

1.2.3 Manuwai

Ecosystem Restoration Management Plan

MIP Year 8-12, Oct. 2011 – Sept. 2016

MU: Manuwai

Overall MIP Management Goals:

- Form a stable, native-dominated matrix of plant communities which support stable populations of IP taxa.
- Control fire and weed threats to support stable populations of IP taxa.

1.2.3.1 Background Information

Location: Northern Waianae Mountains

Land Owner: State of Hawaii

Land Managers: Department of Land and Natural Resources (DLNR) - Natural Area Reserve System (NARS), DLNR – Land Division, DLNR -Forest Reserve.

Acreage: 300 Acres

Elevation Range: 1000ft-3000ft

Description: Manuwai Gulch is located in the northern Waianae Mountains. Manuwai Gulch and a series of adjacent, parallel gulches are drainages off the side of Kamaohanui Ridge, which extends eastward from Kaala. The Manuwai Management Unit (MU) consists of the fenced upper half of Manuwai Gulch, and a side gulch that drains into Alaiheihe Gulch, formed off the dividing ridge between Manuwai and Alaiheihe Gulch. The gulch drains to the Northeast. Most of the upper portion of the MU is within the Lower Kaala Natural Area Reserve (NAR); the rest is in the State Forest Reserve. Access to the MU is via a road through ‘Flying R Ranch’ that connects to a 4x4 contour dirt road managed by The State of Hawaii. There is no formal easement for use of the roads through ‘Flying R Ranch’. The ranch owner allows use of the roads and access is requested as needed through him. Helicopter access to the MU is available.

Much of Manuwai Gulch is steep, and some of these steep areas are not accessible on foot without safety ropes. The elevation gradient of the MU is dramatic, and the vegetation types within the MU span from Wet Forest to Lowland Dry Shrubland/Grassland. There are also several *in situ* rare and endangered plant populations scattered throughout the MU, including some found on cliffs and steep areas. Overall the MU is dominated by canopy weeds; however, there are some pockets of forest with high levels of native canopy.

Native Vegetation Types

Waianae Vegetation Types
<u>Lowland Dry Shrubland/ Grassland</u>
<u>Canopy includes:</u> <i>Erythrina sandwicensis</i> , <i>Myoporum sandwicense</i> , <i>Dodonaea viscosa</i> , <i>Santalum ellipticum</i> , <i>Hibiscus brackenridgei</i> subsp. <i>mokuleianus</i> .
<u>Understory includes:</u> <i>Heteropogon contortus</i> , <i>Sida fallax</i> , <i>Eragrostis variabilis</i> , <i>Abutilon incanum</i> , <i>Leptecophylla tameiameia</i> , <i>Bidens</i> sp.

<u>Dry forest</u>
<u>Canopy includes:</u> <i>Diospyros</i> sp., <i>Myoporum sandwicense</i> , <i>Erythrina sandwicensis</i> , <i>Reynoldsia sandwicensis</i> , <i>Rauvolfia sandwicensis</i> , <i>Santalum ellipticum</i> , <i>Psydrax odoratum</i> , <i>Nestegis sandwicensis</i> and <i>Myrsine lanaiensis</i> .
<u>Understory includes:</u> <i>Dodonaea viscosa</i> , <i>Sida fallax</i> , <i>Bidens</i> spp.
<u>Mesic mixed forest</u>
<u>Canopy includes:</u> <i>Acacia koa</i> , <i>Metrosideros polymorpha</i> , <i>Nestegis sandwicensis</i> , <i>Diospyros</i> spp., <i>Pouteria sandwicensis</i> , <i>Charpentiera</i> spp., <i>Pisonia</i> spp., <i>Psychotria</i> spp., <i>Antidesma platyphyllum</i> , <i>Bobea</i> spp. and <i>Santalum freycinetianum</i> .
<u>Understory includes:</u> <i>Alyxia oliviformis</i> , <i>Bidens torta</i> , <i>Coprosma</i> sp., and <i>Microlepidia strigosa</i>
<u>Mesic-Wet forest</u>
<u>Canopy includes:</u> <i>Metrosideros polymorpha polymorpha</i> . Typical to see <i>Cheirodendron trigynum</i> , <i>Cibotium</i> spp., <i>Melicope</i> spp., <i>Antidesma platyphyllum</i> , and <i>Ilex anomala</i> .
<u>Understory includes:</u> <i>Cibotium chamissoi</i> , <i>Broussaisia arguta</i> , <i>Dianella sandwicensis</i> , <i>Dubautia</i> spp. Less common subcanopy components of this zone include <i>Clermontia</i> and <i>Cyanea</i> spp.
<u>Wet forest</u>
<u>Canopy includes:</u> <i>Metrosideros</i> spp., <i>Cheirodendron</i> spp., <i>Cibotium</i> spp., <i>Ilex anomala</i> , <i>Myrsine sandwicensis</i> , and <i>Perrottetia sandwicensis</i> .
<u>Understory includes:</u> Typically covered by a variety of ferns and moss; may include <i>Melicope</i> spp., <i>Cibotium chamissoi</i> , <i>Machaerina angustifolia</i> , <i>Coprosma granadensis</i> , <i>Hedyotis centranthoides</i> , <i>Nothoperanema rubiginosa</i> , and <i>Broussaisia arguta</i> .
NOTE: For MU monitoring purposes vegetation type is mapped based on theoretical pre-disturbance vegetation. Alien species are not noted.

Views of Manuwai

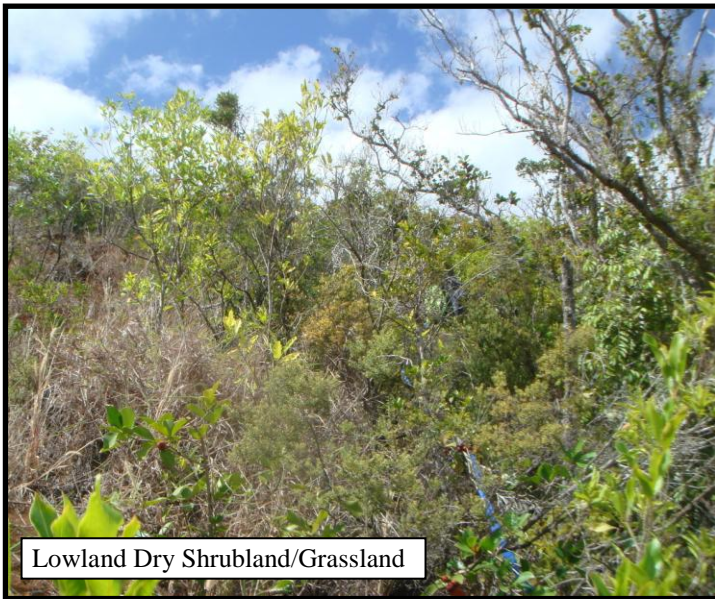


Manuwai Gulch
(looking South)



Manuwai Gulch
(back of gulch)

Primary Vegetation Types at Manuwai



Lowland Dry Shrubland/Grassland



Dry Forest



Mesic Mixed



Mesic-Wet and Wet Forest

MIP/OIP Rare Resources

Organism Type	Species	Pop. Ref. Code	Population Unit	Management Designation	Wild/ Reintroduction
Plant	<i>Abutilon sandwicensis</i>	ANU-A, B, C, D, E, F, G, H, I †	Kaawa to Puulu	MFS	Both (reintroduction not yet done)
Plant	<i>Alectryon macrococcus</i> var. <i>macrococcus</i>	ANU-A, B*, C*	Manuwai	No Management	Wild
Plant	<i>Delissea waianaensis</i>	ANU-A †	Manuwai	MFS	Reintroduction
Plant	<i>Flueggea neowawraea</i>	ANU-A*, B †	Manuwai	Manage Reintroduction for Stability	Both (reintroduction not yet done)
Plant	<i>Hedyotis degeneri</i> var. <i>degeneri</i>	ANU-A, B †	Alaiheihe and Manuwai	MFS	Both (reintroduction not yet done)
Plant	<i>Hibiscus brakenridgei</i> subsp. <i>mokuleianus</i>	ANU-A †	Kaimuhole and Palikea Gulch	MFS	Reintroduction (not yet done)
Plant	<i>Neraudia angulata</i> var. <i>dentata</i>	ANU-A*, ANU-B †, ANU-C †	Manuwai	MFS	Both (wild site extirpated, reintroduction not yet done)
Plant	<i>Phyllostegia kaalaensis</i>	ANU-B †	Manuwai	MFS	Reintroduction (not yet done)
Snail	<i>Achatinella mustelina</i>	ANU-A	ESU-C	MFS	Wild

MFS= Manage for Stability

*= Population Dead

ESU= Ecologically Significant Unit

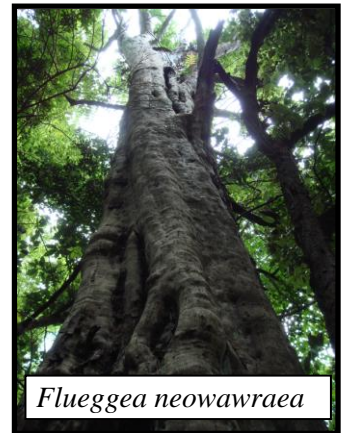
GSC= Genetic Storage Collection

†=Reintroduction not yet done

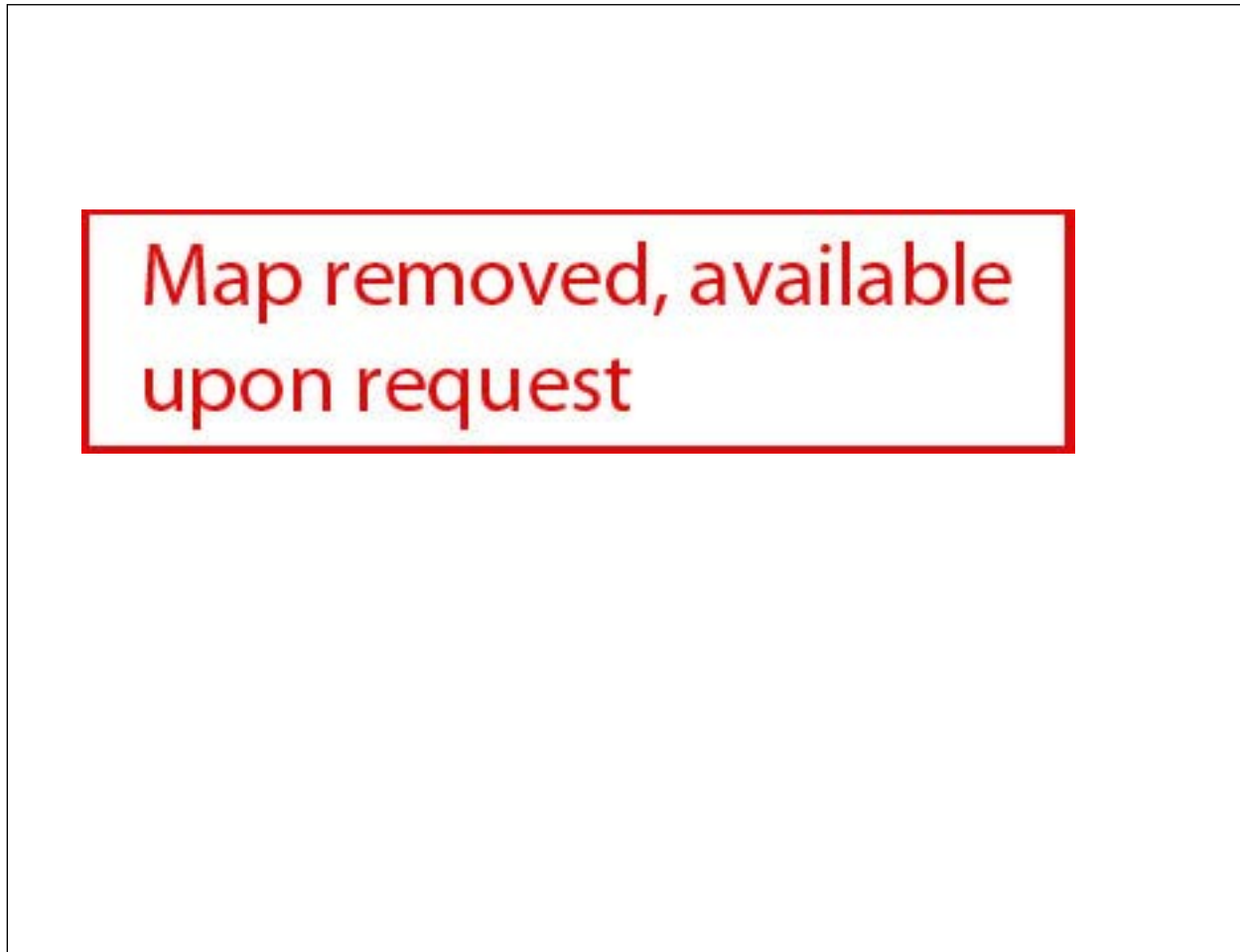
Other Rare Taxa at Manuwai MU

Organism Type	Species	Status
Plant	<i>Bobea sandwicensis</i>	Endangered
Plant	<i>Caesalpinia kavaiensis</i>	Endangered
Plant	<i>Colubrina oppositifolia</i>	Endangered
Plant	<i>Cyanea calycina</i>	Rare
Plant	<i>Dubautia sherffiana</i>	Vulnerable
Plant	<i>Exocarpos gaudichaudii</i>	Rare
Plant	<i>Lobelia niihauensis</i>	Endangered
Plant	<i>Pteralyxia macrocarpa</i>	Vulnerable; Candidate endangered species

MIP Rare Resources at Manuwai



Locations of Rare Resources at Manuwai



MU Threats to MIP/OIP MFS Taxa

Threat	Taxa Affected	Localized Control Sufficient?	MU scale Control required?	Control Method Available?
Pigs	All	No	Yes	Yes; MU fenced
Rats	<i>A. mustelina</i> , <i>A. macrococcus</i> var. <i>macrococcus</i> , <i>D. waianaensis</i> , <i>F. neowawraea</i>	Yes	No	Yes; bait grids will be used around populations as needed
Predatory snails	<i>A. mustelina</i>	Unknown	No	Staff searches and removal
Slugs	<i>D. waianaensis</i> , <i>N. angulata</i> , <i>H. degeneri</i> var. <i>degeneri</i>	TBD	No	Yes; Sluggo® applications around potential recruitment sites for rare plants
Black Twig	<i>A. macrococcus</i> var. <i>macrococcus</i> ,	Unknown	No	No

Borer	<i>F. neowawraea</i> , <i>N. angulata</i> var. <i>dentata</i> * <i>Abutilon sandwicensis</i> *			
Ants	Unknown	Unknown	Unknown	Surveys yet to be conducted
Weeds	All	No	Yes	Yes; for steep cliff areas, herbicide ballistic technology being tested.
Fire	All	No	Yes	Yes; fuel pre-suppression, and rapid response and control of potentially threatening fires

*Threat suspected. Field observation necessary.

Management History

Most OANRP management efforts in Manuwai have been to visit rare plant populations. The State NARS program conducted initial surveys in Manuwai and adjacent areas to document resources and to support the NAR designation for the area. With the completion of the fence in 2011, active management within the MU will begin (MIP Year 8). Ungulates will be removed, weeding will be conducted, and rare plant reintroductions will be established within those weeded areas.

- 1986: Botanist Steve Perlman conducts surveys in area. Manuwai is noted as having patches of the rare forest type, Oahu Diverse Mesic Forest.
- 1990: Mount Kaala Natural Area Reserve Management Plan is written by the Natural Area Reserves System Program.
- 1999-2010: OANRP visit historical rare plant populations, collect fruit from MIP species, and survey for new populations.
- 2000-2004: Snaring program in place for goat control along SBW border east of Kamaohanui.
- 2000-2006: Annual or semi-annual hunts for goats take place in the general Lower Kaala NAR region.
- 2007: In August, fire burns southern-most ridges of MU.
- 2010: Vegetation monitoring across MU conducted.
- 2011: MU fence completed. Pig eradication begins.

1.2.3.2 Ungulate Control

Identified Ungulate Threats: Pigs, Goats (low level threat, but goats are present in nearby gulches)

Threat Level: High

Primary Objectives:

- Eradicate pigs from MU.
- Maintain as pig free.
- Prevent goat ingress in enclosure

Strategy:

- Remove pigs from Subunit II with hunts and traps, and Subunit I with hunts, traps and snares as needed.

- Maintain as pig free by maintaining fence and using snares in Subunit II to reduce impacts and pressure.

Monitoring Objectives:

- Conduct fence checks and transects quarterly around entire MU, including strategic section along entire southern ridge. If absolutely sure that topography is excluding pigs, begin to check this section annually.
- GPS and mark the fence at ten meter intervals so that the fence will be one large transect.
- Monitor for pig sign while conducting other management actions in the fence.

Management Responses:

- If any pig activity is detected within the fenced unit, implement hunting and/or snaring program.

Maintenance Considerations:

There are several sections of the fence that are ‘strategically’ fenced, where natural barriers and geography (cliffs and pinnacle rocks) are used instead of actual fences to prevent pig ingress. There is a break in fencing around a large rock section on the western fenceline. Also, the entire southern edge of the MU is not fenced. The topography along this ridge is extremely steep, and pigs are not expected to be able to traverse. Additionally, Lihue (the forested gulches behind Schofield Barracks West Range) is undergoing fencing and pig removal. Eventually, pigs will be eradicated from this area and therefore the threat of ingress over this fenceless area is hoped to be below. However, special attention will be given to the strategic fences during initial fence checks to ensure that the barriers are effective in keeping ungulates out of the MU.

1.2.3.3 Weed Control

Weed Control actions are divided into 4 subcategories:

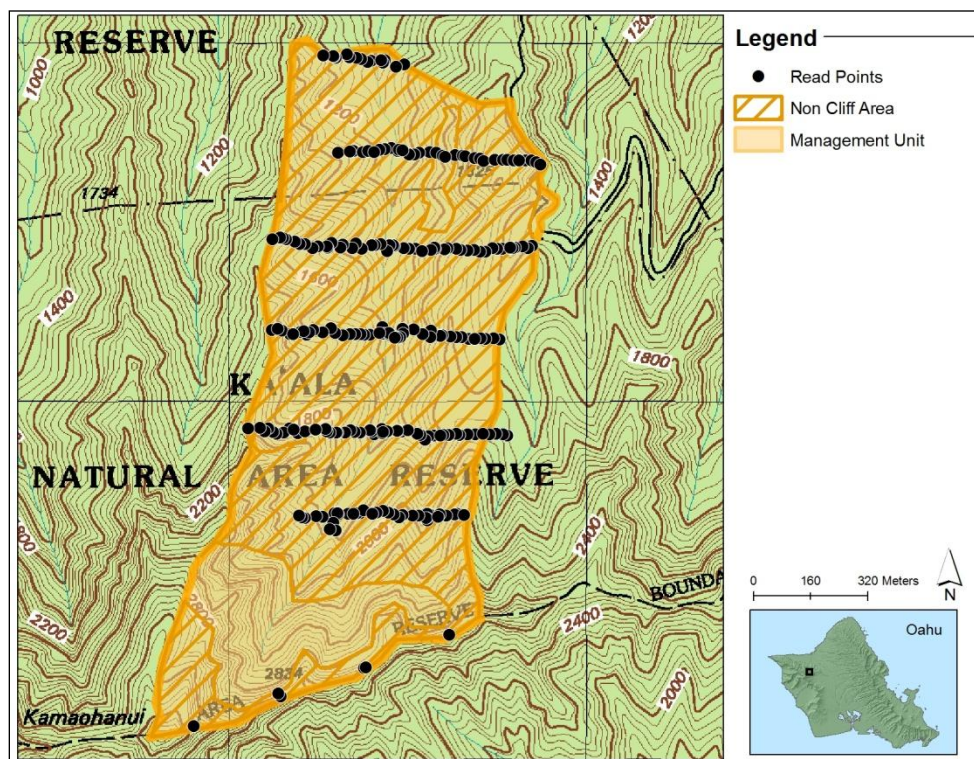
- Vegetation Monitoring
- Surveys
- Incipient Taxa Control (Incipient Control Area - ICAs)
- Ecosystem Management Weed Control (Weed Control Areas - WCAs)

These designations facilitate different aspects of MIP/OIP requirements.

MU Vegetation Monitoring

From October 2010 – April 2011 vegetation monitoring was conducted for the Manuwai management unit (MU). The total effort including commute time was 8 days for a crew of six. In the next few months the vegetation monitoring sub-committee will be meeting to set the monitoring interval for this MU. The vegetation monitoring data will provide NRP with trend analysis on the percent cover for alien vegetation in the understory and canopy, invasion and spatial distribution of priority weed species, and species richness. Since the MU vegetation monitoring protocol was designed in order to address two separate MIP management unit goals, the analysis is divided into two sections. The statistical thresholds used for both sections were copied directly from the Makua Implementation Plan.

Vegetation Monitoring Transects:



Section 1: Alien Percent Cover Management Objective

- Assess if the percent cover for alien understory and canopy is 50% or less across the entire management unit. For more discussion on this objective refer to Makua Impementation Plan, Chapter 10, Table 10.1.

Sampling Objective:

- Be 95% sure of detecting a 10% change in percent cover for both alien understory and canopy.
- The acceptable level of making a Type 1 error (detecting a change that did not occur) is 10% and a Type 11 error (not detecting a change that did occur) is 20%.

Vegetation Monitoring Protocol:

Refer to the monitoring section of the 2008 year-end report for a full description of the methods.

Vegetation Monitoring Analyses for Alien Percent Cover Goals:

Baseline data collected for the Manuwai MU in 2011 showed that the mean percent alien vegetation cover in the understory was 53% and in the canopy it was 64%. The mean alien percent cover did not meet the management goal of 50% or less alien vegetation cover in either the understory or canopy.

Management response:

If future vegetation monitoring analysis indicates that the alien percent in either the understory or canopy has not been met and are not getting closer to being reached, the weed control strategy will be re-evaluated by the IT.

Percent cover data analysis considerations:

To determine the sample size required to detect a minimum of 10% change in cover, a post-hoc power analysis was performed. With 80% power and standard deviation of 32 (the highest standard deviation in the 2010 dataset) the minimum sample size needed to meet the sampling objectives was 81 plots. Though only 81 plots were needed to detect a change in alien percent cover, more plots were monitored to ensure that there was a large enough sample size to detect change in occurrence of target species.

Section 2: Frequency of Occurrence Analysis

Frequency data was collected for all species that occurred within the Manuwai MU in 2010. This data will be used to tracking species richness, spatial distribution, and density of dominate species on an MU scale. This analysis was used by management to help determine if Manuwai is getting more or less native over time. For a complete list of species recorded during the 2010 monitoring period and the percent of plots they occurred in refer to appendix 1-8.

Species Richness and Vegetation Monitoring Checklist:

From the 2010 dataset a vegetation checklist of the vascular plant species was compiled. Within the canopy, a total of 67 plant species were recorded; 46 (69%) of these species were native and 21 (31%) were alien. In the understory, a total of 154 species were recorded; 85 (55%) of these species were native and 69 (45%) were alien.

Management Objective for priority alien species control:

- Assess the spatial distribution and frequency for priority 2 weed species.
- Provide an updated priority weed species list for the Palikea MU.
- Track species richness for alien species across the MU.

Sampling Objective:

- 95% confident of detecting 10% change in occurrence of priority 2 weed species (refer to the target weed species notes table in the weed control section).

Vegetation Monitoring Protocol:

Refer to the monitoring section in the 2008 annual status report.

Established Weed Species Discussion:

Priority weed species which are of particular interest to NRP due to their ecosystem altering potential are controlled on an MU or WCA scale. For notes on the control strategy for each of these species refer to the Summary of Target Taxa table in the ICA section of this report.

Several alien species which NRP plans to controlled on a WCA scale in the next five year are *Psidium cattleianum*, *Blechnum appendiculatum*, *Clidemia hirta*, *Syzygium cumini*, *Toona ciliata* and *Schinus terebinthifolius*. The weed management strategy for these species is to control them around rare plant locations and in native forest patches. Since these species will be controlled on a WCA scale, they will most likely be the species that vegetation monitoring will be detecting change due to weed control management. Given this, it will be important to analyze the change in spatial distribution of all priority weed species in order to determine if more weed control is needed.

Management Response:

If trend analysis indicates there has been no detectable change in any of the priority species, NRP will continue with the current management strategy. If future monitoring indicates that there has been a significant increase in any of the priority weed species, NRP will meet with the IT to evaluate the weed control strategy and decide if a species-specific weed control strategy should be implemented.

Management Objective for Native Species:

- Ensure the plant communities within the MUs are stable and native-dominated .

Sampling objectives:

- Be 95% certain of detecting a 10% change in occurrence of native species.

Native Species Frequency Analysis:

The most common native tree in both the canopy was *Diospyros sandwicensis*, occurring in 55% of the plots in the canopy and 48% of the plots in the understory. The next most common native species were *Psydrax odorata*, *Dodonaea viscosa* and *Diospyros hillebrandii*. For a complete species list refer to Appendix 1-8.

Vegetation Monitoring Protocol:

- Refer to the monitoring section in the 2008 year-end report.

Management response:

- If there has been significant decline in native species occurrence over time, assess the need for additional native species restoration.
- If the frequency of occurrence of native species does not significantly decrease, continue with the current management program.

Addition benefit on vegetation monitoring:Incipient species detected:

A benefit of conducting vegetation monitoring was the detection of *Pterolepis glomerata* which was designated as an incipient population and will be controlled. In addition to this taxon, *Caesalpinia decapetala*, *Begonia vitifolia*, and *Montanoa hibiscifolia* were detected. NRP will continue to document occurrences of these species over the next year, and will evaluate whether they should be added to the incipient species list (Discussed in the Incipient Taxa Control section of this report).

Surveys

Army Training?: No

Other Potential Sources of Introduction: OANRP, State Biologists, pigs

Survey Locations: landing zones, fencelines, access road, high potential traffic areas.

Management Objective:

- Prevent the establishment of any new invasive alien plant species through regular surveys along roads, landing zones, camp sites, fencelines, trails, and other high traffic areas (as applicable).

Monitoring Objectives:

- Quarterly surveys of LZs (if used).
- Annual survey of access road (Lower Kaala NAR access road)
- Quarterly surveys of campsites (if used)
- Note unusual, significant or incipient alien taxa during the course of regular field work, particularly when walking the fenceline.

Management Responses:

- Any significant alien taxa found will be researched and evaluated for distribution and life history. If found to pose a major threat, control will begin and will be tracked via Incipient Control Areas (ICAs)

Surveys are designed to be the first line of defense in locating and identifying potential new weed species. Roads, landing zones, fencelines, and other highly trafficked areas are inventoried regularly. In Manuwai, LZs are surveyed as used, and the Lower Kaala NAR access Road is surveyed annually. The access trail from the parking spot on the road over the saddle and into the gulch bottom will also be surveyed annually (a trail for some of this will still need to be established). OANRP will consider installing additional surveys in other high traffic areas, however, incidental observations during regular field management may suffice.

Incipient Taxa Control (ICAs)

Management Objectives:

- As feasible, eradicate high priority species identified as incipient invasive aliens in the MU by 2016.
- Conduct seed dormancy trials for all high priority incipients by 2016.

Monitoring Objectives:

- Visit ICAs at stated re-visitation intervals. Control all mature plants at ICAs and prevent any immature or seedling plants from reaching maturity.

Management Responses:

- If unsuccessful in preventing immature plants from maturing, increase ICA re-visitation interval, or reassess feasibility of eradication.

Incipient Control Areas (ICAs) are drawn around each discrete infestation of an incipient invasive weed. ICAs are designed to facilitate data gathering and control. For each ICA, the management goal is to achieve complete eradication of the invasive taxa. Frequent visitation is often necessary to achieve eradication. Seed bed life/dormancy and life cycle information is important in determining when eradication may be reached; much of this information needs to be researched and parameters for determining eradication defined. OANRP will compile this information for each ICA species; assistance for this research may be pursued.

The table below summarizes target weed taxa at Manuwai. Appendix 3.1 of the MIP lists significant alien species in the greater Lower Kaala NAR and ranks their potential invasiveness and distribution. Each species is given a weed management code: 0 = not reported from MU, 1 = incipient (goal:

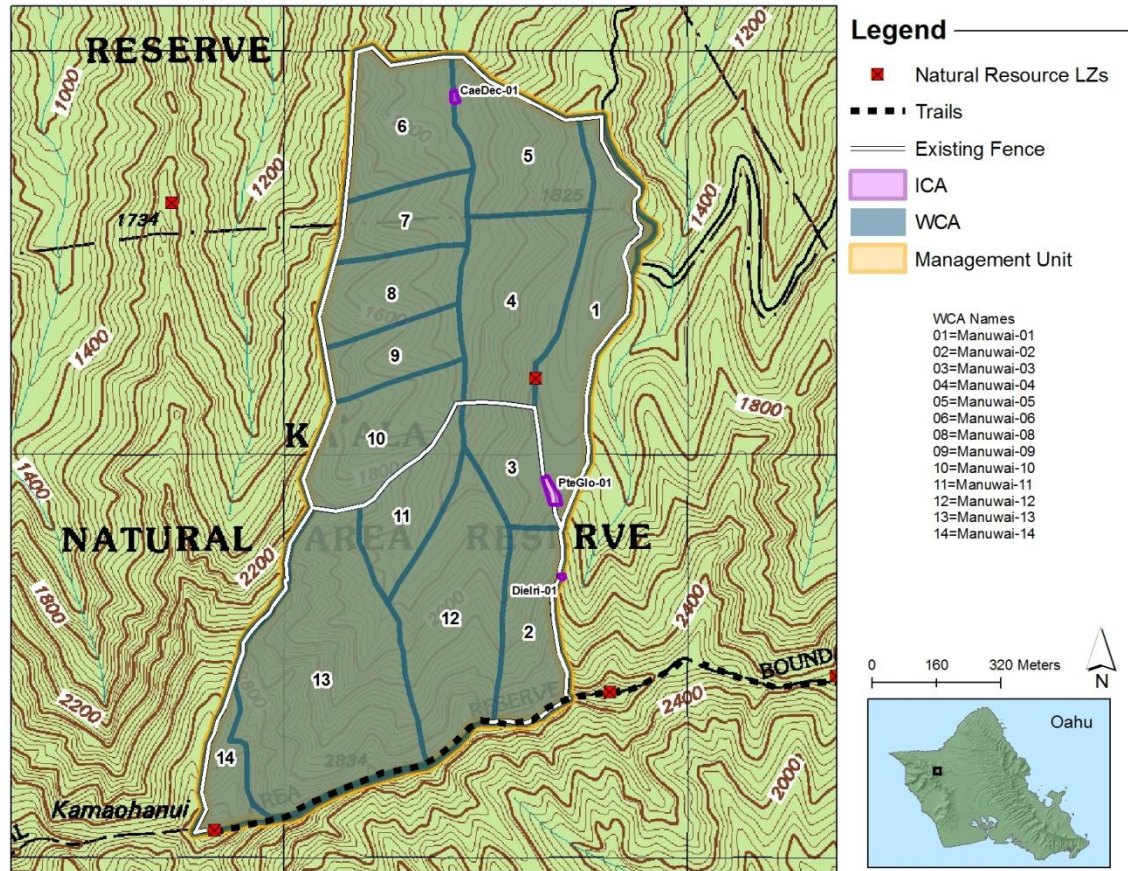
eradicate), 2 = control locally. OANRP supplemented and updated Appendix 3.1 with additional target species identified during field work. In many cases, the weed management code assigned by the MIP has been revised to reflect field observations. If no code is listed in the ‘original’ column, the species was not evaluated by the IP, but was added later by OANRP. While the list is by no means exhaustive, it provides a good starting point for discussing which taxa should be targeted for eradication, immediate control throughout the MU, or control within active WCAs. ICAs are not designated for every species in the table below; however, occurrences of all species in the table should be noted by field staff. All current ICAs are mapped.

Summary of Target Taxa

Taxa	MIP weed code		Notes	No. of ICAs
	Original	Revised		
<i>Acacia confusa</i>	1	2	Widespread on ridges. Target during weed control sweeps in priority WCAs.	0
<i>Begonia vitifolia</i>		1	Map all known locations of <i>B. vitifolia</i> . If widespread, treat during WCA control. If known from very limited locations, treat in ICAs.	0
<i>Caesalpinia decapetala</i>	1	1	One population known from bottom of gulch on north end. Will be targeted for control in an ICA. Any new sites will be treated the same way.	1
<i>Clusia rosea</i>	1	0	Noted from Lower Kaala NAR. Not detected during MU monitoring or initial surveys. If found, will treat as a WCA target.	0
<i>Cupressus lusitanica</i>		2	Treat as MU target. Not documented as being highly invasive in Hawaii, but staff have noted related species spreading in other areas.	0
<i>Dietes iridioides</i>		1	Known from east fenceline, just outside MU. Doesn't spread quickly. Target in ICA. Treat and initially recheck quarterly to establish control frequency.	1
<i>Fraxinus uhdei</i>	1	0	Noted from Lower Kaala NAR. Not detected during MU monitoring or initial surveys. If found, will treat as WCA target.	0
<i>Juniperus bermudiana</i>	1	2	Treat as MU target. Determine if present; easily confused with <i>Cupressus lusitanica</i>	0
<i>Melaleuca quinquenervia</i>	0	2	Treat as MU target. None found during vegetation monitoring, but known from MU. Has potential to spread quickly in appropriate habitat.	0
<i>Melia azedarach</i>	0	2	Target during weed control sweeps in priority WCAs.	0
<i>Montanoa hibiscifolia</i>	0	1	Map all known locations of <i>M. hibiscifolia</i> . If widespread, treat during WCA control. If known from very limited locations, treat in ICAs.	0
<i>Panicum maximum</i>	2	2	Important to strategically treat patches of <i>P. maximum</i> for fire suppression (see fire section). Target in WCAs as needed.	0
<i>Pterolepis glomerata</i>	0	1	Treat known population as an ICA. New populations found will be treated as ICAs.	1
<i>Roystonea regia</i>	0	2	Only a few individuals known. Treat as MU target.	0
<i>Rubus argutus</i>	2	2	Target in WCAs. Frequent retreatment is often required for control of this species. Use control measures such as digging out tubers and aggressive herbicides that will kill entire plant on first treatment.	0
<i>Schefflera actinophylla</i>	0	2	Immature plants are somewhat widespread through MU, and there are not many mature individuals. Treat as MU wide target (treat all known immature individuals throughout the MU at one time), and then control as needed in WCAs. Know to be ecosystem altering, fast growing, fruits prolifically, and disperses widely.	0
<i>Setaria palmifolia</i>	2	2	Target in WCAs around rare taxa.	0

Taxa	MIP weed code		Notes	No. of ICAs
	Original	Revised		
<i>Spathodea campanulata</i>	2	2	Several individuals throughout MU. High concentrations in Subunit II. Treat as MU target, then control as needed in WCAs.	0
<i>Syzygium cumini</i>	2	2	Target in WCAs.	0
<i>Toona ciliata</i>	2	2	Target in WCAs. There are high levels of this weed in the MU; it occurred in the overstory in 44% of vegetation survey plots, and 48% in the understory in survey plots. The tree is fast growing, and mature trees readily produce lots of offspring nearby. Where possible, target small stands entirely where possible in high priority WCAs.	0
<i>Trema orientalis</i>	2	2	Treat as MU target. Many large mature trees seen during vegetation surveys and visual surveys from ridges. Canopy is broad. Several trees are on slopes inaccessible on foot and will require remote control technologies.	0
<i>Triumphetta semitrilobata</i>	2	2	Target during weed sweeps in high priority WCAs, and target along trails, LZs, and campsites.	0

Inciptai and Weed Control Areas at Manuwai



Ecosystem Management Weed Control (WCAs)

MIP Goals:

- Within 2m of rare taxa: 0% alien vegetation cover
- Within 50m of rare taxa: 25% or less alien vegetation cover
- Throughout the remainder of the MU: 50% or less alien vegetation cover

Management Objectives:

- Reach 50% or less alien canopy cover across the MU in the next 5 years.
- In WCAs within 50m of rare taxa, work towards achieving 25% or less alien vegetation cover in understory and canopy.

Management Responses:

Increase/expand weeding efforts if MU vegetation monitoring (conducted every 6 years) indicates that goals are not being met.

Weed Control Summary:

The entire Manuwai MU was broken up into WCAs to ease data tracking. Due to the high level of non-native cover in much of the MU and patchiness of native canopy pockets, large scale weed sweeps

targeting a wide variety of weeds will not take place in most WCAs. Instead, we plan to remove selected species across the entire MU (see ‘MU wide species target list’ table below). This list was selected based on distribution levels of taxa seen during vegetation monitoring, and also based on known characteristics of the taxa. For example, *Schefflera actinophylla* was chosen as a MU wide target because it had a relatively low distribution throughout the MU making it feasible to control. Furthermore, most of the individuals seen were immature, and if the taxon can be treated across the MU before it becomes reproductive, there is a far greater chance to control it.

In addition to MU wide weed targets, OANRP will also conduct smaller scale, localized, intensive control around areas with high levels of native canopy, and around wild sites of rare taxa. Initially, this focused weed control will largely be conducted to prepare rare plant reintroduction sites, and then to maintain low levels of alien cover around those reintroductions. Canopy weed control should be cleared in advance of plant reintroductions so as not to disrupt rare plants after they are already in the ground. Understory weeds will be controlled continually as needed. Rare plant reintroductions will need to avoid large patches of *Blechnum appendiculatum*. It is however feasible to effectively remove smaller patches of this weed and it should be targeted in such cases. Additionally, if, ongoing *B. appendiculatum* herbicide trials find an effective herbicide to control larger patches of this weedy fern, it may be targeted prior to rare plant reintroductions as well.

The WCAs along Kamaohani Ridge and some others in the MU are very steep. On the ground weed control will be difficult in these areas and in most cases control may be achieved via methods such as aerial ball spray or Herbicide Ballistic Technology (still in development). Aerial surveys of these areas is still needed to document distribution of weeds from the MU Wide Species Target List

MU Wide Species Target List

<i>Cupressus lusitanica</i>
<i>Juniperus bermudiana</i>
<i>Melaleuca quinquenervia</i>
<i>Roystonea regia</i>
<i>Schefflera actinophylla</i>
<i>Spathodea campanulata</i>
<i>Trema orientalis</i>

WCA: Manuwai-01

Vegetation Type: Mesic Ridge

MIP Goal: 50% or less alien cover (no rare taxa in WCA).

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA.

Notes: The terrain in this WCA is not as steep as most of the other WCAs in the MU and has slopes with large stands of native dominated forest including areas with *A. koa* canopy, stands of *D. sandwicensis* and a nice short stature shrub forest of *Styphelia tameiameia*, *Metrosideros tremuloides*, and *Dodonea viscosa*. It encompasses a side gulch that drains into Alaihehe Gulch. There are no known rare resources in this WCA, however the native dominated mixed-mesic forest in this gulch would be worthwhile to weed. It is easy to access as it is close to the road, and if given permission by NARS, would be a good site for volunteer weed control. MU wide target species will be controlled by MIP Year 11.

WCA: Manuwai-02

Vegetation Type: Mesic Ridge

MIP Goal: 50% or less alien cover (no rare taxa in WCA).

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA.

Notes: There are no known rare resources in this WCA and it is very steep. The WCA shares some of the native dominated forest aforementioned in WCA 1. However, unless rare plants, or suitable habitat for rare plant reintroductions is found, no regular WCA weed control will take place in this WCA. MU wide target species will be controlled by MIP Year 9.

WCA: Manuwai-03

Vegetation Type: Mesic Ridge

MIP Goal: 50% or less alien cover (no rare taxa in WCA).

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA.

Notes: There was a population of *A. macrococcus* var. *macrococcus* known from this WCA, however it is now thought to be gone. Unless rare plants, or suitable habitat for rare plant reintroductions is found, no regular WCA weed control will take place in this WCA. MU wide target species will be controlled by MIP Year 10.

WCA: Manuwai-04

Vegetation Type: Mesic Ridge

MIP Goal: 25% or less alien cover.

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA. Additionally, common weeds such as *S. terebinthifolius*, *S. cumini*, and *P. cattleianum*, will be treated in the overstory, and *C. arabica* in the understory.

Notes: This WCA has several current and historic rare plant populations. Some of these populations are managed by OANRP and others are managed by the Oahu Plant Extinction Prevention program. Most of these rare plants occur across a mostly native, *D. sandwicensis* dominated slope. Control efforts will be focused across this slope and around MIP rare plant species as needed to maintain low levels of alien cover directly around those populations. This WCA is also high priority for early removal of Target Weed Species. MU wide target species will be controlled by MIP Year 8.

WCA: Manuwai-05

Vegetation Type: Mesic Ridge

MIP Goal: 25% or less alien cover.

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA. Additionally, common weeds such as *S. terebinthifolius*, *S. cumini*, and *P. cattleianum*, will be treated in the overstory, and *C. arabica* in the understory. There are high levels of *P. maximum* throughout the WCA, that will be cleared directly around rare plants in any reintroduction established in this WCA. Aerial or on the ground *P. maximum* control along the northern edge of this WCA (fenceline) will also be evaluated to facilitate fence checks, and may serve as a potential fire break.

Notes: This WCA has several steep, grassy ridges and is largely degraded. There are a few rare plant populations in some of the shallow gulches. Weed control efforts will be focused around MIP rare plant species as needed to maintain low levels of alien cover directly around those populations. MU wide target species will be controlled by MIP Year 11.

WCA: Manuwai-06

Vegetation Type: Mesic Ridge

MIP Goal: 25% or less alien cover.

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA, as well as *P. maximum*.

Notes: There are high levels of *P. maximum* in the northern half of this WCA. The 2007 Waialua fire burned the northern half of this WCA and *P. maximum* has filled in all the burned area. The southern-most gulch of this WCA had a population of *Neraudia angulata* that has since died. There is also a sizeable stand of *Colubrina oppositifolia* on the ridge that divides WCAs 6 and 7. If no reintroductions take place in this WCA, only target weed species will be treated. MU wide target species will be controlled by MIP Year 9. Aerial or ground based *P. maximum* control along the northern edge of this WCA (fenceline) will also be evaluated to facilitate fence checks, and create a potential fire break.

WCA: Manuwai-07

Vegetation Type: Mesic Ridge

MIP Goal: 25% or less alien cover.

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA. Additionally, common weeds such as *S. terebinthifolius*, *S. cumini*, and *P. cattleianum*, will be treated in the overstory, and *C. arabica* in the understory.

Notes: The boundaries of this WCA run from the fenceline down 2 ridges, and surround 1 large gulch. There are rare plant populations in this WCA. Rare plant reintroductions may be conducted in this WCA. If so, weed control will be conducted to prepare sites before outplanting, and weed control thereafter will be conducted to keep alien canopy levels low. If no reintroductions take place in this WCA, only target weed species will be treated. MU wide target species will be controlled by MIP Year 9.

WCA: Manuwai-08

Vegetation Type: Mesic Ridge

MIP Goal: 50% or less alien cover (no rare taxa in WCA).

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA. Additionally, common weeds such as *S. terebinthifolius*, *S. cumini*, and *P. cattleianum*, will be treated in the overstory, and *C. arabica* in the understory.

Notes: The boundaries of this WCA run from the fenceline down 2 ridges, and surround 1 large gulch. These ridges are mostly native mid-slope, but are thick with coffee closer to the gulch. Rare plant reintroductions may be conducted in this WCA. If so, weed control will be conducted to prepare sites before outplanting, and weed control thereafter will be conducted to keep alien canopy levels low. If no reintroductions take place in this WCA, only target weed species will be treated. MU wide target species will be controlled by MIP Year 9.

WCA: Manuwai-09

Vegetation Type: Mesic Ridge

MIP Goal: 50% or less alien cover (no rare taxa in WCA).

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA. Additionally, common weeds such as *S. terebinthifolius*, *S. cumini*, and *P. cattleianum*, will be treated in the overstory, and *C. arabica* in the understory.

Notes: The boundaries of this WCA run from the fenceline down 2 ridges, and surround 1 large gulch. These ridges are mostly native mid-slope, but are thick with coffee closer to the gulch. Rare plant reintroductions may be conducted in this WCA. If so, weed control will be conducted to prepare sites before outplanting, and weed control thereafter will be conducted to keep alien canopy levels low. If no

reintroductions take place in this WCA, only target weed species will be treated. MU wide target species will be controlled by MIP Year 9.

WCA: Manuwai-10

Vegetation Type: Mesic Ridge

MIP Goal: 25% or less alien cover.

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA. Additionally, common weeds such as *S. terebinthifolius*, *S. cumini*, and *P. cattleianum*, will be treated in the overstory, and *C. arabica* in the understory.

Notes: This WCA has high levels of native cover and is of high priority for weeding. There are side gulches with *Pisonia sp.*, and *Cyanea angustifolia* scattered throughout the upper regions. There is also large population of *Melanthera tenuifolia* on and around the cliff that forms at the back of the gulch in the WCA. There are rare plant reintroductions slated for this gulch. Along the elevation gradient of the gulch there is suitable habitat for rare plants, and the terrain is not as steep as in other parts of the MU and is more manageable from that perspective. Weed control in this WCA will start as site preparation for reintroductions, and then be conducted to reduce non-native cover around these rare plant populations. This WCA is also high priority for early removal of Target Weed Species. MU wide target species will be controlled by MIP Year 8.

WCA: Manuwai-11

Vegetation Type: Mesic Ridge

MIP Goal: 50% or less alien cover (no rare taxa in WCA).

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA.

Notes: This WCA shares the native forest in WCA 10, and is also worthwhile to weed in order to extend the suitable habitat for the reintroductions slated for that WCA. Part of the WCA is quite steep and less management will take place in those areas. MU wide target species will be controlled by MIP Year 9.

WCA: Manuwai-12

Vegetation Type: Mesic Ridge

MIP Goal: 50% or less alien cover (no rare taxa in WCA).

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA. Additionally, understory and canopy weeds such as *Ageratina riparia*, *C. hirta*, *P. cattleianum* and *S. terebinthifolius* will be treated around rare plant populations.

Notes: The boundaries of this WCA run down two drainages, and encompass a ridge with a MFS population of *H. degeneri* var. *degeneri*. Weed control will be conducted mostly around these rare plants and in appropriate habitat up and down the ridge as needed. There are also other rare plants on the slopes of the ridge including: *A. macrococcus* var. *macrococcus*, *P. macrocarpa*, *D. sherffiana*. This is a large WCA, and the southern edge of this WCA is very steep and largely inaccessible. If remote weed control technologies are developed, such as Herbicide Ballistic Technology or aerial ball spraying, select weeds may be targeted for cliff side control. MU wide target species will be controlled by MIP Year 9.

WCA: Manuwai-13

Vegetation Type: Mesic Ridge

MIP Goal: 50% or less alien cover (no rare taxa in WCA).

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA.

Notes: This WCA encompasses the cliffs abutting Kamaohanui ridge. The terrain is very steep, or vertical and is mostly inaccessible. Control in this area will be limited to accessible rare taxa and target weed species sites. If remote weed control technologies are developed, such as Herbicide Ballistic Technology or aerial ball spraying, select weeds may be targeted for cliff side control.

WCA: Manuwai-14

Vegetation Type: Wet Forest

MIP Goal: 50% or less alien cover (no rare taxa in WCA).

Targets: Taxa from the MU Wide Species Target List will be treated in this WCA.

Notes: This WCA is the highest in elevation in the MU and is mostly Wet Forest. Unless there is a need to weed around the one population of rare plants in this WCA, or suitable habitat for rare plant reintroductions is found, no regular WCA weed control will take place in this WCA. Similar to WCA 14, remote weed control technologies will be required for control of MU wide target species.

1.2.3.4 Other Threat Control:

As listed in the Threat Summary Table, the following are identified as current or potential threats to MIP species. These threats still need further evaluation. Management approaches will be developed over the next few years as more is learned about how these threats impact the rare resources in the MU.

- Rodents: *Rattus rattus* (black rat, roof rat), *Rattus exulans* (polynesian rat, kiore), *Mus musculus* (house mouse); monitor resources for damage caused by rats and mice.
- Slugs: Take samples opportunistically while conducting management. Species likely include: *Deroceras leae*, *Limax maximus*, *Meghimatium striatum*
- Predatory Snails: *Euglandina rosea* (rosy wolf snail); not yet documented from MU, but likely present.
- Ants: Surveys yet to be conducted at areas with high levels of human activity: Parking area, DZs, campsites and rare plant reintroductions.
- Black Twig Borer: *Xylosandrus compactus*; impacts to *F. neowawraea* reintroduction will be monitored when this reintroduction is planted.

Primary Objective:

- Identify presence of threats mentioned above
- Maintain populations of identified threats to a level that facilitates stabilized or increasing plant and snail populations across the MU by the most effective means possible.

Management Objective: Ensure MIP/OIP rare plant resources within the MU are not impacted by identified threats.

Monitoring Objectives:

- Monitor rare plant and snail resources to help guide localized threat control.
- Sample ant populations at sites with high levels of management to identify species present.

1.2.3.5 Fire Control

Threat Level: Medium

Available Tools: Fuelbreaks, Helicopter water drops, Army Wildland Fire, staff expertise at fire incident command.

Management Objective:

- To prevent fire from burning any portion of the MU at any time.

Fire History

In 2007, a fire burned in Waialua, crossed Kaukonahua Rd. and burned up through ranch land, to State Forest Reserve and Natural Area Reserve Land. OANRP staff and other knowledgeable resource managers guided helicopter water drops to priority areas around natural resources for 8 days as the fire burned. Prior to 2007, no fires had burned through this area in at least 50 years. The southernmost portion of Manuwai MU was burned, and while no rare plants were affected in Manuwai, the fire reached as close as 100 meters to known rare plant populations. The burned area quickly filled back in with *P. maximum*, and serves as a large fuel load at the bottom of the MU.

Photo of area burned in Manuwai Gulch in 2007 fire



Preventative Actions

Since the 2007 fire, OANRP began to contract discing of grass growing in fallow fields along Kaukonahua Road. This creates a wider and continuous fire break at the site where the fire jumped the road in 2007. Efficient grass spraying techniques such as using helicopters with spray booms and ball

sprayers will be investigated. This technique could be useful to create a fuelbreak at the bottom of the MU or in other strategic locations. It is also important to maintain roads and LZs for fire access and as fire escape routes. The help of OANRP staff and other knowledgeable resource managers to direct helicopter water drops to priority areas around natural resources is key in dealing with fires across the area. Additionally, it will be important to work with The State to develop a fire management plan for the entire Mokuleia Forest Reserve and Lower Kaala NAR.

Action Table

Action Type	Actions	MIP Year 8 Oct 2011-Sept 2012				MIP Year 9 Oct 2012-Sept2013				MIP Year 10 Oct 2013-Sept2014				MIP Year 11 Oct 2014-Sept2015				MIP Year 12 Oct 2015-Sept2016			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Monitoring																					
General Survey	Survey LZ 149 (East Ridge) LZ whenever used, not to exceed once per quarter. If not used, do not need to survey.		█				█				█				█				█		
	Survey LZ 55 (Kamaohanui) LZ whenever used, not to exceed once per quarter. If not used, do not need to survey.		█				█				█				█				█		
	Quarterly surveys of campsites (if used)		█				█				█				█				█		
	Survey road from gate at top of Bob Cherry's ranch to contour road, past Puulu gulch, to where road ends in west range (RS-KLN-01).		█				█				█				█				█		
	Survey most frequently used access trail annually: from parking spot over ridge saddle, into gulch (trail yet to be created)		█				█				█				█				█		
ICA	Control <i>Caesalpinia decapetala</i> in the bottom of the gulch in Subunit I every 6 months.	█		█		█		█		█		█		█		█		█		█	
	Map all found locations of <i>B. vitifolia</i> at the end of MIP Year 8. Evaluate level of control needed.	█	█	█	█																
	Control known <i>Dietes iridioides</i> patch on eastern fenceline. Monitor quarterly to evaluate re-treatment frequency needed.	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█

Action Type	Actions	MIP Year 8 Oct 2011-Sept 2012				MIP Year 9 Oct 2012-Sept2013				MIP Year 10 Oct 2013-Sept2014				MIP Year 11 Oct 2014-Sept2015				MIP Year 12 Oct 2015-Sept2016			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	Map all known locations of <i>Montanoa hibiscifolia</i> at the end of MIP Year 8. Evaluate level of control needed.	/	/	/	/																
	Control <i>Pterolepis glomerata</i> on the eastern fenceline quarterly. Use OUST herbicide to exhaust seedbank.	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
WCA 1	Conduct target species weed control across WCA by MIP Year 11; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica</i> , <i>Juniperus bermudiana</i> , <i>Melaleuca quinquenervia</i> , <i>Roystonea regia</i> , <i>Schefflera actinophylla</i> , <i>Spathodea campanulata</i> , <i>Trema orientalis</i> .													/	/	/	/				
WCA 2	Conduct target species weed control across WCA by MIP Year 9; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica</i> , <i>Juniperus bermudiana</i> , <i>Melaleuca quinquenervia</i> , <i>Roystonea regia</i> , <i>Schefflera actinophylla</i> , <i>Spathodea campanulata</i> , <i>Trema orientalis</i> .					/	/	/	/												
WCA 3	Conduct target species weed control across WCA by MIP Year 10; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica</i> , <i>Juniperus bermudiana</i> , <i>Melaleuca quinquenervia</i> , <i>Roystonea regia</i> , <i>Schefflera actinophylla</i> , <i>Spathodea campanulata</i> , <i>Trema orientalis</i> .									/	/	/	/								
WCA 4	Conduct target species weed control across WCA by MIP Year 8; cover entire WCA once every 5 years. Species include but not	/	/	/	/																

Action Type	Actions	MIP Year 8 Oct 2011-Sept 2012				MIP Year 9 Oct 2012-Sept2013				MIP Year 10 Oct 2013-Sept2014				MIP Year 11 Oct 2014-Sept2015				MIP Year 12 Oct 2015-Sept2016			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	limited to: <i>Cupressus lusitanica</i> , <i>Juniperus bermudiana</i> , <i>Melaleuca quinquenervia</i> , <i>Roystonea regia</i> , <i>Schefflera actinophylla</i> , <i>Spathodea campanulata</i> , <i>Trema orientalis</i> .	hatched	hatched	hatched	hatched																
	Control weeds across rare plant zone, and high quality lama-band annually.		hatched				hatched				hatched				hatched				hatched		
WCA 5	Conduct target species weed control across WCA by MIP Year 11; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica</i> , <i>Juniperus bermudiana</i> , <i>Melaleuca quinquenervia</i> , <i>Roystonea regia</i> , <i>Schefflera actinophylla</i> , <i>Spathodea campanulata</i> , <i>Trema orientalis</i> .													hatched	hatched	hatched	hatched				
	Control weeds around isolated rare plant populations as needed.				hatched				hatched				hatched				hatched				hatched
WCA 6	Conduct target species weed control across WCA by MIP Year 9; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica</i> , <i>Juniperus bermudiana</i> , <i>Melaleuca quinquenervia</i> , <i>Roystonea regia</i> , <i>Schefflera actinophylla</i> , <i>Spathodea campanulata</i> , <i>Trema orientalis</i> .																				
WCA 7	Conduct target species weed control across WCA by MIP Year 9; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica</i> , <i>Juniperus bermudiana</i> , <i>Melaleuca quinquenervia</i> , <i>Roystonea regia</i> , <i>Schefflera actinophylla</i> ,					hatched	hatched	hatched	hatched												

Action Type	Actions	MIP Year 8 Oct 2011-Sept 2012				MIP Year 9 Oct 2012-Sept2013				MIP Year 10 Oct 2013-Sept2014				MIP Year 11 Oct 2014-Sept2015				MIP Year 12 Oct 2015-Sept2016			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	<i>Spathodea campanulata, Trema orientalis.</i>																				
WCA 8	Conduct target species weed control across WCA by MIP Year 9; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica, Juniperus bermudiana, Melaleuca quinquenervia, Roystonea regia, Schefflera actinophylla, Spathodea campanulata, Trema orientalis.</i>																				
WCA 9	Conduct target species weed control across WCA by MIP Year 9; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica, Juniperus bermudiana, Melaleuca quinquenervia, Roystonea regia, Schefflera actinophylla, Spathodea campanulata, Trema orientalis.</i>																				
WCA 10	Conduct target species weed control across WCA by MIP Year 8; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica, Juniperus bermudiana, Melaleuca quinquenervia, Roystonea regia, Schefflera actinophylla, Spathodea campanulata, Trema orientalis.</i>																				
	Conduct weed control around rare plant reintroductions; prepare and maintain sites.																				
WCA 11	Conduct target species weed control across WCA by MIP Year 9; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica, Juniperus bermudiana, Melaleuca quinquenervia, Roystonea regia, Schefflera actinophylla,</i>																				

Action Type	Actions	MIP Year 8 Oct 2011-Sept 2012				MIP Year 9 Oct 2012-Sept2013				MIP Year 10 Oct 2013-Sept2014				MIP Year 11 Oct 2014-Sept2015				MIP Year 12 Oct 2015-Sept2016			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	<i>Spathodea campanulata, Trema orientalis.</i>					/	/	/	/												
	Conduct sweeps across lama dominated slopes and ridge shared with WCA 10.			/				/				/				/				/	
WCA 12	Conduct target species weed control across WCA by MIP Year 9; cover entire WCA once every 5 years. Species include but not limited to: <i>Cupressus lusitanica, Juniperus bermudiana, Melaleuca quinquenervia, Roystonea regia, Schefflera actinophylla, Spathodea campanulata, Trema orientalis.</i>					/	/	/	/												
	Weed throughout <i>H. degeneri</i> var. <i>degeneri</i> population and suitable habitat along ridge annually.				/			/				/				/				/	
WCA 13	Evaluate feasibility of controlling target species on the ground (area is very steep). Species include: <i>Cupressus lusitanica, Juniperus bermudiana, Melaleuca quinquenervia, Roystonea regia, Schefflera actinophylla, Spathodea campanulata, Trema orientalis.</i> Where not possible, aerially identify locations of targets. Control with remote control technologies if determined appropriate control for those targets. Complete control by MIP Year 11.													/	/	/	/				
WCA 14	Evaluate feasibility of controlling target species on the ground (area is very steep). Species include: <i>Cupressus lusitanica, Juniperus bermudiana, Melaleuca quinquenervia, Roystonea regia, Schefflera</i>													/	/	/	/				

Action Type	Actions	MIP Year 8 Oct 2011-Sept 2012				MIP Year 9 Oct 2012-Sept2013				MIP Year 10 Oct 2013-Sept2014				MIP Year 11 Oct 2014-Sept2015				MIP Year 12 Oct 2015-Sept2016			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	<i>actinophylla, Spathodea campanulata, Trema orientalis</i> . Where not possible, aerially identify locations of targets. Control with remote control technologies if determined appropriate control for those targets. Complete control by MIP Year 11.													hatched	hatched	hatched	hatched				
Ungulate Control	Continue hunts to remove pigs from Subunit I and II. Use snares as needed to remove pigs from Subunit II.	hatched	hatched	hatched																	
	Conduct quarterly fence checks.	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched	hatched
Other Threat Control	Conduct annual ant surveys at camp site most frequently used.		hatched			hatched				hatched				hatched				hatched			
	Conduct annual ant survey along access trail from the road.		hatched			hatched				hatched				hatched				hatched			
Hatched=Quarter Planned																					