

Ecosystem Restoration Management Plan

MIP Year 14-18, Oct. 2017 – Sept. 2022

OIP Year 11-16, Oct. 2017 – Sept. 2022

MU: Ekahanui, Ekahanui No MU, Huliwai, Huliwai no MU

Overall MIP Management Goals:

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

Background Information

Location: Southern Waianae Mountains

Land Owner: State of Hawaii

Land Managers: DOFAW (State Forest Reserve)

Acreage: 216-acres

Elevation Range: 1800-3127 ft.

Description: Ekahanui MU is in the Southern Windward Waianae Mountains. Puu Kaua is at the apex of many sub drainages that make up Ekahanui. The summit of Puu Kaua is 3127 ft. high. Three major drainages are encompassed in the MU. Overall the area is characterized by steep vegetated slopes and cliffs, especially at higher elevations. Much of the MU is dominated by alien vegetation. There are only small pockets of native vegetation at the back of the gulches and at higher elevation worth of intensive management. The alien dominated areas were included in the MU boundary to ensure management options for the Oahu Elepaio, *Chasiempis sandwichensis ibidis*. Most of this alien dominated area fenced for Elepaio management falls into the Subunit II fence. The MU is accessed via the Kunia road through the Kunia Loa development in the South.

Huliwai MU is also located in the Southern Windward Waianae Mountains, just 1 mile north of Ekahanui by way of the contour trail. While Huliwai gulch is a relatively large drainage made up of several small sub drainages with the summit of Puu Kanehoa (2728 ft.) at its apex. The Huliwai MU is just a small fraction of this area because of the poor quality of the native habitat that remains. The MU consists of a small fence (0.3-acres) enclosing a population of *Abutilon sandwicense*. The fence includes a small stand of *Sapindus oahuensis* and a mix of native and alien canopy and understory species. The surrounding area is mostly invaded by alien species, but there is a volunteer group “Friends of Honouliuli” that have been working in the nearby areas to restore native plants and help control targeted invasive species. The MU is most easily accessed from the Wili Wili Ridge Trail head via the Monsanto Farm Gate.

Native Vegetation Types

Waianae Vegetation Types	
Mesic mixed forest	<p><u>Canopy includes</u>: <i>Acacia koa</i>, <i>Metrosideros polymorpha</i>, <i>Nestegis sandwicensis</i>, <i>Diospyros</i> spp., <i>Planchonella sandwicensis</i>, <i>Charpentiera</i> spp., <i>Pisonia</i> spp., <i>Psychotria</i> spp., <i>Antidesma platyphyllum</i>, <i>Bobea</i> spp., <i>Sapindus oahuensis</i>, and <i>Santalum freycinetianum</i>.</p> <p><u>Understory includes</u>: <i>Alyxia stellata</i>, <i>Bidens torta</i>, <i>Coprosma</i> spp., and <i>Microlepidia strigosa</i></p>

Mesic-Wet forest	<p><u>Canopy includes:</u> <i>Metrosideros polymorpha polymorpha</i>. Typical to see <i>Cheirodendron trigynum</i>, <i>Cibotium spp.</i>, <i>Melicope spp.</i>, <i>Antidesma platyphyllum</i>, and <i>Ilex anomala</i>.</p> <p><u>Understory includes:</u> <i>Cibotium chamissoi</i>, <i>Broussasia arguta</i>, <i>Dianella sandwicensis</i>, and <i>Dubautia spp.</i> Less common subcanopy components of this zone include <i>Clermontia spp.</i> and <i>Cyanea spp.</i></p>
NOTE: For MU monitoring purposes vegetation type is mapped based on theoretical pre-disturbance vegetation. Alien species are not noted.	

Vegetation Types at Ekahanui



Mesic Mixed Forest



Mesic-Wet Forest



MIP/OIP Rare Resources at Ekahanui

Organism Type	Species	Pop. Ref. Code	Population Units	Management Designation	Wild/ Reintroduction
Plant	<i>Abutilon sandwicense</i>	EKA-A, B, C, HUL-A	Ekahanui and Huliwai	MFS (OIP)	Both
Plant	<i>Alectryon macrococcus</i> var. <i>macrococcus</i>	EKA-A*, B, C, D*, E*, F	Ekahanui	Genetic Storage and MFS (MIP)	Wild
Plant	<i>Cenchrus agrimonioides</i> var. <i>agrimonioides</i>	EKA-A, B, C, D	Central Ekahanui	MFS (MIP)	Both
Plant	<i>Cyanea grimesiana</i> subsp. <i>obatae</i>	EKA-A*, B, C	North Branch of South Ekahanui	Genetic Storage and MFS (MIP)	Both
Plant	<i>Delissea waianaensis</i>	EKA-A, B*, C*, D	Ekahanui	MFS (MIP)	Both
Plant	<i>Kadua parvula</i>	EKA-A	Ekahanui	MFS (MIP)	Reintroduction
Plant	<i>Phyllostegia mollis</i>	EKA-A*, B*, C*	Ekahanui	MFS (OIP)	Both
Plant	<i>Plantago princeps</i> var. <i>princeps</i>	EKA-A, B, C, D	Ekahanui	MFS (OIP)	Both
Plant	<i>Schiedea kaalae</i>	EKA-A, B, C*, D, E#	Ekahanui	MFS (MIP)	Both
Snail	<i>Achatinella mustelina</i>	EKA-A, B, C, D, E, F, G	ESU-E	MFS (MIP)	Wild
Bird	<i>Chasiempis sandwichensis ibidis</i>	N/A	Ekahanui	MFS	Wild
Arthropod	<i>Drosophila montgomeryi</i>	N/A	Ekahanui	None	Wild

MFS= Manage for Stability

GSC= Genetic Storage Collection

* = Population Dead

† = Reintroduction not yet done

= not an IP population

Other Rare Taxa at Ekahanui

Organism Type	Species	Status
Plant	<i>Asplenium dielfalcatum</i>	Endangered
Plant	<i>Asplenium unisorum</i> *	Endangered
Plant	<i>Chrysodracon forbesii</i>	Endangered
Plant	<i>Cyanea pinnatifida</i>	Endangered
Plant	<i>Cyanea calycina</i>	Endangered
Plant	<i>Dissochondrus biflorus</i>	Species of Concern
Plant	<i>Euphorbia herbstii</i> *	Endangered
Plant	<i>Phyllostegia hirsuta</i>	Endangered
Plant	<i>Phyllostegia kaalaensis</i> *	Extirpated
Plant	<i>Platydesma cornuta</i> var. <i>decurrens</i>	Endangered
Plant	<i>Schiedea hookeri</i>	Endangered
Plant	<i>Schiedea pentandra</i>	Candidate
Plant	<i>Urera kaalae</i>	Endangered
Plant	<i>Tetramolopium lepidotum</i> var. <i>lepidotum</i>	Endangered
Plant	<i>Zanthoxylum dipetalum</i> var. <i>dipetalum</i>	Endangered
Plant	<i>Solanum sandwicense</i>	Endangered
Snail	<i>Philonesia</i> sp.	Species of Concern
Snail	<i>Amastra spirizona</i>	Species of Concern

* = Population Dead

Rare Resources at Ekahanui



Mature *Cyanea grimesiana* subsp. *obatae* at reintroduction



D. waianaensis recruitment around reintroduced plants.



Abutilon sandwicense flower



Wild *Schiedea kaalae* patch



Plantago princeps var. *princeps* with infructescence

Locations of Rare Resources at Ekahanui

Map removed to protect rare resources

MU Threats to MIP/OIP MFS Taxa

Threat	Rare Taxa Affected	Management Strategy	Current Status, 2017
Pigs	All	Across MU	No animals within fence
Rats	All	Across MU	MU-wide snap trap grid currently running
Predatory snails <i>Euglandina rosea</i>	<i>Achatinella mustelina</i>	Predator-proof snail enclosure offsite (Palikea)	Limited to hand-removal. Majority of the <i>A. mustelina</i> have been placed in SEPP rearing laboratory. All <i>A. mustelina</i> in MU will be moved into Palikea North enclosure, which will be completed by the end of 2017.
Slugs	<i>C. grimesiana</i> subsp. <i>obatae</i> , <i>D. subcordata</i> , <i>S. kaalae</i> , <i>P. mollis</i> , seedlings of several other species may be affected	Affected rare taxa sites only	Slug control toxicant (FerroxxAQ®) applied every 6 weeks.
Ants	Potential threat to <i>Drosophila montgomeryi</i>	Fly breeding sites	Ants known to harm <i>Drosophila</i> are present throughout this MU, however research is needed to find fly breeding sites and to identify insecticides that will control ants without harming the flies.

Weeds	All	Rare taxa sites primarily, across MU secondarily	Regular maintenance required several times per year
Fire	All	Target <i>Urochloa maxima</i>	Regular grass control within the MU and along fence line as needed.
Black Twig Borer <i>Xylosandrus compactus</i>	<i>Alectryon macrococcus</i> var. <i>micrococcus</i> ,	None	These remain a threat and damage to plants will be noted, however no control methods are available
Jackson's Chameleons	<i>A. mustelina</i>	None	Limited to hand-removal and the physical barriers (enclosures), to protect <i>Achatinella</i> from predators under construction.

Management History

- 1860s-80s: Area severely degraded by overgrazing by unmanaged herds of cattle. James Campbell purchases Honouliuli and drives more than 30,000 head of cattle off the slopes and lets the land "rest."
- 1925: Honouliuli Forest Reserve established for watershed protection purposes.
- 1930s-50s: Division of Forestry and Civilian Conservation Corps builds roads, trails and fences and continue removal of feral goats and cattle; plants 1.5 million trees in the Honouliuli Forest Reserve mainly below the 1800' elevation.
- 1970's: *Clidemia* first introduced to the Waianae Mountains in North Honouliuli.
- 1990-2009: Honouliuli Preserve managed by The Nature Conservancy.
- 1998-2002: Biological surveys by TNC staff and Joel Lau.
- 1996-1998: TNC staff conducts *Schinus terebinthifolius* trials to determine the most effective control method using girdling and herbicide (Garlon4) application techniques.
- 1999: Elepaio management begins with banding and rodent control around approximately 6 pairs by TNC. By 2006, the number of territories protected is about 20. By 2009, over 25 pairs are known and protected by rat control efforts.
- 2000: Subunit I fence completed by TNC (40-acres). TNC eradicated the last pigs through the use of volunteer and staff hunters.
- 2001-2002: OANRP begins collaboration with TNC by helping to build fence around *Amastra spirizona* and to create rat control grids with bait boxes and victor traps to protect *Achatinella mustelina* and *Plantago princeps* var. *princeps*.
- 2001-2006: Catchment tanks and field nursery installed by TNC staff. Other common native restoration efforts done by TNC/Army staff.
- 2002: *Achatinella mustelina* surveys by Army Staff and Joel Lau.
- 2003: TNC outplanted *Cyanea grimesiana* subsp. *obatae* plants (EKA- B) into Palai Gulch.
- 2003: *Delissea waianaeensis* plants (EKA-D) reintroduced into Subunit I fence by TNC.
- 2003: *Schiedea kaalae* plants (EKA-D) were outplanted by TNC in the S. Ekahanui gulch.
- 2004: OANRP builds additional population unit (PU) fences outside of Subunit I.
- 2005: A 120-acre fire burns into the forest, well into the adjacent gulch to the south of Ekahanui as well as into the lower reaches of Ekahanui Gulch itself.
- 2005: *Cenchrus agrimonioides* var. *agrimonioides* (EKA-B) plants reintroduced along fenceline (Subunit I/II) on ridge.
- 2006: *C. grimesiana* subsp. *obatae* (EKA-C) plants reintroduced into the S. Ekahanui gulch "2D" site.
- 2007: Active management by TNC stops due state wide realignment of priorities.
- 2008: Subunit II/III fence completed by OANRP. Fence was vandalized not long after completion.

- 2008: *C. agrimonioides* var. *agrimonioides* (EKA-C) plants introduced on the North ridge on B-line.
- 2008 Ant surveys implemented.
- 2009: James Campbell Co. sells Honouliuli Preserve to the State of Hawaii and TNC transfers lease. TNC ends their involvement and operations in MU.
- 2010 last pig removed from Subunit II fence.
- 2010-2011: Large-scale rodent trapping grid system installed using 512 Victor snap traps throughout the whole MU. However, only the Victor traps surrounding the *Plantago princeps* var. *princeps* and the *A. mustelina* populations along the crest line are monitored year-round, whereas the rest of the Victor traps are checked during the Elepaio breeding season.
- 2011: Stream in airplane gulch breaches fence and is later repaired.
- 2011: *Abutilon sandwicense* plants (EKA-B) reintroduced into the Subunit I fence.
- 2011: *C. agrimonioides* var. *agrimonioides* (EKA-D) into the “Bump-out”/Subunit IV.
- 2011: One hundred and two Victor snap traps are added to existing rodent trapping grid. Total of 667 traps.
- 2012: Subunit IV fence completed. Pigs ingress Subunit I; ungulates removed via hunting.
- 2012: *Phyllostegia mollis* plants (EKA-D) reintroduced in the PlaPriPri/PhyMol gulch.
- 2013: Thirty-four Goodnature A24 Rat Trap- Automatic & Self-Resetting are added to trapping grid to assist rodent control surrounding the *Achatinella mustelina* and *Plantago princeps* var. *princeps* populations at the top crest line of MU.
- 2013: *A. sandwicense* plants (EKA-C) reintroduced into the Subunit III fence.
- 2013-2015: OANRP *Drosophila* fly surveys begin around *Urera* sites. None were observed.
- 2014: *P. princeps* var. *princeps* plants (EKA-D) were outplanted.
- 2014: Huliwai fence completed to protect *A. sandwicense* (HUL-A).
- 2014: Pig ingress in Ekahanui subunit II; ungulates removed via hunting.
- 2016: Eleven pigs reported in Subunit I fence by OANRP staff; one pig caught in a snare. Further ungulate sign was observed.
- 2016: *Kadua parvula* plants (EKA-A) reintroduced along the top crest line above *P. princeps* var. *princeps* population.
- 2016: Strategic area above Subunit I enclosed, mauka line of Subunit I repaired, no further ungulate sign detected.
- 2016: Two temporary enclosures for *A. mustelina* were built near populations that were rapidly declining in order to protect the remaining *A. mustelina* until the Palikea North enclosure is complete. Unfortunately, the exclosures EKA-M on Mamane ridge south and EKA-S located north near the *Amastra spirizona* both failed to help the snails survive and they were discontinued.
- 2016: All but one individual *P. mollis* (EKA-D) reintroduction confirmed dead.
- 2017: One hundred and two *A. mustelina* were collected and brought to the Snail Extinction Prevention Program’s housing and rearing facility.

Future goals

- 2017: All Victor snap traps will be replaced with The Goodnature A24 Rat Traps. A total of 350 A24 traps will be added.
- 2018: All ESU-E *A. mustelina* will be translocated to the Palikea North enclosure.

Ungulate Control

Species: *Sus scrofa* (pigs), *Capra hircus* (goats)

Threat Level:

- *Sus scrofa*: High
- *Capra hircus*: Low level (but are present in gulches and ridges on the leeward side and to the south)

Management Objectives:

- Maintain fenced Subunits I-IV as ungulate free.

Strategy and Control Methods:

- Exclusion of all ungulates from MU via large-scale fencing.
 - Subunit I completed by TNC contractor in 2000
 - Four PU fences completed by OANRP staff in 2004
 - Subunit II/III completed by OANRP in 2008
 - Subunit IV completed by OANRP in 2011
- Conduct quarterly perimeter fence checks.
- Conduct yearly Subunit and interior fence checks.
- Note any pig sign while conducting day to day actions within fenced MU.
- If any pig activity is detected, work with Ungulate Management/Elepaio Stabilization Coordinator to implement hunting or snaring.

Discussion: There is a perimeter fence around the entire MU. The major threats to the perimeter fence include fallen trees, vandalism, rock fall, and high water events. There are no “major” gulch crossings but rather three smaller crossings that have potential to carry a large amount of debris. Special emphasis will be placed on checking the fence after extreme weather events, such as in when 2011 when a stream breached the unit II part of the perimeter. There have been relatively few incidences of vandalism to the fence in the past.

For Ungulate Management Map, please see Weed Survey Map for existing fence lines.

Weed Control

Weed Control actions are divided into 4 subcategories:

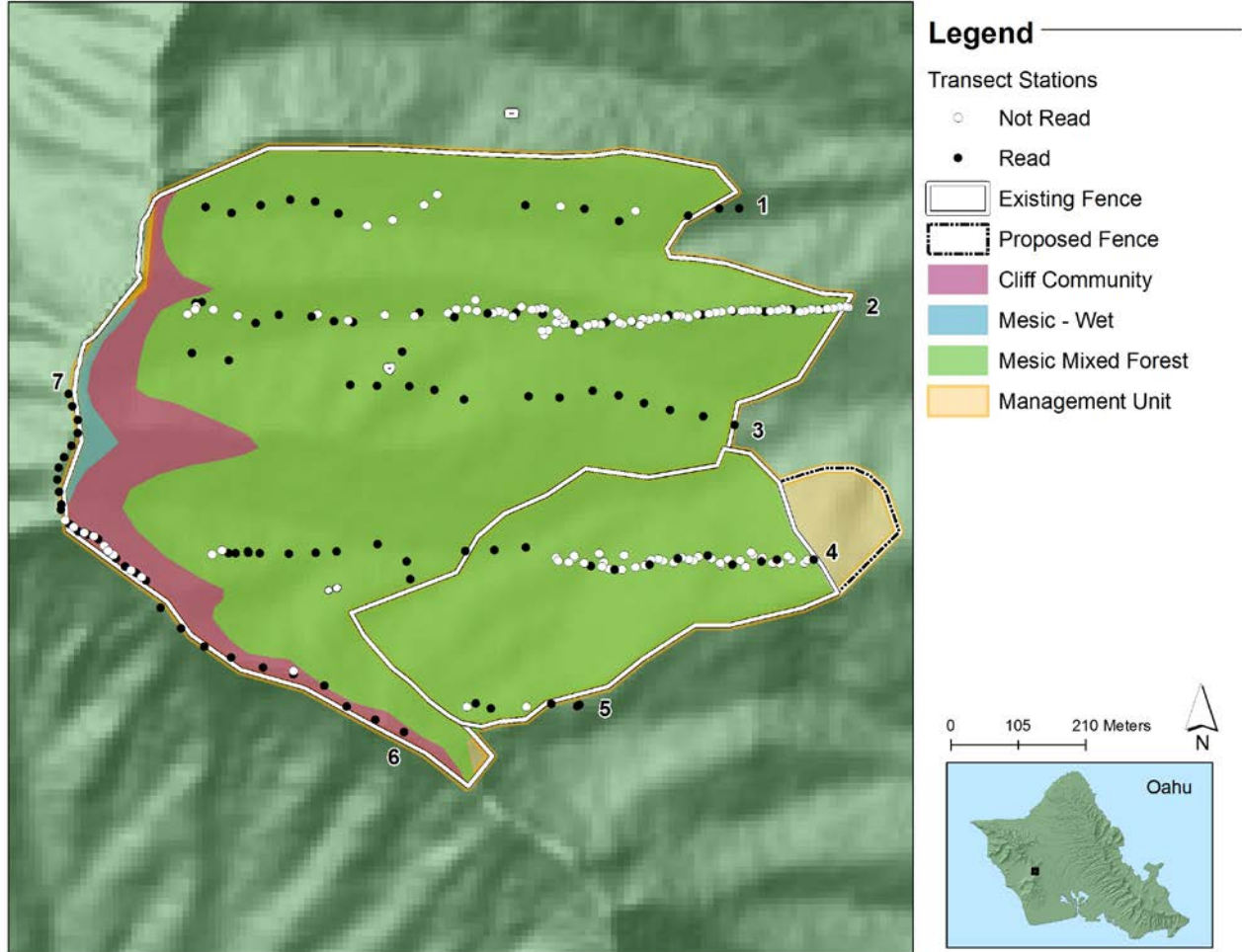
- 1) Vegetation Monitoring
- 2) Surveys
- 3) Incipient Taxa Control (Incipient Control Area - ICAs)
- 4) Ecosystem Management Weed Control and Restoration Actions (Weed Control Areas - WCAs)

These designations facilitate different aspects of MIP/OIP requirements.

Vegetation Monitoring

From October to November of 2008, a total of 115 bell plots in 7 transects were monitored for the Ekahanui management unit (MU). MU monitoring will be conducted every ten years and will provide OANRP with trend analyses on vegetation cover and species diversity. Results from the 2008 monitoring are included in the 2009 annual report (map of the locations of MU monitoring transects below reflects Ekahanui MU from the 2008 monitoring). Plots measuring 5 x 10 m were generally located every 20 m along transects. Transects were located in accessible areas (as the majority of the MU is too steep to access), spaced approximately 50 m apart. Understory (0 – 2 m AGL, including low branches from canopy species) and canopy (> 2 m AGL, including epiphytes) vegetation was recorded by percent cover for all non-native and native species present. Summary percent cover by vegetation type (shrub, fern, grass/sedge) in the understory, overall summary percent cover of non-native and native vegetation in the understory and canopy, and bare ground (non-vegetated < 25 cm AGL), were also documented. Percent cover categories were recorded in 10% intervals between 10 and 100%, and on finer intervals (0-1%, 1-5%, and 5-10%) between 0 and 10% cover. Based on MIP recommendations, p-values < 0.05 were considered significant, and only absolute cover changes $\geq 10\%$ were recognized. Additional methodology information is detailed in Monitoring Protocol 1.2.1 (OANRP 2008). All analyses were performed in IBM SPSS Statistics Version 24. These included Wilcoxon signed-rank tests and Friedman's tests with Bonferroni adjusted post-hoc pairwise comparisons for cover data, paired t tests and repeated measures ANOVA for species richness data, and McNemar's tests for frequency data.

Locations of MU Monitoring Transects



Vegetation Monitoring Analyses

The mean alien vegetation cover in the understory was 33% across the MU. The 90% confidence interval for the mean was 28% to 37%. This percentage meets the management goal of 50% or less non-native cover in the understory. The mean alien canopy cover was 56% with 90% confidence that the mean was 50% to 62% (refer to MU Vegetation Monitoring table).

Pimenta dioica and *Fraxinus uhdei* are non-native species which OANRP is interested in tracking over time in order to learn more about the potential threat of these species. From the data collected for the 2008 MU vegetation monitoring, *P. dioica* occurred in one out of 115 plots and *F. uhdei* in six.

A large portion of the MU was fenced for the protection of Elepaio and has been weeded on a gradual basis. In areas around rare plant taxa, OANRP has been taking a more aggressive approach to weed management (refer to Ecosystem Management Weed Control section) to meet the IP goals for each OIP/MIP managed plant taxon. In addition, OANRP has plans to restore native habitat for rare taxa and decrease weeding efforts in areas where staff has spent large amounts of time weeding via native common outplanting. Possible restoration efforts in Ekahanui MU is discussed in the Ecosystem Weed Control section below.

MU Vegetation Monitoring Analyses

Variable	Count	Mean	StDev	*lower limit	*upper limit
NF	115	5.4	15.4	3.1	7.8
NS	115	9.5	15.6	7.1	11.9
NG	115	1.6	4.4	1	2.3
XF	115	3.8	12.4	1.9	5.7
XS	115	18.8	21.1	15.5	22
XG	115	11.2	21.1	8	14.5
NoVegUS	115	53.6	34.5	48.3	59
NativeUS	115	15.2	21.7	11.8	18.5
AlienUS	115	32.9	29.3	28.4	37.4
NativeCanopy	115	15.9	25.3	12	19.9
AlienCanopy	115	56.3	38.1	50.5	62.2
TotalCanopy	115	68	31	63.2	72.8
*90% probability interval					

NF=Native ferns NS=Native shrubs NG=Native grasses XF=Alien ferns XS=Alien shrubs XG=Alien grasses
 NoVegUS=Total Non-vegetative (bare ground) understory NativeUS= Total Native understory AlienUS= Total alien understory

With the exclusion of the cliff and wet-mesic communities Ekahanui is a mixed mesic forest. The majority of management falls within this vegetation type and was analyzed separately to aid in setting WCA vegetation percent cover goals. A large portion of the mesic forest was dominated by established monotypic *Psidium cattleianum* stands. This is the main reason for the low percentage of alien vegetation cover and low species diversity in the understory. The mixed mesic vegetation community's mean alien cover in the understory was 33% and 75% in the canopy. The mean native vegetation cover for the understory was 7.2% and 9.4% for the canopy (refer to the Mixed Mesic Vegetation Type Monitoring Analysis table).

Mixed Mesic Vegetation Type Monitoring Analysis

Variable	Count	Mean	StDev	*lower limit	*upper limit
Native US	86	7.2	12	5	9.3
Alien US	86	33.3	30.2	27.8	38.7
Nonveg	86	63.1	32.4	57.3	68.9
Native canopy	86	9.4	17.4	6.3	12.5
Alien canopy	86	74.8	24	70.5	79.1
*90% Confidence Level					

NonVeg=Total Non-vegetative (bare ground) understory NativeUS= Total Native understory AlienUS= Total alien understory

For the MU the alien species mean in the understory was 6.5 and 1.9 in the canopy. The native understory species mean was 6.2 and 1.5 in the canopy (Refer to MU Species Count Table). For the mixed mesic vegetation type the alien species mean in the understory was 4.7 and 2.3 in the canopy. The native understory species mean was 3.7 and 1.2 in the canopy (refer to the Mixed Mesic Vegetation Type Species Count table). This baseline data will be used to track species diversity of the MU over time.

MU Species Count

Variable	Count	Mean	StDev	*lower limit	*upper limit
Native US	115	6.2	6.3	5.2	7.1
Alien US	115	6.5	4.4	5.8	7.2
Native Canopy	115	1.5	2	1.2	1.8
Alien Canopy	115	1.9	1.3	1.7	2.1
*90% Confidence Level					

NativeUS= Total Native understory

AlienUS= Total alien understory

Mixed Mesic Vegetation Type Species Count

Variable	Count	Mean	StDev	*lower limit	*upper limit
Native US	86	3.7	3.8	3	4
Alien US	86	4.7	2.9	4.1	5.2
Native canopy	86	1.2	1.4	0.9	1.4
Alien canopy	86	2.3	1.17	2.1	2.5
*90% Confidence Level					

NativeUS= Total Native understory

AlienUS= Total alien understory

Vegetation Monitoring Response:

- Increase weeding efforts if the non-native vegetation goals are not being met in the MU.

Surveys

Potential Vectors: OANRP activity, hikers/hunters, pigs/goats, alien birds, wind.

Management Objective:

- Prevent the establishment of any new invasive alien plant or animal species through regular surveys along roads, landing zones, camp sites, fence lines, trails, and other high traffic areas.

Strategy and Control Methods:

- Note unusual, significant, or incipient alien taxa during the course of regular field work. Map and complete Target Species form to document sighting.
- Survey LZs quarterly (if used) and Campsites used in the course of field work, not to exceed once per quarter.

Discussion:

Surveys are designed to be the first line of defense in locating and identifying potential new weed species. Roads, landing zones, fence lines, and other highly trafficked areas are inventoried regularly to facilitate early detection and rapid response; Army roads and LZs are surveyed annually, non-Army roads are surveyed annually or biannually, while all other sites are surveyed quarterly or as they are used.

At Ekahanui, landing zones are checked when used (not exceeding once per quarter). LZs within the MU include the following: 132 EKA Summit, 106 Ekahanui Crestline, and 136 Ekahanui North. LZ 132 is used increasingly less due to the ingress of *Melinis minutiflora* grass that obstructs the landing zone. This LZ will be cleared to use in case of emergencies. The Ekahanui Trailhead LZ (99) is no longer in existence as it was on private, fallow agricultural land which has been sold and developed. Establishment of another LZ in the area was proposed but has been determined unnecessary since the re-establishment of

the SBS LZ. There is a weed transect along the access trail from the trailhead to the fence. There are currently no road surveys for the MU as the access road now goes through private, agricultural land.

Incipient Taxa Control

All weed control geared towards eradication of a particular invasive weed is tracked via Incipient Control Areas, or ICAs. Each ICA is species-specific and geographically defined. One infestation may be divided into several ICAs or one ICA, depending on infestation size, topographical features, and land ownership. Some ICA species are incipient island-wide, and are a priority for ICA management whenever found. Others are locally incipient to the MU, but widespread elsewhere. In either case, the goal is eradication of the ICA. The goals, strategies, and techniques used vary between ICAs, depending on terrain, surrounding vegetation, target taxon, size of infestation, and a variety of other factors.

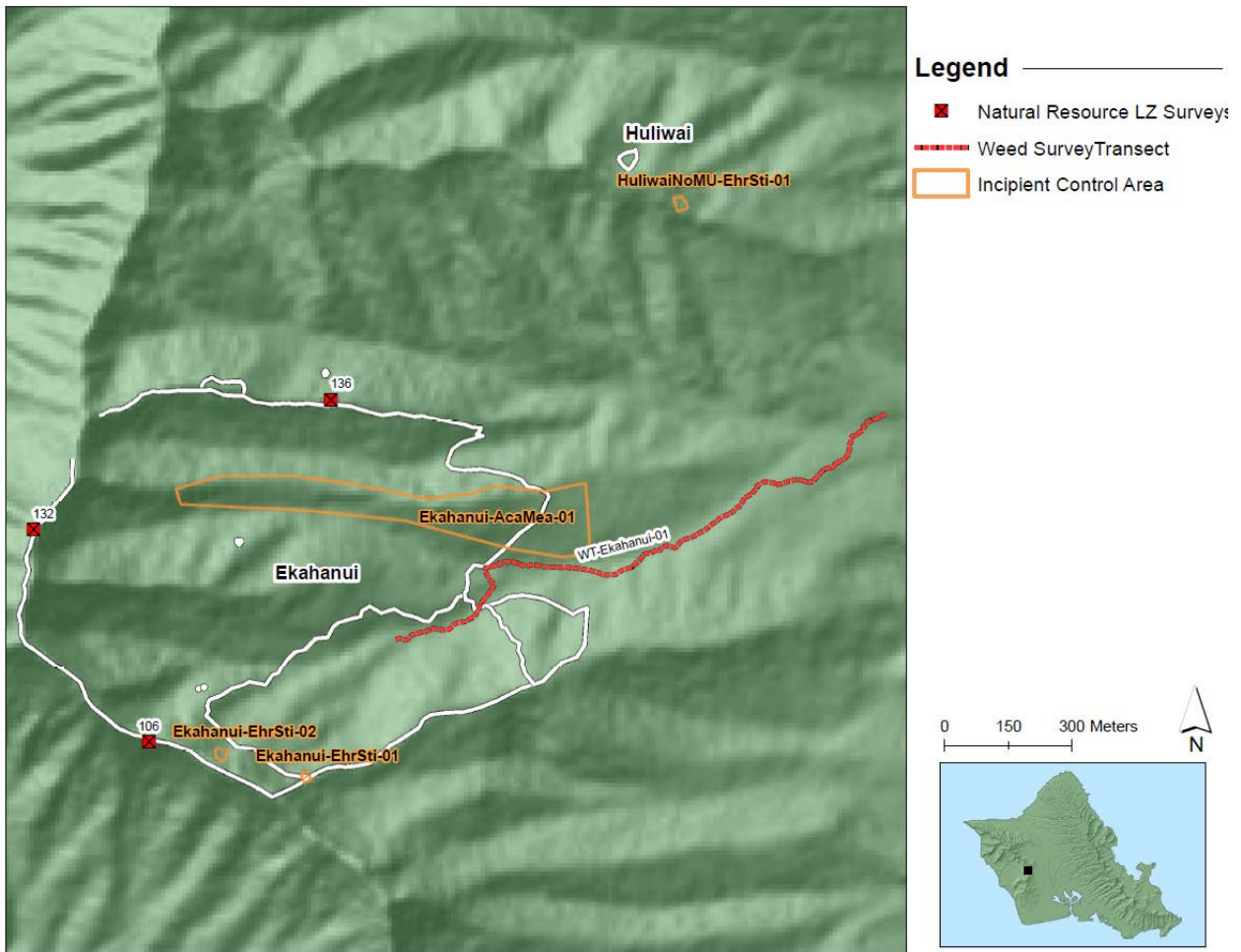
Management Objectives:

- Eradicate ICAs through regular and thorough monitoring and treatment. In the absence of any information about seed bank longevity for a particular species, eradication is defined as 10 years of consistent monitoring with no target plants found.
- Study seed bank longevity of ICA taxa, and revise eradication standards per taxon.
- Evaluate any invasive plant species newly discovered in MU, and determine whether ICA-level control is warranted. Factors to consider include distribution, invasiveness, locations, and infestation size, availability of control methods, resources, and funding.

Strategy and Control Methods:

- Species and ICAs are listed in the table below. History and strategy is discussed for each species.
- Monitor the progress of management efforts, and adjust visitation rates to allow staff to treat plants before they mature. Remember that one never finds 100% of all plants present.
- Use aggressive control techniques where possible. These include power spraying, applying pre-emergent herbicides, clearcutting, aerial spraying, and frequent visits.

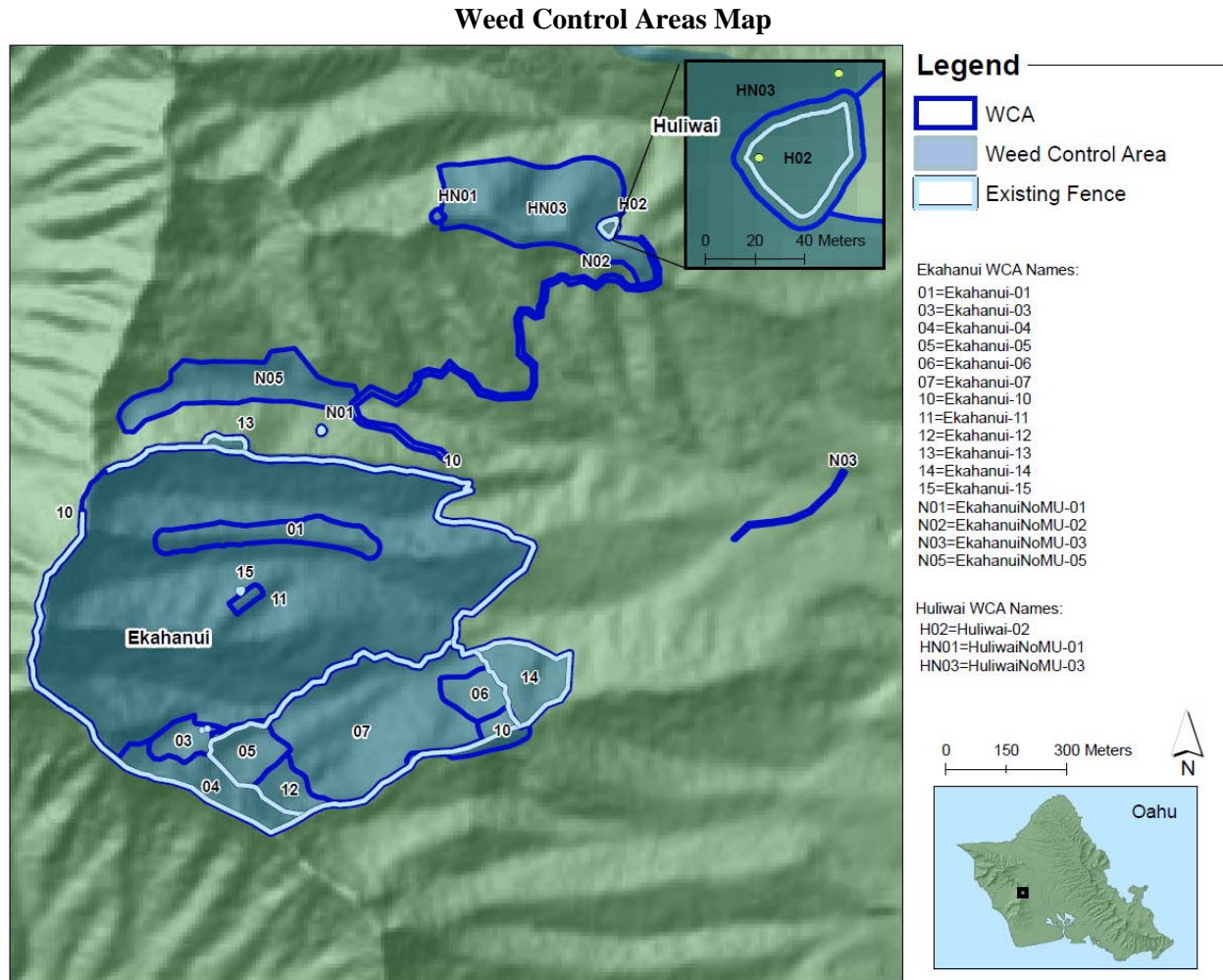
Incipient Control Area and Survey Locations Map



Two incipient species have been identified by OANRP in the MU: *Ehrharta stipoides* and *Acacia mearnsii*. *E. stipoides* ICAs were first reported in 2012 and 2015, which may have been introduced by Pono Pacific staff while monitoring Palikea, where *E. stipoides* is well-established, and Ekahanui rodent trapping grids. Return visits will be scheduled to prevent immature individuals from reaching maturity and to eradicate these species from the MU.

Summary of ICAs

Taxon	ICA Code	Control Discussion
<i>Acacia mearnsii</i>	Ekahanui-AcaMea-01	Known from one location within MU. ICA formed, control ongoing annually. Ekahanui MU is mauka of forestry plantings of <i>A. mearnsii</i> . Seeds persist in seed bank. Need wider surveys to better define ICA boundary. Identify any hotspots.
<i>Ehrharta stipoides</i>	Ekahanui-EhrSti-01	All sites checked at least once per quarter. Targeted for eradication, which can be successfully done due to short-lived seed bank (2 yrs.). Pick and remove from field any potentially mature fruit. Use pre-emergent herbicide. This species is cryptic and can be difficult to ID.
	Ekahanui-EhrSti-02	
	HuliwaiNoMU-EhrSti-01	



Ecosystem Management Weed Control

MIP Goals:

- Within 2m of rare taxa: 0% alien vegetation cover except where removal of weeds causes harm.
- 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:

- In WCAs within 50m of rare taxa, work towards achieving 25% or less alien vegetation cover in understory and canopy.

Discussion: Weed control began in Ekahanui with the efforts of TNC. Most of this effort has taken place within the Subunit I fence. *Passiflora suberosa*, which is pervasive throughout the MU, was cleared out of the many *Pisonia* dominated gulches, and *Psidium cattleianum* was thinned from areas with native canopy. Hundreds of endangered plants were planted in this MU by TNC, and many more followed by OANRP. Reintroductions of common natives were also used by TNC to restore habitat within the MU. Much of the weed control conducted by staff in Subunit I follows the actions set forth by TNC staff.

The Ekahanui Subunit II and III fences were completed in 2009. There are a few WCAs within these subunits, and for the most part they are small and are for weed control only as needed around rare plant sites. The entire Subunit II and III was not broken up into WCAs as is the case with some other MUs, due to the fact that most of Subunit II and III are highly degraded. Subunit III was constructed mainly to protect a wild population and of *Abutilon sandwichensis*. Later this site was augmented with reintroduction *A. sandwichensis* in 2013. The weeding of the WCA in Subunit III is primarily focused on improving the habitat for this species and providing more space for managing reintroduction.

A large concern with weed control in Ekahanui MU is its potential impacts on Oahu Elepaio. The MU has one of the largest breeding populations of Elepaio on the island, and impacts of weed control during breeding season are not well understood. It is reasonable to assume that killing potential foraging and nest trees during breeding season has the potential to be at the very least disruptive to the endangered bird. It is also reasonable to assume that Elepaio have evolved with native forest components and would persist better within restored habitat. No or limited weed control is proposed for the weed-dominated areas of Subunit II. Elepaio territories are surveyed and mapped each year and within these territories canopy weed control is prohibited during breeding. Restricted canopy control may be conducted during ‘off’ season, with the guidance of the Elepaio specialists.

Weed control in the WCAs of Huliwai are very limited. Weeding is focused around a two IP species (*A. sandwichensis* and *Cenchrus agrimonioides* var. *agrimonioides*). *A. sandwichensis* sites was enclosed by a 0.5 acre fence in 2014. Overall, Huliwai is heavily degraded with alien vegetation and is of low priority for OANRP to manage. Fortunately, a volunteer group named “Friends of Honouliuli” help manage this area with native plant restoration and incipient control.

The table below summarizes invasive weeds found at Ekahanui, excluding ICA species. While the list is by no means exhaustive, it includes the species targeted/prioritized for control. The distribution of each taxon is estimated as: Widespread (moderate to high densities of individuals, common across MU), Scattered (low densities across all or much of the MU), or Restricted (low or high densities, all in one discrete location).

Summary of Target Taxa

Taxon	Distribution	Notes
<i>Araucaria columnaris</i>	Restricted	Found in gulch to the North of Ekahanui fence. Plants are localized and new locations of this taxa found outside of this gulch in the MU will be noted. <i>A. columnaris</i> grow large, thus becoming a dominate canopy species. Additionally, <i>A. columnaris</i> produces large amounts of leaf litter, which can inhibit native plant recruitment.
<i>Chrysophyllum oliviforme</i>	Scattered	In HuliwaiNoMU-03. Targeted for control within WCAs by the Senior Day care.
<i>Clidemia hirta</i>	Widespread	First observed in the 1970’s. High priority to control around rare plant taxa. <i>Clidemia</i> is bird dispersed and can become a dominant understory species. <i>Clidemia</i> is best treated by using the clip-and-drip method (cutting stump and applying Garlon4 herbicide).
<i>Ficus macrophylla</i>	Widespread	Targeted for control within WCAs. Map individuals/groups of plants within the MU.
<i>Grevilia robusta</i>	Widespread	Widespread throughout the MU. Trees shade out rare plant taxa. Selectively control trees as part of WCA efforts. IPA method using Aminopyralid (Milestone) is effective in

		controlling <i>Grevilia</i> .
<i>Heliocarpus popayanensis</i>	Widespread	Targeted for control within WCAs. Effective IPA control method known.
<i>Kalanchoe pinnata</i>	Widespread	Targeted for control within WCAs, especially around rare taxa sites. <i>K. pinnata</i> competes with native plant recruitment in inhabiting an area. <i>Kalanchoe</i> reproduces vegetatively from cut leaves and stems. It sometimes forms dense stands. It should not be controlled via clip-and-drip treatments, as cut material may regrow. Plants should be treated with a foliar spray of glyphosate or foliar drizzle of Garlon 4.
<i>Passiflora suberosa</i>	Widespread	Widespread vine in MU. It has a WRA of 12 (very high), roots from multiple nodes, smothers surrounding vegetation, and is labor-intensive to remove. Control around rare taxa as part of WCA efforts.
<i>Pimenta dioca</i>	Restricted	Found in gulch to the North of Ekahanui fence. Plants are localized and spread out of this gulch into the MU will be noted. Targeted for control. Effective IPA control method known.
<i>Psidium cattleianum</i>	Widespread	Targeted for control within WCAs, especially around rare plant taxa sites. <i>Psidium</i> is one of the most invasive tree species in Hawaii and has the ability to become the dominant species in the forest. However, <i>Psidium</i> will not be aggressively controlled in Subunit II, where Elepaio occur. Elepaio tend to use this tree species for nesting.
<i>Ricinus communis</i>	Scattered	Targeted for control whenever observed; map individuals/groups of plants within the MU. Bird dispersed, so could come up anywhere.
<i>Schefflera actinophylla</i>	Scattered	Targeted for control whenever observed; map individuals/groups of plants within the MU. High priority since it has the ability to become a canopy dominant species. Bird dispersed, so could come up anywhere. Effective IPA treatment known.
<i>Schinus terebinthifolius</i>	Widespread	Targeted for control within WCAs, especially around rare plant taxa sites and along the fenceline. Trees shade out rare plant taxa and rip apart slopes when they fall over. Trials conducted from 1996-98 suggest that girdling and applying herbicide is one of the best control methods. Since it may be a dominant canopy species around rare plant taxa, controlling <i>Schinus</i> will be gradually removed and replaced by common native outplantings.
<i>Setaria palmifolia</i>	Scattered	Large patches occur on the access trails below the MU, as well as several occurrences within the MU. This grass is controlled along well-used access trails and around rare taxa sites. <i>Setaria</i> can thrive in shaded areas, which makes it a major threat.
<i>Spathodea campanulata</i>	Scattered	Kill when seen. Effective IPA treatment known. Occurs in low densities in this MU.
<i>Urochloa maxima</i>	Scattered	<i>U. maxima</i> is widespread in the disturbed habitats that surround the MUs. <i>U. maxima</i> patches are found scattered throughout the Ekahanui MU and are targeted when feasible along with other grasses to reduce potential fire fuel loads. This grass is targeted for eradication in the Huliwai MU, and is controlled along well-used access trails and within frequently managed sites.

Restoration activities are discussed in the notes section for each WCA. The table below contains specific notes on what native taxa and what type of stock may be appropriate for projects at Ekahanui.

Taxa Considerations for Restoration Actions:

Native Taxon	Outplant?	Seedsow/ Division/ Transplant?	Notes
<i>Acacia Koa</i>	Yes	Yes	Tree. Grow from seed.
<i>Antidesma platyphyllum</i>	Yes	No	Tree. Grow from cuttings or seed.
<i>Antidesma pulvinatum</i>	Yes	No	Tree. Grow from cuttings or seed.
<i>Bidens torta</i>	No	Seed sow	Herb. Easily grown via seed sows.
<i>Carex meyenii</i>	Yes	Seedsow/Division	Sedge. Grow from seed. Seed sows slow to germinate but effective.
<i>Carex wahuensis</i>	Yes	Seedsow/Division	Sedge. Grow from seed. Seed sows slow to germinate but effective.
<i>Coprosma foliosa</i>	Yes	No	Shrub. Grow from cuttings or seed.
<i>Claoxylon sandwicensis</i>	Yes	No	Small tree. Grow from seed.
<i>Dodonea visoca</i>	Yes	No	Small tree. Grow from seed.
<i>Dianella sandwicensis</i>	Yes	Division	Herb. Conduct divisions in the field.
<i>Eragrostis grandis</i>	Yes	Seedsow/Transplant	Grass. Grow from seed, sow as stock available
<i>Hibiscus arnotianus</i>	Yes	No	Tree. Fast-growing. Grow from cuttings.
<i>Kadua affinis</i>	Yes	No	Small tree. Grow from seed.
<i>Metrosideros polymorpha</i>	Yes	No	Tree. Slow-growing. Grow from cuttings or seed.
<i>Microlepia strigosa</i>	Yes	Division	Fern. Survives transplanting in mesic-wet environments in moist conditions. Can also bring divisions back from field for more successful propagation and consequently outplant
<i>Myrsine lessertiana</i>	Yes	No	Tree. Grow from seed.
<i>Pipturus albidus</i>	Yes	Seedsow/Transplant	Small tree. Fast growing. Known to grow from seed sows, particularly in gulches and areas with light gaps.
<i>Pisonia brunoniana</i>	Yes	Seedsow/Transplant	Tree. Fast growing. Easy to propagate via cuttings. Known to grow from seed sows.
<i>Pisonia sandwicensis</i>	Yes	Seedsow/Transplant	Tree. Fast growing. Easy to propagate via cuttings. Known to grow from seed sows.
<i>Pisonia umbelifera</i>	Yes	Seedsow/Transplant	Tree. Fast growing. Easy to propagate via cuttings. Known to grow from seed sows.
<i>Planchonella sandwicensis</i>	Yes	No	Tree. Grow seed. Slow growing.
<i>Plumbago zeylanica</i>	Yes	Division	Herb/ground cover. Grow from cuttings or seed. Unknown if transplanting effective.
<i>Psydrax odorata</i>	Yes	No	Tree. Grow from seed.
<i>Sapindus oahuensis</i>	Yes	No	Tree. Grow from seed.
<i>Urera glabra</i>	Yes	No	Small tree. Grow from cuttings or seed.

WCA: Ekahanui-01 (Airplane Ridge)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 25% non-native cover

Targets: *Psidium cattleianum* and *Schinus terebinthifolius* are targeted for gradual removal from the overstory. *P. suberosa* densities are surprisingly low in this WCA given high densities elsewhere in the MU. Therefore, it is targeted on all weed sweeps.

Notes: This WCA occurs around a wild population of *C. agrimonioides* var. *agrimonioides*. Weed control is currently conducted across the north-facing slope on a large ridge around the many small patches of this rare grass. Overstory canopy consists mostly of *P. cattleianum* and *S. terebinthifolius*, which are gradually removed to reduce large light gaps. *G. robusta* is prevalent throughout the ridge and is controlled during weed sweeps.

Alien grass species are hand cleared around the wild *C. agrimonioides* var. *agrimonioides*. Grass specific herbicides may be used to treat alien grass across the ridge in the future, but only after thorough surveys have been conducted to identify all individuals. After all these small patches are thoroughly weeded, larger sweeps between all these patches will begin thus creating continuous habitat across the slope.

WCA: Ekahanui -03 (Small *S. kaalae* fences)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 25% non-native cover

Targets: Understory weeds such as *Cyclosorus parsitica* and *Rubus rosifolius*

Notes: Originally this WCA was a very small area in Subunit II around a population of *S. kaalae* individuals, but was expanded in size to include an area for reintroduction of *Phyllostegia mollis* in 2012. As of 2016, none of the *P. mollis* outplants remain due to a powdery mildew that causes 100% mortality. Management of this reintroduction area through weed and slug control has improved the understory and canopy greatly. Although, the *P. Mollis* reintroduction have failed, the area will continued to be weeded because the native patch is so diverse and has few weedy species. In addition, this site may be a potential reintroduction site again for *P. mollis* or other managed plant taxa. For the two *S. kaalae* fences, targeting weeds in the understory for control is conducted directly around the rare plants. The canopy in both fences is predominately *P. cattleianum* canopy and has not been heavily weeded to maintain light levels.

WCA: Ekahanui -04 (Upper Cliffs to Crestline)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 25% non-native cover

Targets: Understory and canopy weeds, targeting *P. cattleianum* and *S. terebinthifolius* for gradual removal.

Notes: Weed control is focused in this area around *Plantago princeps* var. *princeps*, *Tetramolopium lepidotum* var. *lepidotum*, *Achatinella mustelina*, and *Kadua parvula*. The area is steep, and weed control is therefore conducted in smaller patches between cliff areas. Removal of alien vegetation is targeted for slow removal as there is a mix of native and non-native plants throughout the WCA. Because there are snails in the area, alien trees and shrubs will be girdled, and not cut down. Grass control is important in maintaining native habitat for the cliff-dwelling rare plants. However, grass sprays are difficult given the steep terrain. Grass control will be conducted only after thorough surveys of grass locations are completed, thereby facilitating safer sprays. *Kadua parvula* was reintroduced on to the cliffs in this WCA

in 2016. Weed control around this population will have to be conducted while on rappel. A protocol for weed control while on rappel should be developed in order to conduct this action.

WCA: Ekahanui -05 (Reintroduction Zone)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 25% non-native cover

Targets: Understory weeds are currently the largest target in this WCA, however overstory *P. cattelianum* and *S. terebinthifolius* is targeted for gradual removal where it is found in mostly native areas.

Notes: Due to the existence of a small patch of native forest that has a long history of weeding by TNC and later by OANRP in this area, there is a high density of native cover in this WCA. This small native forest patch is appropriate habitat for several rare species and many reintroductions are established here. These species include: *C. agrimonioides* var. *agrimonioides*, *Cyanea grimesiana* subsp. *obatae*, *C. pinnatifida* (TNC reintroduction), *D. waianaensis*, *P. mollis*, *Schiedea kaalae*, *S. hookeri* (TNC reintroduction), *Solanum sandwicense* (TNC reintroduction) and *Urera kaalae* (TNC reintroduction). There are also wild *S. kaalae* and formerly there was a wild *Alectryon macrococcus* var. *macrococcus* individual within the WCA. Regular weed sweeps will continue through the area to maintain this diverse native habitat.

While the areas around the rare plants are the most native, there are still a few larger stands of *P. cattelianum* throughout the WCA. These weeds are targeted for gradual removal during weed sweeps, with particular consideration of Elepaio, as there are several breeding pairs in this area. No canopy *P. cattelianum* will be treated during breeding season.

Large scale grass control has not yet been necessary in this WCA as most of it is gulch terrain. However, there is a fair amount of *Melinis minutiflora* growing on the *C. agrimonioides* var. *agrimonioides* reintroduction ridge. Grass is hand pulled directly around the rare grass to reduce the non-target impact from herbicide. After all the *C. agrimonioides* var. *agrimonioides* individuals have been identified and cleared around, the herbicide is sprayed far enough away to prevent the effects of drift. This area of the WCA needs common native reintroductions to reduce light levels in the understory and reduce competition from alien grasses with *C. agrimonioides* var. *agrimonioides*. Plantings of *Acacia koa* and *Dodonea viscosa* at a relatively high density may help.

WCA: Ekahanui -06 (Palai Gulch)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 25% non-native cover

Targets: Understory weeds include: *R. rosifolius* and *C. parsitica*. *Passiflora suberosa* is also controlled.

Notes: Nicknamed Palai Gulch for its many native ferns, this WCA occurs around reintroduced *A. sandwicense*, *C. grimesiana* subsp. *obatae*, *U. kaalae* (TNC planting) and *S. kaalae*. Understory weeds such as *R. rosifolius* and *C. parsitica* compete with native ferns, and along with *P. suberosa* are the most common weeds controlled during weed sweeps. There is a significant amount of *P. cattelianum* that circles about half way around the WCA, however, control to push these dense stands back is limited by the fact that the WCA is within an Elepaio territory. Canopy weed control will not be conducted during

Elepaio breeding season to avoid disrupting foraging and nesting behavior. Canopy weed control, if any, will only be conducted outside of Elepaio breeding season, and in consultation with the Elepaio specialist.

Weed control has expanded in this WCA further up the gulch over the years. Recent efforts have focused on clearing understory weeds and *P. suberosa* in an area where *A. sandwicense* has been reintroduced. Once a relatively open area this section of the gulch has been filled in by *Pipturus albidus*, and weeding efforts focus on controlling *R. rosifolius*.

Due to the shady canopy, the weedy grass *Oplismenus hirtellus*, thrives in the gulch. Near the mauka edge of the WCA the canopy is more open and there is also *U. maxima* present. Annual grass sprays will be conducted to control these grasses.

WCA: Ekahanui -07 (Unit I)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 50% non-native cover

Targets: *G. robusta*, *P. cattelianum*, *Urochloa maxima*.

Notes: For this iteration of the MU plan the WCA has been expanded to include the rest of the undesignated areas in the unit I fence. Like its predecessor, this expanded WCA is comprised of alien dominated forest, with no actively managed rare plant populations. Elepaio pairs inhabit the majority of this WCA, therefore no control of any canopy weeds will be conducted during Elepaio breeding season, if at all. In years prior, on silky oak ridge TNC staff planted hundreds of small *A. koa*, with poor results. Most of the saplings did not do well under the dense *G. robusta* canopy. Since Elepaio seldom nest in *G. robusta* this would be a good potential test site to restore native habitat for nesting Elepaio. Weed control in this WCA will be focused on maintaining the trails that service the rat trapping grid.

WCA: Ekahanui -10 (Fenceline)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 25% non-native cover

Targets: Fallen trees that may affect the integrity of fence, and thick understory along fence line that may obscure view of bottom of fence. *U. maxima* is abundant on the southeast corner of the fence and is a fire threat.

Notes: This WCA accounts for all weed control that takes place in order to maintain the fence line and facilitate fence checks. WCA Ekahanui-08 has been incorporated into this WCA as it fell along the fence line and had overlapping targets and goals. *U. maxima* is an extremely flammable fuel, and elimination from the fence as well as creating a buffer on the outside of the fence is desired. Other actions for this WCA may include: removing downed trees, treating thick understory, and spraying other grass as needed along the perimeter fences of subunit I and II. Weed control needs for this WCA will be assessed and conducted quarterly as needed in conjunction with quarterly fence checks.

WCA: Ekahanui -11 (Cenagragr EKA-C Site)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 25% non-native cover

Targets: Understory weeds directly around remaining reintroduced *C. agrimonioides* var. *agrimonioides*.

Notes: Weed control was initiated in this area because of a reintroduction of *C. agrimonioides* var. *agrimonioides*. However, the population has had a sharp decline (6 of 39 plants remain) and the site has been determined to be unsuitable. No more plants will be planted here. Understory weed control will continue directly around the remaining plants but greater habitat restoration here will not be conducted.

WCA: Ekahanui -12 (*Amastra* fence slope)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 25% non-native cover

Targets: Control all understory weeds and *P. suberosa*, and gradually treat *P. cattleianum* and *S. terebinthifolius*.

Notes: *A. mustelina* and several TNC rare plant reintroductions occur in this WCA. This WCA has similar species composition and range of topography as its neighbor adjacent on the same contour, WCA-05. However, WCA-12 has fewer native patches and more weedy zones. Weed efforts will be two fold; maintain the small native patches in the WCA, and weed between them in order to achieve the long term goal of having one continuous contour of suitable habitat for a number of rare taxa along the top of Subunit I. Weed sweeps and grass sprays will be conducted annually.

WCA: Ekahanui -13 (New Cenagragr EKA-D Site)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 25% non-native

Targets: Understory weeds, gradual removal of *P. cattleianum* and *S. terebinthifolius* from canopy.

Notes: Weed control has been conducted in this area in support of a reintroduction of *C. agrimonioides* var. *agrimonioides* as well as a wild population that was discovered in 2011 on the day of the reintroduction. Canopy weeds of *P. cattleianum* and *S. terebinthifolius* have been removed gradually; however not much native canopy species recruitment has occurred.

Grasses and other understory weeds have become more plentiful in this WCA over the last five years. While many of the outplanted *C. agrimonioides* var. *agrimonioides* have died, many have reproduced and some of those F1's have matured. This site would benefit from an outplanting of *A. koa* and *D. viscosa* to decrease light levels in the understory and ease the control of understory broadleaf weeds and grasses.

WCA: Ekahanui -14 (Abutilon)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 25% non-native

Targets: Understory weeds such as *Lantana camara*, *O. hirtellus*

Notes: This WCA is highly degraded, and minimal weed control is conducted around a wild/augmented population of *A. sandwicense*. The slope that the plants are on is somewhat steep and has soft soil. Heavy foot traffic around the plants is not desired. Weed control of nearby *L. camara* patches and thinning of *S. terebinthifolius* has been conducted annually along with rare plant monitoring to reduce negative impacts to the population. In 2013 incision point application (IPA) was used to treat *Grevillea robusta* in the overstory with mixed results. The focus on recent visits has been on controlling *O. hirtellus* and *Mesosphaerum pectinatum* in the understory. Once more of the *Grevilia* canopy has been successfully thinned, common reintroductions of *A. koa*, *S. oahuensis*, *D. viscosa*, and *M. strigosa*, *P. brunoniana* should be planted around the plants to aid in stabilization of soil, reduce weeding efforts, and to improve overall habitat.

WCA: Ekahanui -15 (Unit II)

Veg Type: Mesic Mixed Forest

MIP Goal: Less than 50% non-native cover

Targets: *G. robusta*, *P. cattelianum*,

Notes: For this iteration of the MU plan the WCA has been expanded to include the rest of the undesignated areas in the unit II fence. This expanded WCA is comprised of alien dominated forest, with no actively managed rare plant populations. Elepaio pairs inhabit the majority of this WCA, therefore no control of any canopy weeds will be conducted during Elepaio breeding season, if at all. Weed control in this WCA will be focused on maintaining the fence line and trails that service the rat trapping grid.

WCA: Ekahanui NoMU-01 (DelWai EKA-A)

Veg Type: Mesic Mixed Forest

MIP Goal: Weed 2m around *D. waianaeensis* individuals

Targets: *S. terebinthifolius*, *Clidemia hirta*

Notes: This WCA occurs outside of the MU, however is still within Ekahanui drainage. Weed control is conducted primarily around a small wild, fenced population of *D. waianaeensis*. Weeding is done only directly around the plant as it is a genetic storage collection. Understory weeds and grasses are treated. No canopy is weeded; however *S. terebinthifolius* will be cleared if fallen on the fence.

WCA: Ekahanui NoMU-02 (Contour Trail)

Veg Type: Mesic Mixed forest

MIP Goal: N/A

Targets: *U. maximum* and *Setaria palmifolia*

Notes: This WCA was created to maintain access along the Honouliuli contour trail from Ekahanui to Huliwai MU. The trail is occasionally sprayed to prevent the spread of *U. maxima* and *S. palmifolia* further along the trail, ultimately preventing its spread into the MU. *S. terebinthifolius* and various shrubs will also be trimmed off the trail if necessary.

WCA: Ekahanui NoMU-03 (Ekahanui trail)

Veg Type: N/A

MIP Goal: N/A

Targets: *U. maxima* and *S. palmifolia*

Notes: This WCA was created to maintain the trail access into Ekahanui MU. The trail is occasionally sprayed to prevent the spread of *U. maxima* and *S. palmifolia* further along the trail, ultimately preventing its spread into the MU. *S. terebinthifolius* and various shrubs will also be trimmed off the trail if necessary.

WCA: Ekahanui NoMU-05 (Allspice gulch)

Veg Type: Mesic Mixed forest

MIP Goal: N/A

Targets: *Pimenta dioica*

Notes: WCA was created for control of *P. dioica* by the volunteer group “Friends of Honouliuli.” OANRP staff performed one control effort in 2012, but it is unclear as to whether the volunteer group has continued work in this area.

WCA: Huliwai-02 (Abutilon)

Veg Type: Mesic Mixed forest

MIP Goal: Less than 25% non-native

Targets: Understory weeds such as *O. hirtellus*, *Rivina humilis*

Notes: This WCA is highly degraded, and minimal weed control is conducted around a wild population of *A. sandwicense*. *S. terebinthifolius* and *S. cumini* have been thinned out to increase light levels for *A. sandwicense* however the native *S. oahuensis* canopy cover has increased as a response. Due to the shady canopy, the weedy grass *O. hirtellus*, thrives throughout the WCA. *A. sandwicense* has recruited within a thick *O. hirtellus* understory and NRM staff noticed an increase in seedling mortality once *O. hirtellus* was removed. Due to the climate here, this may be because the seedlings became exposed and dried out. Further removal of the grass around seedlings will be compared to leaving it to see whether it is beneficial for the recruitment of the *A. sandwicense* or not. Replacing the non-native grass with natives that would allow for recruitment, such as *C. meyenii* and *C. wahuensis* will also be a goal.

WCA: HuliwaiNoMU-01 (Cenchrus)

Veg Type: Mesic Mixed forest

MIP Goal: Less than 25% non-native

Targets: Understory weeds such as *M. minutiflora*, *Paspalum conjugatum*, *P. cattelianum*, *C. hirta*

Notes: This WCA is highly degraded, and minimal weed control is conducted around a wild population of *C. agrimonioides* var. *agrimonioides*, which is only managed for genetic storage. Keeping non-native grasses and fast growing understory weeds out of area is a priority.

WCA: HuilwaiNoMU-03 (Satin leaf)

Veg Type: Mesic Mixed forest

MIP Goal: N/A

Targets: *Chrysophyllum oliviforme*

Notes: This WCA was created to control *C. oliviforme* along the Honouliuli contour trail. NRM staff now controls grass, target canopy and understory weeds from ridgeline as this is the access trail for the of *C. agrimonioides* var. *agrimonioides*. WCA is lower priority for OANRP staff since there are minimal rare taxa. WCA has been weeded by the volunteer group “Friends of Honouliuli” targeting the pockets of natives and *C. oliviforme* infestation.

Small Vertebrate Control

Species: *Rattus rattus* (black rat, roof rat), *Rattus exulans* (Polynesian rat, kiore)

Threat level: High

Seasonality/Relevant Species Biology: OANRP manages some species only seasonally for *Chasiempis ibidis* or ‘Oahu Elepaio’ during the nesting season that runs from December to June. Other species i.e. *A. mustelina* and *P. princeps* var. *princeps* are protected year-round. Spikes in rodent population is often observed following the fruiting season (about twice a year) of *Psidium cattelianum* then returns back to a regular level.

Management Objective:

- Maintain low levels of rat activity across entire MU. Ideally less than 10% activity measured in tracking tunnels.
- Facilitate stabilization or increasing of managed taxa populations across the MU.
- Keep sensitive *A. mustelina* populations safe from rat predation via construction of a predator proof fence (*A. mustelina* enclosure to be built offsite at the Palikea MU).

Strategy and Control Methods

- Control rodents annually around *A. mustelina* and *P. princeps* var. *princeps*.
- Monitor ground shell plots for predation of *A. mustelina* by rats
- Monitor rare plant resources to help guide localized rodent control
- Quarterly tracking tunnels for indicators.
- Convert Victor snap trap grid to Goodnature A24 grid.

Rat control strategies to be utilized by OANRP in 2015-2016.

MU/Area	Primary Spp. Protected	Control Method	Description	Trap Type	# Traps	Deployment	Check Interval
Ekahanui† i	<i>A. mustelina</i>	Trapping Grid	Many small grids	Victor® w/out boxes	47	Year-round	4-6 weeks
				A24 Automatic traps	30		
	<i>C. ibidis</i>	Trapping Grid	Large-scale grid	Victor® w/ & w/out boxes ⁱ	620	Annual: Dec-June	2 weeks

† Contracted Pono Pacific to maintain rat grids during Elepaio nesting season.

i The majority of traps have been removed from the wooden boxes and placed in trees.

Discussion: OANRP manages rats threatening some rare species only seasonally for *Chasiempis ibidis* during the nesting season, while *A. mustelina* and *P. princeps* var. *princeps* are protected year-round. Above is a table from the 2016 OANRP annual report and will be updated by the 2018 OANRP annual report after transforming the trapping grid to all A24s. There are small localized trapping grids consisting of 34 A24s and 47 Victor snap traps around the *A. mustelina* and *P. princeps* var. *princeps* areas. The large trapping grid for the entire MU currently has 620 Victor snap traps for *C. ibidis*. Although rodent control in the MU is mainly for *A. mustelina*, *P. princeps* var. *princeps* and *C. ibidis*, traps are placed throughout the MU, thereby protecting other MIP/OIP taxa that are also located in the MU. At other sites, rodent damage has been observed on *C. grimesiana* and *D. waianaeensis*. If other MIP/OIP taxa are

determined to be affected adversely by rodents, OANRP will evaluate the use of smaller localized grids for the protection of these species. By the end of 2017, the Ekahanui MU Victor snap trapping grid will be replaced by 350 Goodnature A24s. This will allow rodent control to become year-round for all managed taxa in this MU. OANRP staff will check A24s every 4 months and continue monitoring rodent activity using tracking tunnels quarterly.

Small Vertebrate Management Map

Map removed to protect rare resources

Slug Control

Species: *Deroceras laeve*, *Limax maximus* and *Meghimatium striatum*

Threat Level: High

Seasonality/Relevant Species Biology: Slugs are seasonally abundant during the wet season. However, slugs are not detectable during the dry season from May-September, therefore summer application is less critical.

Management Objectives:

- Control slugs locally to ensure germination and survivorship of *Cyanea grimesiana* subsp. *obatae*, *Delissea waianaensis* and *Schiedea kaalae*.
- Conduct annual census monitoring of rare plant taxa to look for seedling recruitment and slug herbivory.
- Avoid potential impacts to rare snails.

Strategy and Control Methods: Slug Control Areas (SLCAs) around rare plant locations have been surveyed and receive treatment every 6 weeks with FerroxxAQ®. No rare snails are present within 20m of any SLCA.

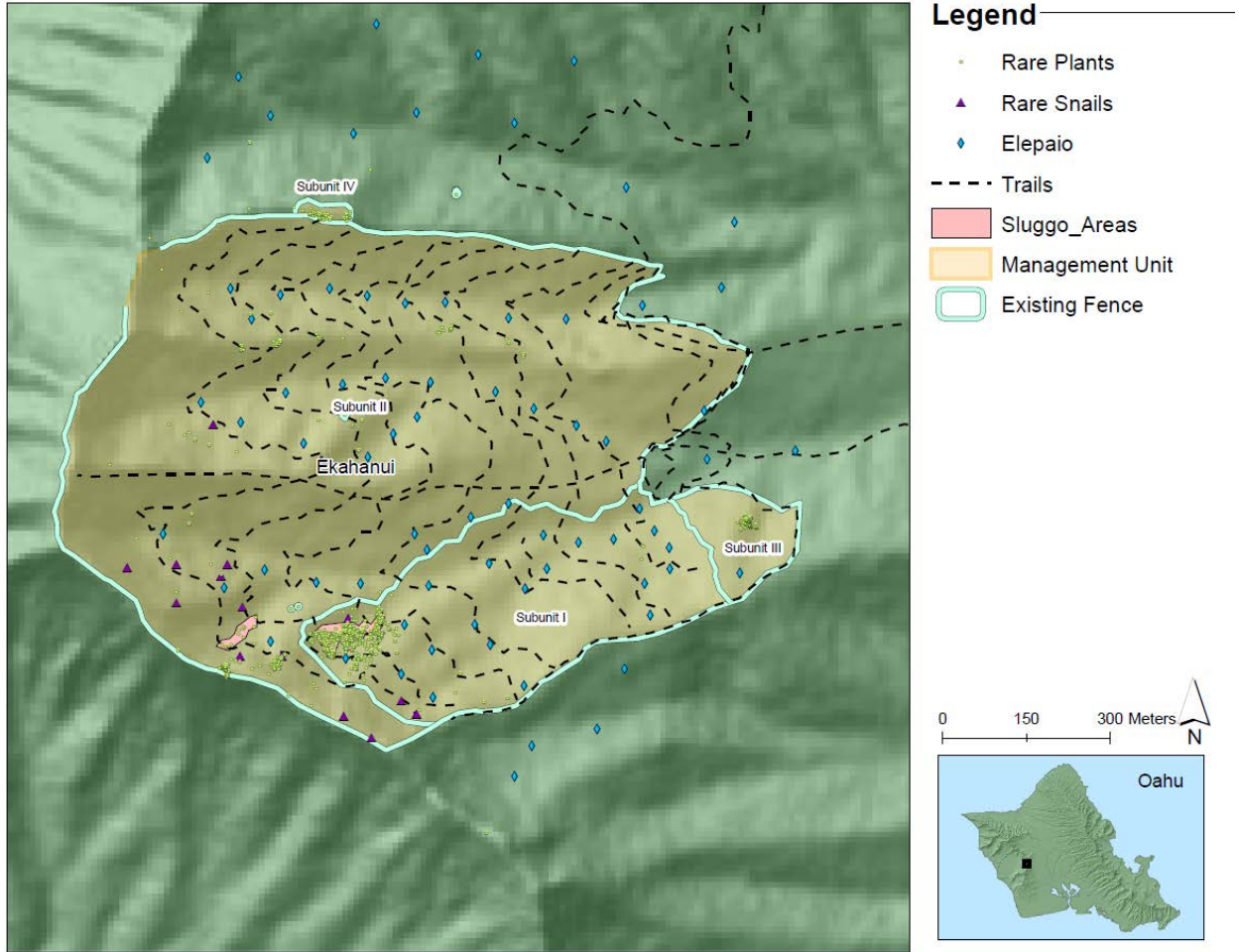
- If new sites for rare plant reintroductions are chosen outside of the existing SLCAs, and slug damage is observed, we will begin slug control if 1. Slug abundance monitoring indicates slugs are active in the area and 2. If surveys indicate there are no native snails nearby.

Slug Control Area Locations Table

SLCA Code	Plant population reference codes	Date slug control begun
EKA-A-1	<i>C. grimesiana</i> subsp. <i>obatae</i> (EKA-C), <i>D. waianaensis</i> (EKA-D), <i>S. kaalae</i> (EKA-D)	2011

Discussion: Slug control in Ekahanui began in early 2011 following the registration of Sluggo for use in natural areas. Since then, it has been applied regularly around rare plant taxa observed to be vulnerable to slug attack. Seedlings of *S. kaalae*, *C. grimesiana* and *D. waianaensis* have emerged in areas receiving regular slug control. The use of FerroxxAQ® began in 2017 after determining that this slug control product was more effective managing slugs as compared to Sluggo.

Slug Management Map



Ant Control

Species: *Solenopsis papuana*, *Technomyrmex albipes* and *Plagiolepis alludi*

Threat Level: Medium to high (for *Drosophila*)

Seasonality/Relevant Species Biology: Varies by species, but nest expansion is typically observed in late summer to early fall.

Management Objectives:

- Prevent spread of ant species into areas where not already established. Conduct annual surveys during the summer to determine what ant taxa are present in the MU.
- Detect incursions of new ant species prior to establishment.
- If incipient, high-risk ant species are found. Implement control methods that will not impact *Drosophila*.

Strategy and Control Methods:

- Sample ants at human entry points using the standard survey protocol (see survey protocol below) and *Drosophila* sites a minimum of once a year (see table below). Use samples to track changes in existing ant densities and to alert OANRP to any new introductions.
- If incipient species are found and deemed to be a high threat and/or easily eradicated locally (<0.5-acre infestation), begin control.
- Sample ants at areas with high traffic (i.e. flying new materials in for snail enclosures or plant reintroduction sites)
- Look for evidence of ant tending of aphids or scales on rare plants during annual rare plant monitoring.

Ant Survey Site Table

Site description	Reason for survey
2D outplanting site	This is a rare plant reintroduction site with a drop zone. Formerly a lot of material was flown into the area making it a high risk area for accidental introductions.

Discussion: Ants have been documented to pose threats to a variety of resources, including native *Drosophila*, plants (via farming of Hemipterian pests), and birds. It is therefore important to prevent new species to become established in areas of conservation value. Since 2008, we sampled ants at rare plant reintroduction sites, water tanks, and trailhead using the following survey protocol:

Survey protocol: Vials are baited with SPAM, peanut butter and honey. We remove the caps and space vials along the edges of, or throughout, the area to be sampled. Vials are spaced at least 5 meters from each other. A minimum of 10 baited vials are deployed at each site, in a shaded area for at least 1 hour. Ant baiting takes place no earlier than 8:00 am in the morning. No sampling occurs on rainy, blustery or cold days as, both rain and low temperatures reduce ant activity. Ants collected in this manner are returned to invertebrate specialist for later identification.

Annual surveys at the current (2D) site may be discontinued in the near future since no new plants or materials have been flown into that area for three years. Ant species present are widespread and not a target for eradication. New sites may be surveyed for ants if plant reintroductions are planned for that area in the MU.

Predatory Snail Control

Species: *Euglandina rosea* (rosy wolf snail)

Threat level: High (for *Achatinella*)

Seasonality/Relevant Species Biology: Peak numbers recorded March through June.

Management Objectives:

- Keep sensitive snail populations safe from predatory snails via construction of a predator-proof fence (*A. mustelina* enclosure), which will be located at the Palikea MU. While the enclosure is being prepared, snails will be collected and maintained in a laboratory by the Snail Extinction Prevention Program
- Since our management objective is to maintain *A. mustelina* offsite, control of *E. rosea* is not necessary. Rather our focus will be to collect all *A. mustelina* and protect them from threats offsite

Strategy and Control Methods

- There are no effective techniques for controlling *E. rosea* in the field except for manual removal when found by known *A. mustelina* sites.
- *A. mustelina* at this MU have declined in numbers dramatically and the temporary enclosures failed, so translocating all *A. mustelina* to the SEPP rearing laboratory has been an ongoing action.
- *A. mustelina* removed from Ekahanui will be permanently translocated to the Palikea North snail enclosure once the enclosure is complete.

Discussion: Surveys confirm *E. rosea* and are present in this MU, though their numbers appear to have declined over the past year. Control options for *E. rosea* are limited to hand removal of snails when found near native snails. Such efforts are no longer a priority however as *A. mustelina* are actively being removed from Ekahanui for eventual translocation to the permanent predator proof fence, Palikea North enclosure, at Palikea by 2018. In 2016 two small temporary enclosures for *A. mustelina* were built near populations that were rapidly declining in order to protect the remaining *A. mustelina*. Snails from these areas were placed inside to see if this was a viable option. Unfortunately the *A. mustelina* did not fare well and the project was concluded. Management of the *A. mustelina* population (ESU-E) in this MU is discussed further in chapter 5 of the 2017 annual report.

Jackson's Chameleon Control

Species: *Chamaeleo jacksonii* ssp. *xantholophus* (Jackson's chameleon)

Threat Level: High (for *Achatinella*)

Seasonality/Relevant Species Biology: Unknown

Management Objectives:

- Survey MU for Jackson's chameleons
- Keep sensitive snail populations safe from chameleons via removing both Chameleons and native snails from the MU. The *Achatinella* will be maintained in a laboratory offsite, the chameleons will be euthanized

Strategy and Control Methods:

- Construct a predator proof fence at Palikea North for *Achatinella*
- Collect remaining *Achatinella* for ex-situ conservation until they are reintroduced to the predator proof enclosure in Palikea
- While surveying for native snails or conducting any other field work in the MU, note, GPS and remove any chameleons

Discussion: Chameleons are known to consume *Achatinella* where their ranges overlap. Therefore, if *Achatinella* are present within the MU, staff needs to note the presence of any chameleons while conducting periodic snail surveys and may be able to use dogs to detect chameleons. If chameleons are found, then staff should follow up immediately by searching for at least two full days and two full nights for more in the vicinity. All *A. mustelina* from Ekahanui will be translocated to the permanent predator proof fence, Palikea North enclosure, at Palikea by 2018. Although, chameleons have been found to the north at Hapapa and to the south at Palikea, chameleons have not yet been observed in Ekahanui. Staff will continue to look for them when surveying, for it is possible that they have not yet been detected due to their cryptic habits.

Fire Control

Threat Level: Medium

Seasonality/Potential Ignition Sources:

Fire may occur whenever vegetation is dry. Generally, this happens in summer, but may occur at other times of the year, depending on variations in weather pattern. *Urochloa maxima* has a high fire index, and is the dominant vegetation in areas below the Honouliuli Forest Reserve. Potential for fire ignition comes from the Kunia Loa farms development which is adjacent to the forest reserve, hikers who may be camping and hunting, and arson on the Kamehameha Hwy.

Management Objectives:

- To prevent fire from burning any portion of the MU at any time.
- To prevent fire from damaging any rare taxa locations.

Strategy and Control Methods:

- Communication through fire meetings between land owners and local agencies, to access forest reserve areas and water sources.
- Develop a plan for coordination of chain of command between Hawaii Fire Department and Federal Fire Department, and other ground crews involved.
- Include Army biologist in planning to provide information on locations of rare and endangered taxa.
- Helicopter water drops from the air.
- Local fire agencies fighting on the ground.
- Fuel Breaks. Discuss with DOFAW to have Honouliuli contour trail maintained as an access trail and as a fuel break. Discuss with Monsanto how to manage fallow fields to reduce fuel between Kamehameha Hwy. and Honouliuli forest reserve.

Discussion: In 2016, a fire burned inside the Forest Reserve boundary through moist, heavy fuels mostly dominated by iron wood trees (*Casuarina* sp.), with some *Grevillea robusta*, *Formosa koa*, *Schinus terebinthifolius*, and *Fraxinus uhdei* (see map below). The fire posed a threat to native mesic forest including rare and federally listed endangered plant species located approximately 250 meters to the south and about 300 meters to the north all in the Honouliuli Forest Reserve. The endangered plant taxa most directly threatened by this fire include *Delissea waianaensis* and *Abutilon sandwicense*. Additionally, known pairs and single males of the endangered forest bird, the Oahu Elepaio (*Chasiempis ibidis*) were found as recently as 2016 in the North Ekahanui Gulch area, and *Achatinella mustelina* and *A. concavospira* snails were known from the adjacent Huliwai gulch area. Had the fire escaped from the North Ekahanui Gulch area into Central and South Ekahanui, and Huliwai gulch, numerous other rare and endangered taxa would have been threatened.

It was believed that this fire was ignited from a camp fire near the contour trail which was not sufficiently extinguished.

Since this fire, a volunteer conservation group known as the “Friends of Honouliuli” has begun efforts manage the site. They are planting native species such as *Dodonaea viscosa* and managing grass to help prevent fire fuel loads from building again.

In 2005, there was a fire on two ridges on the South side of Ekahanui (see map below). 170-acres burned, 5 of which were in the Honouliuli Forest Reserve. This fire started in the pineapple fields and burned heavy fuels dominated by *Urochloa maximus* grass, with some *Grevillea robusta*, *Acacia confusa*, and *Schinus terebinthifolius*. The fire posed a threat to native mesic forest including rare and federally listed endangered plant species located approximately 500m to the West. These included *Abutilon sandwicense* and Oahu Elepaio (*Chasiempis ibidis*) nesting territories.

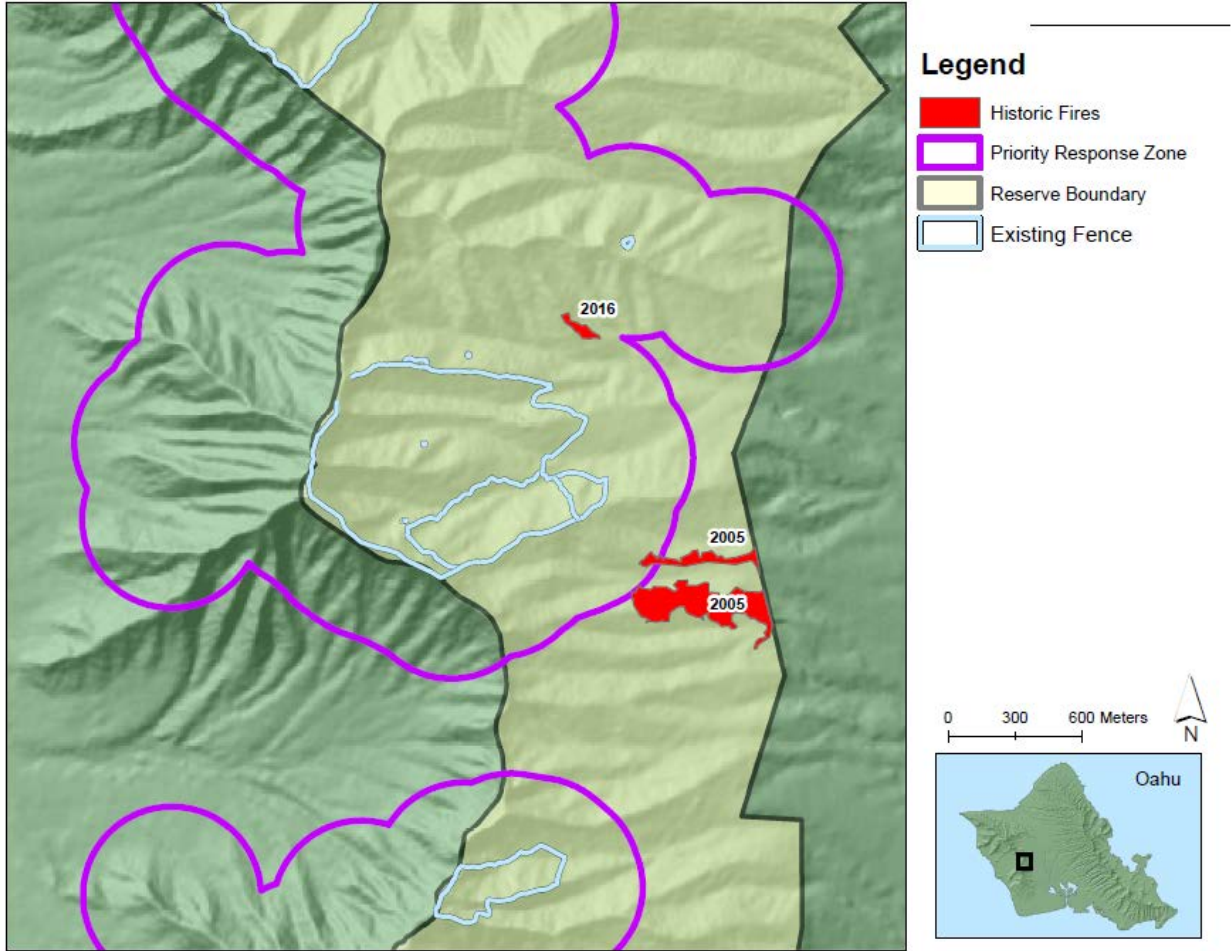
In conclusion of this fire, according to TNC personnel there were communication errors that could have prevented the fire from being contained more efficiently. There was chain of command issues between the Hawaii Fire Department and Federal Fire Department. There was also an issue of communication between HFD Air One, the contract helicopters, and the ground crews trying to direct them.

Historically, numerous fires have also have been ignited along Kamehameha Highway. Even though, Ekahanui MU is ~2.5 km from Kamehameha Highway, these fires pose a threat because they are separated by fallow fields and small farms in Kunia Loa dominated with *Urochloa maxima*. A grass known for high fuel load for fire. It would be beneficial to address this issue, by communicating with Monsanto to help manage fuel loads in their fallow fields, and with DOFAW to maintain fire breaks and access in Honouliuli.

With development of the Kunia Loa farmland local firefighting agencies have conducted meetings with stakeholders to address the issues of communications for firefighting resources and access. This has become even more important due to the many new land holders, the development becoming gated and creation of several water reservoirs.

Most of the Ekahanui's rare and endangered taxa are in non-fire threatened areas. They persist in areas which are higher in elevation, where the moisture regime is more wet-mesic than dry-mesic. These areas are also buffered by vegetation which hold less fire fuel load potential like dense stands of *Psidium cattleianum* which dominate most of the mid elevation areas of the Ekahanui MU. The rare and endangered taxa most threatened by fire are in the lower elevations areas near Huliwai, Huliwai no-MU, and Ekahanui no-MU.

2016 Ekahanui Fire Management Map



Action Table

The table below is a comprehensive list of threat control actions planned for the MU for the next five years. Actions are grouped by type; for example, Ungulate Control or Ant Control. Weed control actions are grouped into the following categories: General Survey, ICA, or WCA code. Cells filled with hatch marks denote the quarters in which an action is scheduled. IP years run from October of one year through September of the next. Therefore, Quarter 4 (October-December) is listed first for each report year, followed by Quarter 1 (January-March), Quarter 2 (April-June), and Q3 (July-September). Species names are written as six-digit abbreviations, such as ‘CenSet’ instead of *Cenchrus setaceus*, for brevity.

Action Type	Actions	MIP Year 13 OIP Year 10 Oct 2016- Sept 2017				MIP Year 14 OIP Year 11 Oct 2017- Sept 2018				MIP Year 15 OIP Year 12 Oct 2018- Sept 2019				MIP Year 16 OIP Year 13 Oct 2019- Sept 2020				MIP Year 17 OIP Year 14 Oct 2020- Sept 2021			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Vegetation Monitoring	MU vegetation monitoring by surveying every belt plot along transects.																				
General Survey	LZ-HON-106: Survey Ekahanui Crestline LZ whenever used, not to exceed once per quarter. If not used, do not need to survey.																				
	LZ-HON-132: Survey Puu Kaua LZ whenever used, not to exceed once per quarter. If not used, do not need to survey.																				
	LZ-HON-136: Survey north Ekahanui LZ whenever used, not to exceed once per quarter. If not used, do not need to survey.																				
	WT-Ekahanui-01: Survey Ekahanui access trail, from parking area up gulch to enclosure, up to lower catchment on silky oak ridge; annually.																				
ICA AcaMea	Ekahanui-AcaMea-01: Define infestation area. Survey greater area (aerial + ground) to delineate ICA. Adjust goals based on results. Survey areas around and between known AcaMea sites (top of side road, along access trail, just inside fence, up ridge between Airplane and Cyanea gulches) as well as 200m buffer around known plants.																				
	Ekahanui-AcaMea-01: Monitor/control AcaMea along ridge between Airplane and <i>Cyanea</i> gulches in Unit 2 and along jeep trail access to MU, annually. Collect fruit and remove from field. Flag locations of any plants found to facilitate later follow-up. Track weeded area																				

Action Type	Actions	MIP Year 13 OIP Year 10 Oct 2016- Sept 2017				MIP Year 14 OIP Year 11 Oct 2017- Sept 2018				MIP Year 15 OIP Year 12 Oct 2018- Sept 2019				MIP Year 16 OIP Year 13 Oct 2019- Sept 2020				MIP Year 17 OIP Year 14 Oct 2020- Sept 2021			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	with GIS; large ICA.																				
ICA EhrSti	Ekahanui-EhrSti-01: Monitor/control EhrSti on Ekahanui south fenceline 2x/quarter. Spray. Flag location to facilitate revisitation. Pick and remove from field any potentially mature fruit. Use preemergent herbicide. This species is cryptic and can be difficult to id.																				
	Ekahanui-EhrSti-02: Monitor/control EhrSti on S line by ground AchMus shell plot 2x/quarter. Spray. Flag location to facilitate revisitation. Install webbing to improve access. Pick and remove from field any potentially mature fruit. Use preemergent herbicide. This species is cryptic and can be difficult to id.																				
	HuliwaiNoMU-EhrSti-01: Monitor/control EhrSti at junction of wiliwili trail and contour trail every 3-6 months. Spray. Flag location to facilitate revisitation. Pick and remove from field any potentially mature fruit. Use preemergent herbicide. This species is cryptic and can be difficult to id.																				
Restoration	WCAs-05, 13, SE corner of 10, 1, 14. Consider koa/aalii combo for ridges. Sapoah for 14.																				
General WCA	Survey/evaluate/create WCAs MU, as resources allow. Use geographical and vegetation data; change and create new if necessary.																				
Ekahanui-01 (CenAgr EKA-A)	Conduct weed control around all CenAgr EKA-A groups annually. Control both understory and canopy weeds; remove canopy weeds gradually. Control alien grasses also.																				
Ekahanui-03 (PhyMol/SchKaa Bowl)	Control understory and canopy weeds across this area, focusing on native forest patches. Remove canopy gradually. Keep in mind Elepaio and <i>Amastra</i> considerations.																				
	Control weeds around PhyMol reintro site every annually, targeting understory and gradual removal of																				

Action Type	Actions	MIP Year 13 OIP Year 10 Oct 2016- Sept 2017				MIP Year 14 OIP Year 11 Oct 2017- Sept 2018				MIP Year 15 OIP Year 12 Oct 2018- Sept 2019				MIP Year 16 OIP Year 13 Oct 2019- Sept 2020				MIP Year 17 OIP Year 14 Oct 2020- Sept 2021			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	canopy weeds. [REINTRO FAILED - MAY SEE RECRUITMENT, OR PLANT AGAIN]																				
	Control weeds around SchKaa sites annually, targeting understory and gradual removal of canopy weeds. Do in conjunction with RP monitoring.																				
Ekahanui-04 (Cliffs to Crestline)	Conduct weed sweeps through this steep area, focusing around wild rare plants (PlaPri A, B, and C; TetLep), snail trees, and native forest; annually. Control understory and canopy weeds, targeting PsiCat and SchTer for gradual removal.																				
	Control grasses throughout WCA as needed, annually. Includes MelMin, PasCon and SetGra. May need to access area via multiple points: ridgetop, base of Plapripri A cliff, ridge above CenAgr reintro.																				
	Control weeds around PlaPri EKA-D reintro site every 3-6 months, targeting understory and gradual removal of canopy weeds.																				
	Control weeds around KadPar EKA-A reintro site annually or as needed. Steep/cliff terrain.																				
Ekahanui-05 (2D Reintro Zone)	Conduct weed control across WCA. Sweep whole area at least 1x/year. Target reintros across all the subgulches (2D, 2C) and on fenceline (CenAgr). Focus on understory weeds, PasSub, and gradual canopy removal.																				
	Control grasses across WCA annually or as needed. Focus on area around CenAgr reintro in particular.																				
Ekahanui-06 (Palai Gulch)	Conduct weed control across WCA, at least twice a year. Focus efforts around rare taxa, native forest patches, pushing into weedier zones. Target understory, gradual removal of canopy. Elepaio in area, exercise caution when weeding any canopy, avoid dramatic change, and time work outside of breeding season.																				
	Control grasses, particularly Oplhir, through WCA annually. Focus around rare taxa, native forest patches.																				

Action Type	Actions	MIP Year 13 OIP Year 10 Oct 2016- Sept 2017				MIP Year 14 OIP Year 11 Oct 2017- Sept 2018				MIP Year 15 OIP Year 12 Oct 2018- Sept 2019				MIP Year 16 OIP Year 13 Oct 2019- Sept 2020				MIP Year 17 OIP Year 14 Oct 2020- Sept 2021			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Ekahanui-07 (Unit 1)	Clear/maintain rat grid trails and access trails, as needed.																				
	Conduct gradual control of canopy, targeting Psicat and Grerob. Low priority project. Interactions with Elepaio breeding habitat. Use volunteer assistance. Do in conjunction with common reintros. [NO ACTION PLANNED IN NEXT 5 YEARS]																				
Ekahanui-10 (Ekahanui Fenceline)	Clear/maintain fence. Remove downed trees, spray grass, treat thick understory, as needed.																				
	Control weedy grasses at SE corner of fence, top of Palai Gulch, both inside and outside enclosure, every 6mo/year. Goal is to remove UroMax and reduce fuel loads.																				
	Maintain/clear contour trail in Ekahanui, as needed. Goal is to facilitate access, for general field work and fire response. Use volunteers if possible.																				
Ekahanui-11 (Cenchrus EKA-C Reintro)	Conduct weed control around CenAgr EKA-C reintro as long as plants are still alive (reintroduction has been discontinued). Control understory and canopy at both reintro groups. Target Psicat.																				
Ekahanui-12 (Amastra Fence Slope)	Control weeds across WCA, at least 1-2x/year. Focus effort around rare taxa, native forest patches, pushing into weedier zones. NW side of WCA more native (includes <i>Amastra</i> site), with habitat quality decreasing as move SE. Target understory, gradual removal of canopy.																				
Ekahanui-13 (North Fence Cenchrus D)	Conduct weed control around CenAgr EKA-D reintro site, native forest patches. Focus on understory weeds and opening up canopy gradually.																				
	Control grass across WCA, particularly UroMax. Treat as needed.																				
Ekahanui-14 (Abutilon Unit 3)	Conduct understory/canopy weed control around wild and outplanted AbuSan, at least 2x/year. Area fairly degraded. Target understory and select canopy removal.																				

Action Type	Actions	MIP Year 13 OIP Year 10 Oct 2016- Sept 2017				MIP Year 14 OIP Year 11 Oct 2017- Sept 2018				MIP Year 15 OIP Year 12 Oct 2018- Sept 2019				MIP Year 16 OIP Year 13 Oct 2019- Sept 2020				MIP Year 17 OIP Year 14 Oct 2020- Sept 2021			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	Control grasses across WCA annually or as needed. Focus on area around AbuSan in particular.																				
	Conduct weed control across WCA, annually. Focus on native forest patches, and gradual removal of target species such as GreRob.																				
Ekahanui-15 (Unit 2)	Clear/maintain rat grid trails, as needed.																				
EkahanuiNoMU-01 (DelWai EKA-A)	Conduct weed control at DelWai EKA-A enclosure. Focus only around DelWai; this not an MFS location. Control understory weeds, grasses, some canopy (don't change light levels), keep fence clear of SchTer.																				
EkahanuiNoMU-02 (Contour Trail)	Maintain/clear contour trail north of Ekahanui fence, as resources permit. Goal is to facilitate access to trail, particularly for potential fire response. Use volunteers as much as possible. Target UroMax and SetPal.																				
EkahanuiNoMU-03 (Ekahanui Trail)	Control weedy grasses, remove tree falls along Ekahanui access trail, as needed. Target UroMax and SetPal.																				
EkahanuiNoMU-05 (Allspice Gulch)	Control PimDio and other weeds (HelPop, Ficus spp) in gulch with volunteer groups or State if asked; this is a Senior Day Care group work site. Not a priority OANRP action.																				
Huliwai-02 (Huliwai Abutilon)	Control weeds around AbuSan, in fenced area, twice a year. Focus on understory weeds and gradual removal of alien canopy weeds. Additional light may favor AbuSan.																				
HuliwaiNoMU-01 (Huliwai Cenchrus)	Conduct weed control around CenAgr HUL-A annually. This population is GSC only. Focus on understory weeds, gradual removal of some canopy species, directly around CenAgr sites.																				
HuliwaiNoMU-03 (Huliwai	Control ChrOli, GreRob, and other weeds in area. Not a priority OANRP action. Senior Day Care works in this area on ChrOli control; coordinate ChrOli efforts with																				

Action Type	Actions	MIP Year 13 OIP Year 10 Oct 2016- Sept 2017				MIP Year 14 OIP Year 11 Oct 2017- Sept 2018				MIP Year 15 OIP Year 12 Oct 2018- Sept 2019				MIP Year 16 OIP Year 13 Oct 2019- Sept 2020				MIP Year 17 OIP Year 14 Oct 2020- Sept 2021			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Satinleaf)	them.																				
Ungulate Control	Maintain fence integrity.																				
	Elimination of any pig ingress into the fence with use of snares and traps.																				
Rodent Control	Rat control for Elepaio, rare plants and Achatinella. A24s, blue team snaps, and large-scale grid.																				
	Tracking Tunnel Set up & Running																				
Ant Control	Sample ants at 2D outplanting site																				
Predatory Snail	Euglandina seek and destroy in snail bait zone. For Achmus: EKA-A, EKA-B, EKA-C																				
	Systematically search enclosure for <i>E. rosea</i> as designated by following chart. At least 2 hours a quarter at lowest level of effort. Be sure to rotate through entire enclosure over the year. [Not scheduled unless needed to assist with searches.]																				
Slug Control	FerroxxAQ® needed for entire site applied once every 6 weeks. Ekahanui 2D site																				