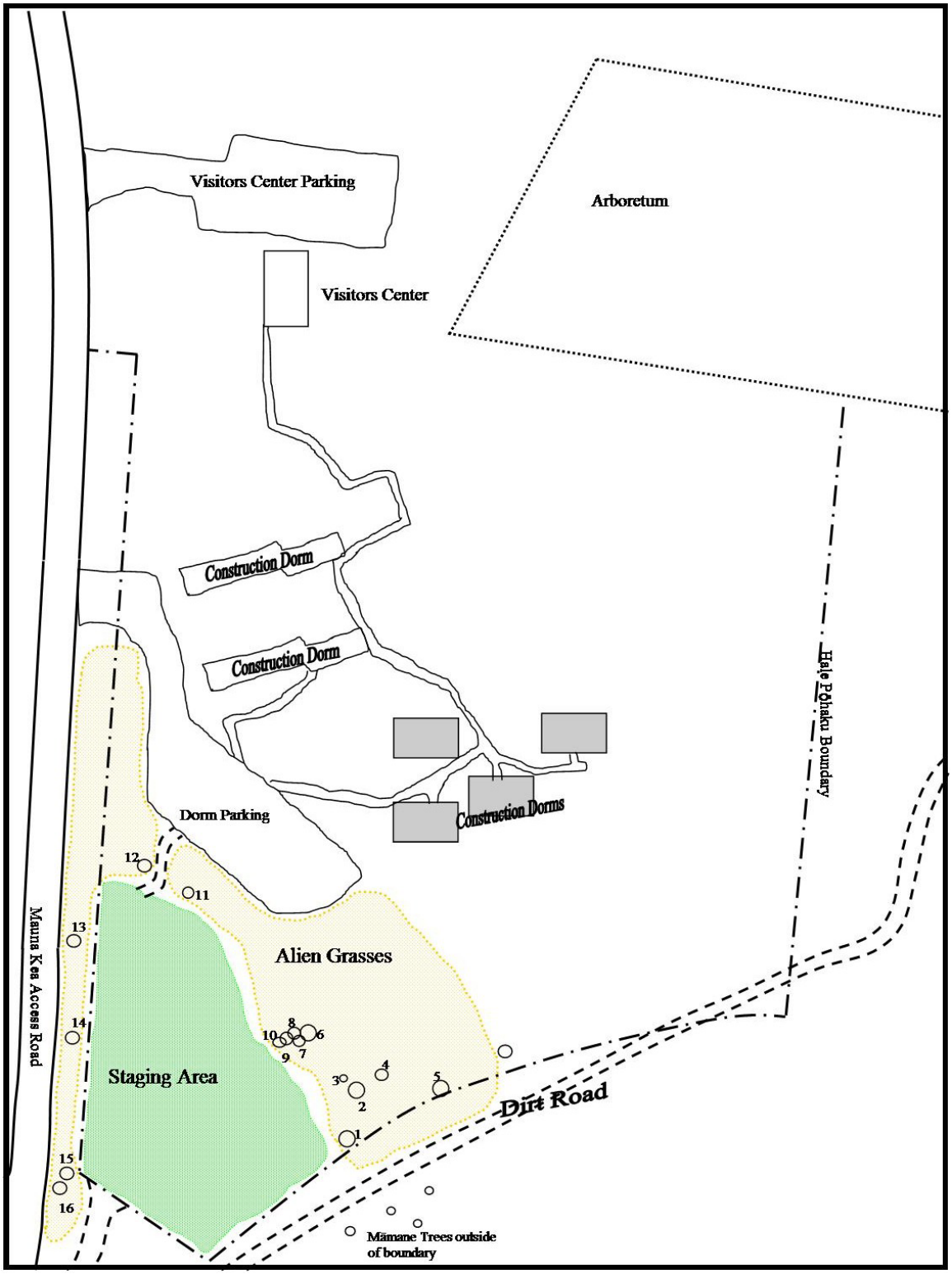


Figure 1. Map of Vegetation Surrounding Hale Pōhaku Construction Staging Area

NEAR-BY *MĀMANE* TREES FOUND WITHIN THE HALE PŌHAKU BOUNDARIES

Twelve *māmane* trees were found within the Hale Pōhaku Mid-Elevation Facilities boundaries within 31 m (100 ft) of the existing construction staging area. Below are pictures of those trees with a description of the approximate height and width of each tree. The locations of the trees are shown in Figure 1.

māmane Tree 1
3.5 m x 3.7 m

māmane Tree 2
3.5 m x 3.5 m

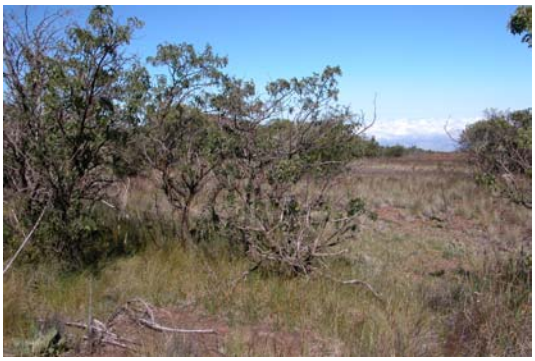
māmane Tree 3
1.5 m x 1.2 m

māmane Tree 4
3.5 m x 3.5 m

māmane Tree 5
4.6 m x 3.5 m

māmane Tree 6
2.4 m x 3.5 m

māmane Tree 7
2.4 m x 1.8 m



māmane Trees 8 and 9
2.4 m x 2.4 m and 1.8 m x 1.8 m

māmane Tree 10
2.1 m x 2.7 m

māmane Tree 11
3.5 m x 3.5 m

māmane Tree 12
3.5 m x 3.7 m

NEAR-BY *MĀMANE* TREES FOUND OUTSIDE THE HALE PŌHAKU BOUNDARIES

Thirteen *māmane* trees were found outside the Hale Pōhaku Mid-Elevation Facilities boundaries, but within 31 m (100 ft). Below are pictures of those trees with a description of their approximate height and width.

māmane Tree 13
4.6 m x 4.6 m

māmane Tree 14
3.7 m x 3.5 m

māmane Trees 15 and 16
2.4 m x 3.5 m and 1.8 m x 2.4 m

māmane Trees 17, 18, and 19
3.1 m x 4.6 m, 1.8 m x 2.4 m,
and 1.5 m x 2.4 m

māmane Tree 20
1.5 m x 1.0 m

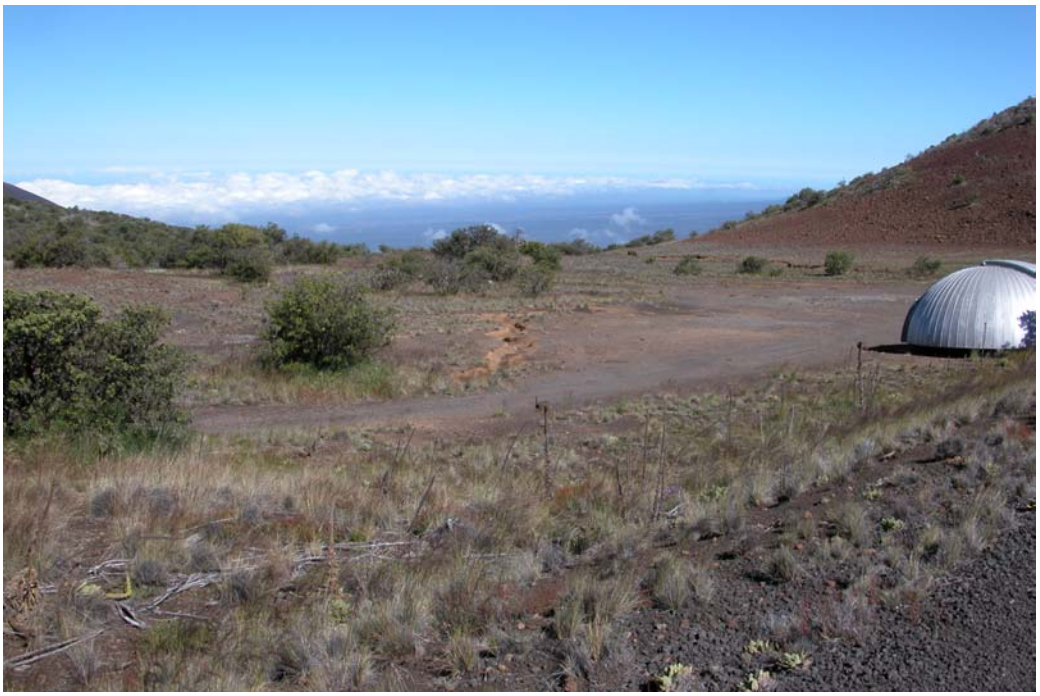
māmane Tree 21
2.1 m x 2.4 m

Four of the thirteen māmane trees outside of the Hale Pōhaku Mid-Elevation Facilities boundaries but within 31 m (100 ft) of the construction staging area.

The construction staging area (outlined in green) and surrounding vegetation.

View of the vegetation to the East and North of the site.

Looking East from the Mauna Kea Access Road across the site.



Looking South from the Mauna Kea Access Road across the site.

Panorama of the surrounding vicinity taken from the center of the site

Dirt road to site from Mauna Kea Access Road

Looking Southwest towards Mauna Kea Access Road

Looking West towards Mauna Kea Access Road

Looking Northwest

Looking towards the construction dorms

View East

View Southeast

View South

DISCUSSION

The vegetation at the Hale Pōhaku Mid-Elevation Facilities has been surveyed four times previous to this study. No threatened or endangered species or species of concern have been found during any of those studies.

The construction staging area is highly disturbed and largely bare of vegetation. The *māmane* trees that occur near the site are small to medium sized trees. A few of the trees near the site have lost many of their leaves and are apparently dying. The cause is not clear, but dying trees can be seen in less disturbed areas as well. It is unlikely that *palila* would use the trees on the site or surrounding the site within 31 m (100 ft) because trees are more dense, healthy, and abundant elsewhere.

In previous botanical surveys conducted at this site it was recommended that efforts be directed to managing the natural resources on and around the site. The recommendations included plantings of native species and removing introduced species, such as the California Poppy. These recommendations are still valid today.

Because of increased tourist traffic and resident recreational use of the surrounding area, it is possible that more nonindigenous species are being introduced. Construction vehicles and containers for the Outrigger Telescopes Project will be cleaned and inspected for alien species before proceeding up the Mauna Kea Access Road (at the intersection of the Saddle Road and Mauna Kea Access Road) as part of the Wēkiu Bug Mitigation Plan. These inspections are likely to intercept other alien species that may cause harm to the surrounding critical habitat at Hale Pōhaku.

Other habitat protection measures contained in the Wēkiu Bug Mitigation Plan are also applicable at the construction staging area. For example, control of trash, dust, and material is important to minimize disturbance to adjacent habitat. And, it is good practice to limit the amount of hazardous materials to decrease the potential for spills.

Another important habitat protection measure especially applicable at the construction staging area is prevention of fire. The *māmane* forest surrounding the construction staging area is dry and susceptible to fire, and once started, a fire may be difficult to control. It is best to take precautions to prevent fire, such as advising personnel of the susceptibility of habitat to fire, limiting smoking to designated areas away from dry grass, and limiting the amount of activity that would cause sparks or fire that may spread to adjacent habitat. It is advisable to have fire extinguishers on hand and the construction staging area personnel should be trained in their use. These are practical measures that are usually applied at construction sites, but are especially important in natural areas where fire may have an important impact on endangered species and their habitats.

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