

1.3.5 Pahole

Ecosystem Restoration Management Plan

MIP Year 7-11, Oct. 2010 – Sept. 2015

MU: Pahole

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. Implement all control methods by 2015.

Background Information

Location: Northern Waianae Mountains

Land Owner: State of Hawaii

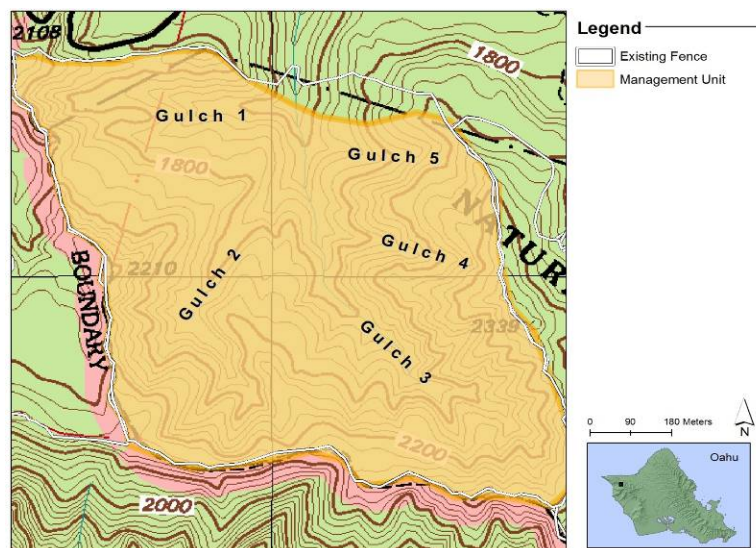
Land Manager: State of Hawaii, NARS

Acreage: 215

Elevation Range: 1500-2400 ft.

Description: Pahole MU is one of three major gulches within the Pahole NAR. The other two gulches that make up the NAR are Kapuna and Keawapilau and are covered in the upper Kapuna Ecosystem Restoration Management Plan. The Pahole MU itself is further divided into five gulches. When facing South, these five gulches are shaped like a left handprint, with Gulch 1 representing the thumb (see picture below). Gulch 1 ends in the main Waianae Summit ridge separating Pahole from Kahanahaiki, Gulch 2 and 3 reaches back to the Makua rim, and gulchs 4 and 5 ends at the ridge that separates Pahole from Kapuna. The Pahole MU as a whole is diverse, mesic, and contains numerous rare taxa. The east rim of Pahole contains many wild and reintroduced endangered MIP plant sites as well as the ridges dividing each gulch. The most intact native habitat is found above Gulches 2, 3, while the weediest areas are in gulches 4 and 5.

Pahole NAR Gulch Numbers



Native Vegetation Types

Waianae Vegetation Types	
Mesic Ridge/crest	
Canopy includes: The canopy is dominated by <i>Acacia koa</i> and/or <i>Metrosideros polymorpha</i> . Other canopy associates include <i>Psychotria</i> spp., <i>Antidesma platyphylum</i> , <i>Bobea</i> spp. and <i>Santalum freycinetianum</i> .	
Understory includes: <i>Microlepia strigosa</i> , <i>Sphenomeris chinensis</i> , <i>Alyxia stellate</i> , and <i>Coprosma</i> spp.	
Mesic Slope	
Canopy includes: <i>Diospyros sandwicensis</i> , <i>Sapindus oahuensis</i> , <i>Nestigis sandwichensis</i> , <i>Pouteria sandwicensis</i> , <i>Antidesma platyphylum</i> , and <i>Pisonia</i> spp.	
Understory includes: <i>A. stellate</i> , <i>Psydrax odorata</i> , and <i>Bidens</i> spp.	
Mesic Gulch	
Canopy includes: <i>Pisonia</i> spp., <i>Charpentiera tomentosa</i> , <i>Psychotria</i> spp., and <i>D. hillebrandii</i>	
Understory includes: <i>Diplazium sandwicensis</i> , <i>Microlepia strigosa</i> and <i>Tectaria gaudichaudii</i> as well as <i>Freycinetia arborea</i> , <i>Urera glabra</i> , <i>Pipturus albidus</i> and <i>Coprosma</i> spp.	
NOTE: For MU monitoring purposes vegetation type is mapped based on theoretical pre-disturbance vegetation. Alien species are not noted.	
NOTE: For MU monitoring purposes, vegetation types will be subdivided using topography (gulch, mid-slope, ridge). Topography influences vegetation composition to a degree. Combining vegetation type and topography is useful for guiding management in certain instances.	

MIP/OIP Rare Resources

Organism Type	Species	Pop. Ref. Code	Population Unit	Management Designation	Wild/Reintroduction
Plant	<i>Alectryon macrococcus</i> var. <i>macrococcus</i>	PAH-A,B,F,G	Kahanahaiki to W. Makaleha	MFS	Wild
Plant	<i>Chamaesyce herbstii</i>	PAH-E,F,G,H,I,R	Kapuna to Pahole	MFS	Both
Plant	<i>Cenchrus agrimonioides</i> var. <i>agrimonioides</i>	PAH-A,B,C,D,E,F	Kahanahaiki and Pahole	MFS	Both
Plant	<i>Cyanea grimesiana</i> subsp. <i>obatae</i>	PAH-A,B,C,D	Pahole to W. Makaleha	MFS	Both
Plant	<i>Cyanea longiflora</i>	PAH-A,B,C,G,H,I	Pahole	MFS	Wild Reintroduction
Plant	<i>Cyanea superba</i> subsp. <i>superba</i>	PAH-A,B	Pahole to Kapuna	MFS	Reintroduction
Plant	<i>Cyrtandra dentata</i>	PAH-A,B,C,D,E,F,G	Pahole to Kapuna to West Makaleha	MFS	Wild
Plant	<i>Delissea waianaeensis</i>	PAH-B,C,E	Kahanahaiki to Keawapilau	MFS	Both
Plant	<i>Flueggea neowawraea</i>	PAH-A,C	Kahanahaiki to Kapuna	MFS	Wild
Plant	<i>Hedyotis degeneri</i>	PAH-A,B	Kahanahaiki to	MFS	Wild

Organism Type	Species	Pop. Ref. Code	Population Unit	Management Designation	Wild/ Reintroduction
	<i>var. degeneri</i>		Pahole		
Plant	<i>Nototrichium humile</i>	PAH-A	Kahanahaiki	GSC	Wild
Plant	<i>Phyllostegia kaalaensis</i>	PAH-B	Pahole	MFS	Reintroduction Wild*
Plant	<i>Plantago princeps var. princeps</i>	PAH-A	Pahole	GSC	Wild
Plant	<i>Schiedea kaalae</i>	PAH-A,B,C,E	Pahole	MFS	Both
Plant	<i>Schiedea nuttallii</i>	PAH-A,B,D,E	Kahanahaiki to Pahole	MFS	Both
Plant	<i>Schiedea obovata</i>	PAH-A,C,D,E	Kahanahaiki to Pahole	MFS	Reintroduction Wild*
Snail	<i>Achatinella mustelina</i>	ESU-A	Kahanahaiki to Pahole	MFS	Wild

MFS= Manage for Stability

* = Population Dead

GSC= Genetic Storage Collection

† = Reintroduction not yet done

Other Rare Taxa at Pahole MU:

Organism Type	Species	Status	Comments
Plant	<i>Diellia falcata</i>	Endangered	
Plant	<i>Neraudia melastomifolia</i>	Species of Concern	
Plant	<i>Tetraplasandra kavaensis</i>	Species of Concern	
Plant	<i>Lobelia yuccoides</i>	Species of Concern	
Plant	<i>Pteralyxia macrocarpa</i>	Candidate	
Plant	<i>Exocarpos gaudichaudii</i>	Species of Concern	
Plant	<i>Bonamia menziesii</i>	State endangered	
Plant	<i>Nothoestrum longifolium</i>	Species of Concern	

Rare Resources at Pahole



Chamaesyce herbstii



Hedyotis degenerii var. degenerii



Cyanea longiflora



Schiedea obovata

Locations of Rare Resources at Pahole

Map removed, available
upon request

MU Threats to MIP/OIP MFS Taxa

Threat	Taxa Affected	Localized Control Sufficient?	MU scale Control required?	Control Method Available?
Pigs	All	No	Yes	MU fenced
Rats	<i>A. mustelina</i> , <i>C. grimesiana</i> , <i>C. herbstii</i> , <i>C. longiflora</i> , <i>C. superba</i> , <i>C. dentata</i> , <i>D. waianaensis</i> , <i>P. princeps</i> , <i>P. kaalaensis</i> , <i>S. nuttallii</i> , <i>S. obovata</i> ,	On-going at snail areas	No	Localized control
Black twig borer (BTB) <i>Xylosandrus compactus</i>	<i>F. neowawraea</i> , <i>A. macrococcus</i> var. <i>macrococcus</i>	Unknown	No	No effective methods known. No control taking place
Predatory snails, <i>Euglandina rosea</i> , <i>Oxychilus alliarius</i>	<i>Achatinella mustelina</i>	Yes	No	Physical enclosure to protect native snails from alien snails in place
Slugs	<i>C. grimesiana</i> , <i>C. herbstii</i> , <i>C. longiflora</i> , <i>C. superba</i> , <i>C. dentata</i> , <i>D. waianaensis</i> , <i>P. princeps</i> , <i>P. kaalaensis</i> , <i>S. nuttallii</i> , <i>S. obovata</i>	Yes	No	Revised label for Sluggo under review by Hawaii Department of Agriculture. Currently no control is taking place
Ants	Unknown, possibly a threat to native snails, arthropods, plants and birds	Yes	No	Hydramethylnon (Amdro, Maxforce, Siege) available. Currently no control is taking place
Weeds	All	Yes	Yes	Yes
Fire	All	No	Yes	Yes

Management History

- 1981: Listed as a NAR.
- 1996: First recorded rare plant monitoring by OANRP.
- 1998: Pahole MU fence completed.
- 1998: Snail enclosure built.
- 1999: All pigs were removed by NARS.
- 2000: First outplanting in Pahole.
- 2002: Although started weeding prior, OANRP began extensive weed control in 2002.
- 2006: Several small pigs breached the fence and were able to breed before detection.
- 2008: All pigs removed after breach in 2006. A total of 23 pigs were removed via snares.
- 2009: Rat, snail, and slug monitoring began as a part of the Kahanahaiki trap out study.

Ungulate Control

Identified Ungulate Threats: Pigs

Threat Level: High

Strategy:

- Eradication in the MU. NARS staff is the primary manager for this MU therefore all management actions must be cleared through the NARS Specialist.

Primary Objective:

- Maintain the fenced area as ungulate-free.

Secondary Objective:

- It would be advantageous to reduce current pig activity just outside of the fence by using snares on the upper slopes of Makua to reduce pressure on fence.

Monitoring Objectives:

- Conduct monthly fence checks during the public hunting season, and quarterly fence checks when not hunting season.
- Work with NARS crew to install 1-2 transects. The transect locations have not yet been decided.
- Monitor for pig sign when conducting other management actions in the fence.

Management Responses:

- If any pig activity detected in the fence area, implement a NARS directed snaring program.

Maintenance Issues:

- There is a perimeter fence around this 215 acre MU. The major threats to the perimeter fence include fallen trees and vandalism; there is one major gulch crossings. The fence is constructed in such a way at the crossing that allows the water to pass under without opening access to pigs. There have been relatively few incidences of vandalism in the past. Special emphasis will be placed on checking the fence after extreme weather events.

Weed Control

Weed Control actions are divided into 4 subcategories:

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

These designations facilitate different aspects of MIP/OIP requirements.

Vegetation Monitoring

Primary Objectives

- 1) Assess the cover of alien plant species within a specific MU to determine if it is less than 50% across the sampled unit or continuing to decrease to ultimately meet that threshold requirement (Makua Implementation Team et al. 2003).
- 2) If alien species cover is not below the 50% threshold, determine if this value is decreasing significantly toward that goal based on repeat monitoring of the MU.

Secondary Objectives

- 1) Monitor the status of native plant species within the MU.
- 2) Determine if any ungulates (feral pigs or goats) are detected within the fenced portion of a MU.

MU Vegetation Monitoring

- Conduct MU vegetation monitoring every three years (2012 and 2015) to measure the effectiveness of current weeding effort within the MU.

Surveys

Army Training: None

Other Potential Sources of Introduction: OANRP, NARS, pigs that breach the fence, birds, mongoose, public visitors, construction and landscaping at Dillingham Ranch.

Survey Locations: Roads, Landing Zones, Fencelines, Trails, and High Potential Traffic Areas.

Management Objective:

- Prevent the establishment of any new invasive alien plant or animal species through early detection, regular surveys along roads, fencelines, trails, and other high traffic areas.

Surveys are designed to be the first line of defense in locating and identifying potential new weed species. Roads, fencelines, and other highly trafficked areas are inventoried regularly; Army roads are surveyed annually, non-Army roads are surveyed annually or biannually, while all other sites are surveyed quarterly or based on frequency of use. OANRP will continue to do annual road surveys. No weed transects have been established along fence lines or other possible high traffic areas, such as trails and staging areas. OANRP will consider whether such transects are a valuable tool at Pahole in the coming year. Due to its small size, incidental observations during regular field management may suffice.

Monitoring Objectives:

- Survey roads annually.
- Quarterly survey of LZs.
- Note unusual, significant, or incipient alien taxa during the course of regular field work.
- Install monitoring transects in conjunction with ungulate transects.

Incipient Taxa Control (ICAs)

Management Objectives:

- As feasible, eradicate high priority species identified as incipient invasive aliens in the MU by 2015.
- Conduct seed dormancy trials for all high priority incipients by 2015.

Monitoring Objectives:

- Visit ICAs at stated revisitation intervals. Control all mature plants at ICAs and prevent any immature or seedling plants from reaching maturity.
- Detect 100% of known mature incipient invasives at all ICAs and at least 75% of known immature incipient invasives through quarterly ICA sweeps.

Management Responses:

- If unsuccessful in preventing immature plants from maturing, revisit ICA's more frequently.

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. OARNP will compile this information for each ICA species; assistance from graduate students for this research will be sought.

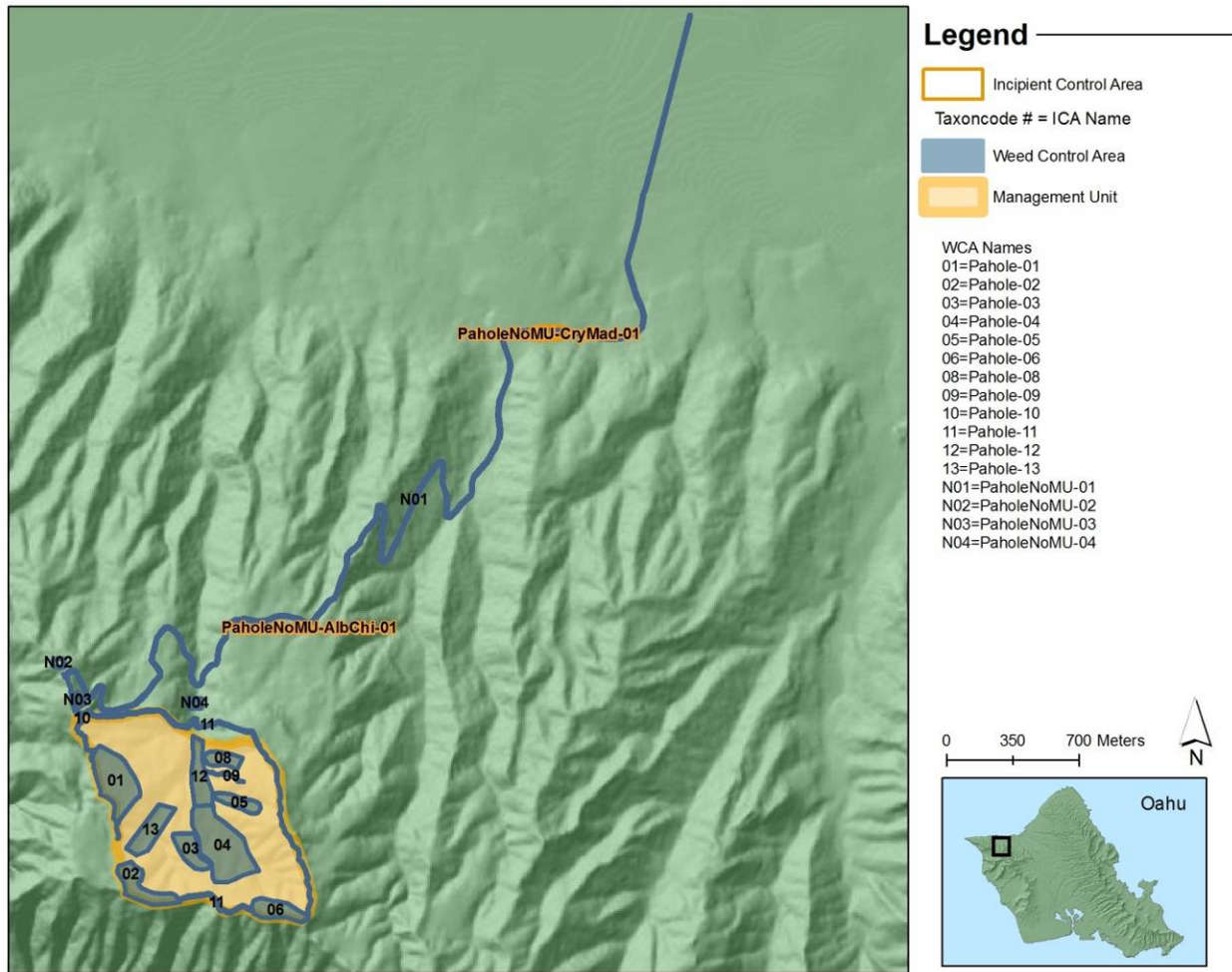
The table below summarizes incipient invasive taxa at Pahole MU. Appendix 3.1 of the MIP lists significant alien species and ranks their potential invasiveness and distribution. Each species is given a weed management code: 0 = not reported from MU, 1 = incipient (goal: eradicate), 2 = control locally. While the list is by no means exhaustive, it provides a good starting point for discussing which taxa should be targeted for eradication in an MU. OARNP supplemented and updated Appendix 3.1 with additional target species identified during field work and communication with NARS staff. In many cases, the weed management code assigned by the MIP has been revised to reflect field observations. Vegetation monitoring will better define the range and abundance of many of the species listed below; codes may be revised again after monitoring. ICAs are not designated for every species in the table below; however, occurrences of all species in the table should be noted at Pahole MU. ICAs have been designated for taxa in shaded cells and text in red.

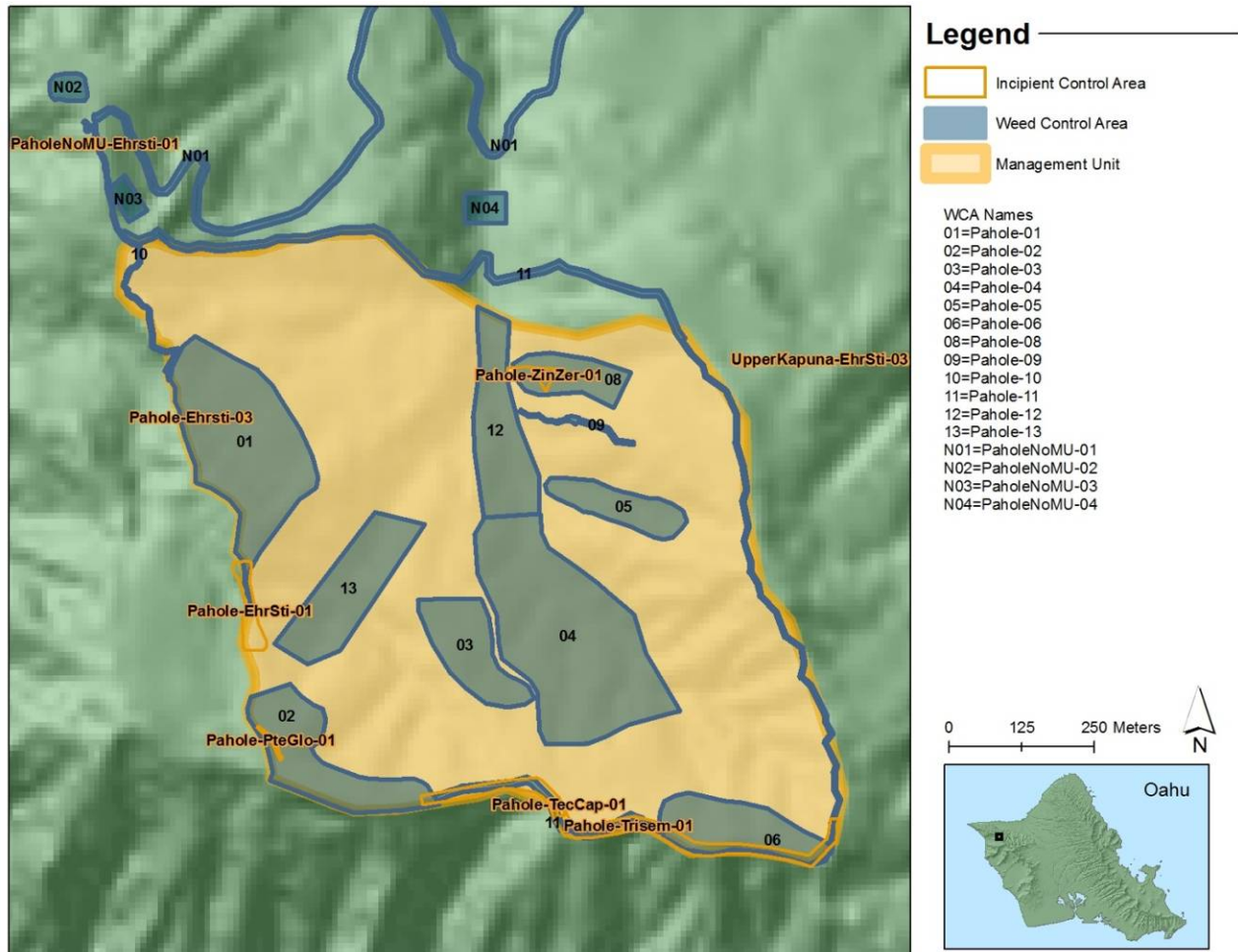
OARNP have been very diligent about regular re-visitation of ICAs throughout the MU. While most are visited quarterly and are treated before more individuals become mature, some species persist and may need more frequent visitation or new control methods in order to reach complete eradication. OARNP would also like to discuss with NARS staff the use of Oust, a pre-emergent herbicide, at *Ehrharta stipoides*, *Pterolepis glomerata* and possibly other ICAs. Use of this herbicide would be minimized and restricted to known ICA areas.

Summary of Potential ICA Target Taxa

Taxa	MIP weed man. code		Notes	No. of ICAs
	Original	Revised		
<i>Acacia mearnsii</i>	N/A	1	Located on the border of Kahanahaiki and Pahole at the top of the Schwepps trail. The population is recorded under the Kahanahaiki MU as an ICA. On both sides of the trail there is only a minute amount.	0
<i>Achyranthes aspera</i>	1	1	Small population located in the lower section of the Pahole NAR. The objective is to keep it out of the Pahole MU by targeting this species when observed in WCAs.	0
<i>Albizia chinensis</i>	<u>1</u>	<u>1</u>	<u>Only a few plants found near the Peacock Flats gate. Monitor location.</u>	<u>1</u>
<i>Angiopteris evecta</i>	<u>1</u>	<u>1</u>	<u>In gulch 5, systematic control and surveys needed.</u>	<u>0</u>
<i>Axonopus compressus</i>	1	1	Medium size population located at the top of the Switchbacks near the water catchment. Sprayed previously and continue to monitor. The population is recorded under the Kahanahaiki MU as an ICA.	0
<i>Cryptostegia grandiflora</i>	N/A	<u>1</u>	<u>Only known from along Pahole road near Dillingham Ranch. Treatment on May 2010 was effective in killing the known plant. Continue to monitor and treat with State assistance.</u>	<u>1</u>
<i>Ehrharta stipoides</i>	<u>1</u>	<u>1</u>	<u>Species present both in and outside of MU. Control needed to prevent greater spread of this species.</u>	<u>4</u>
<i>Grevillea robusta</i>	2	2	Not targeted by OARNP. NARS staff are currently treating large trees. Will continue communication with NARS staff to assess help needed.	0
<i>Montanoa hibiscifolia</i>	1	2	Known from multiple locations across MU, and appears to be widespread. It will be a target weed species at all weed control areas and all occurrences will be GPSed.	0
<i>Passiflora suberosa</i>	1	1	Found only on fenceline border of Kahanahaiki and Pahole. Appears to be more widespread in Kahanahaiki MU than originally thought. Controlled as part of Kahanahaiki MU. Vegetation monitoring in Pahole will help determine distribution. This species will be controlled in WCAs.	0
<i>Pennisetum clandestinum</i>	0	1	None from one location on state land near the NIKE site. Population is not spreading, no seed produced. OANRP will monitor to detect potential changes in behavior and work with State to determine level of control.	0
<i>Pterolepis glomerata</i>	<u>1</u>	<u>1</u>	<u>Small infestation along trail was found May 2007 and was probably carried in on accident on a shoe of a hiker. A pre-emergent such as Oust may need to be used to help eradicate this species.</u>	<u>1</u>
<i>Sphaeropteris cooperi</i>	1	1	Small infestation along trail. One mature found on 3-4-10.	0
<i>Tecomaria capensis</i>	N/A	<u>1</u>	<u>Potential for invasiveness has been observed elsewhere. This site is located at the top of the ridge dividing gulch 2 and 3. The last 3 visits yielded no plants. Control was effective.</u>	<u>1</u>
<i>Triumpheta semitriloba</i>	<u>1</u>	<u>1</u>	<u>Most of the plants are known from the Makua rim along the Makua/Pahole fenceline including where the Upper Kapuna fence meets the Pahole fence. This is where the control has been focused. Emphasis is placed on preventing movement off the ridge and into Pahole.</u>	<u>1</u>
<i>Zingiber zerumbet</i>	N/A	<u>1</u>	<u>Known from one location in Gulch 5. Ica formed, and control is ongoing. This plant is a Polynesian introduction, and is only controlled in MU.</u>	<u>1</u>

Incipient and Weed Control Areas at Pahole





Ecosystem Management Weed Control (WCAs)

MIP Goals:

- Within 2m of rare taxa: 0% alien vegetation cover (with exceptions where this will cause harm to rare taxa).
- 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:

- Conduct baseline vegetation monitoring transects by 2011 in MU. Management objectives will then be defined based upon these monitoring outcomes.
- In WCAs within 50m of rare taxa, work towards achieving 25% or less alien vegetation cover in understory and canopy. Although monitoring not yet done, OANRP already know that most rare plant taxa sites do not meet this goal.

Management Responses:

- Increase/expand weeding efforts if MU vegetation monitoring (conducted every 3 years) indicates that goals are not being met.

Pahole as a whole consist mostly of invasive plants, however in a certain areas such as the back of gulches 2 and 3 just below the edge of the Makua ridge, intact plant communities exist hosting the largest wild, naturally occurring populations of *C. dentata*, *C. hebstii*, *C. longiflora*, *H. degeneri* var. *degeneri*, and *S. nutalii* in the world. Large populations of wild and reintroduced *C. agrimonioides* var. *agrimonioides*, *C. superba*, *C. grimesiana*, and *S. obovata* also exist in Pahole MU. OANRP began small scale weed control around some of these rare plant populations in Pahole prior to 2002, but it was in that year when extensive weed control began around all known wild sites, reintroduction sites that were planted in subsequent years, and incipient taxa.

There are 12 WCAs inside the Pahole MU, and 4 WCAs outside the MU. A few of these WCAs have *R. rosifolius* and *B. appendiculata* as its main understory weeds. OANRP should consider developing a strategy to reduce the amount of time needed for weeding especially in these highly repetitive areas, perhaps by utilizing common reintroductions. Rat grids and slug control in the immediate areas surrounding rare taxa may help seedlings get established and make weeding more effective, as well as protecting the parent plant from predation and destruction.

Future vegetation monitoring at Pahole will commence in 2012 and will likely indicate that it will take a long time to meet the MU 50% alien cover goal in the understory and canopy. Most of the WCAs are drawn around rare taxa sites, where the alien goal is 25% or less, and OANRP effort is focusing in these areas. A few WCAs are drawn where there are no rare taxa; this is done to facilitate control of target species throughout the MU like *M. hibiscifolia*. Areas around rare taxa will continue to be priority. Where *A. mustelina* are present, OANRP will seek to avoid unintentional negative impact by being cognizant of snail presence and avoiding control of preferred snail trees.

WCA Pahole-01 (Switchbacks Schnut Reintro)

Veg Type: Mesic slope

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *Schinus terebinthifolius*, *Psidium cattleianum*, *Montanoa hibiscifolia*, and shrubs.

Notes: This WCA is located at the top of Gulch 1 which includes part of the Pahole/Kahanahaiki trail and stretches from Puu 2210 to the Kahanahaiki Schwepes trail. This is a large WCA, priority being understory and gradual control around rare plant taxa, then grass control and canopy control. There is a large patch of *Microlepis strigosa* in the area encompassing the *D. waianaensis* outplanting and controlling the understory weeds may help this native understory expand. Many areas along the rim just need periodic grass spray and minimal weeding of alien understory. OANRP should start *B. appendiculatum* control in this area. It is better to attack before clumps get too large. If the population extends past an easy control threshold it is still possible to kill *B. appendiculatum* in 5 X 5 meter sections over time (a few years), reducing alien understory gradually.

WCA Pahole-02 (Cenagragr PAH-A)

Veg Type: Mesic slope/ridge

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, *M. hibiscifolia*, and shrubs.

Notes: This large WCA spans a north facing gulch slope and includes the area from the Pahole Snail enclosure to the *H. degeneri* var. *degeneri* population. The area surrounding the large *C. agrimonioides* outplanting site is native dominated and will be maintained. However, the surrounding area will require

further weeding, including periodic grass spray, *B. appendiculatum*, and *P. cattleianum* control. *H. degeneri*, *C. longiflora*, and *P. princeps* are located on the eastern side of this WCA. Although portions of the WCA are dominated by native understory, there is a concern of removing too much canopy, allowing non-native and invasive canopy to move in. Common reintroductions may help, with *Acacia koa* being a good candidate.

WCA Pahole-03 (Cenagragr PAH-B)

Veg Type: Mesic slope

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, *M. hibiscifolia*, and shrubs.

Notes: This fairly steep sloped WCA is located on top of the ridge dividing Gulches 2 and 3 which includes the in-situ population of *C. agrimonioides*. Sprinkled throughout this population are pockets of the native panicum grass. The top portion of the ridge is mostly covered by natives, canopy as well as understory. Unfortunately the parts not covered by natives have been overgrown with *M. minutiflora*. Periodic grass spray/ hand pull is needed. Directly downslope of the *C. agrimonioides* population there is a large stand of *P. cattleianum*. This should be replaced slowly with *Acacia koa* as weeds are removed, so as not to let *P. cattleianum* continually encroach upon the wild population. Continuing down this ridge in a southern direction is the *D. falcata* - A population.

WCA Pahole-04 (Gulch 3 Cyasup reintro/Chaher)

Veg Type: Mesic Gulch

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, and shrubs.

Notes: This WCA is located in gulch 3 and includes the area from the bottom *C. superba* outplanting site to the top of the Gulch 3 *C. herbstii* sites G, I, and R. The majority of this WCAs overstory consists of large *P. cattleianum* stands. In most areas of the gulch, little light is able to penetrate through the overstory. The groundcover in the gulch is partially comprised of native taxa such as *M. strigosa*, *Asplenium macrei*, and *A. kaulfussii*. Continue periodic control of *R. rosifolius*, *P. cattleianum* and grasses, as well as sweeps to continually control *M. hibiscifolius*. Weeding of ground cover around the *C. superba* and *C. herbstii* populations to help recruitment seedlings is the primary objective. The area requires lots of repetitive weed control of *R. rosifolius* in the understory. OANRP should start *B. appendiculata* control around these sites and future reintroduction sites as it is much easier to control before the establishment of endangered taxa into the area.

WCA Pahole-05 (Gulch 4)

Veg Type: Mesic Gulch

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, and shrubs.

Notes: WCA is in gulch 4 around the failed *P. kaalaensis* reintroduction. The rare taxa, *C. dentata* are located on the eastern slope of the WCA. Weeding to help native recruitment of rare taxa such as *Pisonia sp.* is important as there are a lot of light gaps. Sweeps should be continually conducted for *M. hibiscifolia*. This WCA is cool, moist, and shady due to the large overstory created mostly by *P.*

cattleianum. If *P. kaalaensis* is reintroduced to this site again, continual weeding of *R. rosifolius* and *B. appendiculatum* will be necessary, especially in the vicinity the planted plants. It would be prudent to target the non-native understory and then gradually aim towards non-native canopy removal.

WCA Pahole-06 (East Pahole Rim Schnut/Cyalon)

Veg Type: Mesic slope

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *P. cattleianum* and shrubs.

Notes: Stretching from the eastern side of Gulch 3 up to the Pahole rim, lies WCA-06. This WCA is extremely sensitive due to steep, wet banks with possible *C. longiflora* recruitments in the soil. Due to the sensitivity of the habitat, it is recommended that activities in the area, such as weeding (*P. cattleianum*) and plant monitoring, be coupled with plant collection trips to minimize the number of visits to the site. There are several pockets of native forest patches. Rare taxa in the WCA include populations of *C. longiflora*, *C. dentata*, and one population of *S. nuttalii*. All these populations are evenly dispersed among the WCA. The canopy consist of *A. koa*, *C. glaucum*, *A. platyphylum*, and the understory consist of *A. oliviformis*, *A. nidus*, and *B. occidentale*.

WCA Pahole-08 (Gulch 5)

Veg Type: Mesic gulch

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, and shrubs.

Notes: WCA is located in gulch 5 around the *C. grimesiana* and *S. kaalae*. Overstory cover is fairly dense, with *S. terebinthifolius* and *P. cattleianum* as dominant species. Also intermixed is *A. moluccana* and *D. sandwicensis*. Understory is patchy and includes *B. asiatica*, *M. strigosa*, and *A. oliviformis*. The gulch is steep and narrow, and the closed canopy encourages a wet environment. The goal in this WCA is to improve habitat, by gradually controlling weedy understory and canopy without shocking area with major changes in light levels. This will provide a more suitable habitat for the reintroduced *C. grimesiana* subsp. *obatae* and wild and reintroduced *S. kaalae*.

WCA Pahole-09 (Cenagragr outplanting site)

Veg Type: Mesic slope

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, and shrubs.

Notes: This WCA is located on the ridge dividing Gulches 4 and 5, and is maintained mostly for the *C. agrimonioides* reintroduction population F. This is the only rare taxa in the immediate area, therefore the main focus of weeding is specific to this one population. Alien grasses are hand pulled near *C. agrimonioides* and grasses that are a safe distance away are sprayed. Continual weeding of *R. rosifolius* and *B. appendiculatum* is recommended. It would be prudent to target the non-native understory and then gradually work towards non-native canopy removal. Some of the canopy cover consists of non-natives, such as *P. cattleianum*, as well as native canopy, such as *A. koa*.

WCA Pahole-10 (Pahole Trail Spraying)

Veg Type: Mesic Ridge

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, and shrubs.

Notes: This WCA spans from the Pahole trailhead to the Schweps trail, the most northern point of WCA 1. WCA 10 is comprised primarily of the main Pahole trail and the areas adjacent to the trail. This WCA was created primarily to facilitate grass sprays along the trail, however since there are now reintroduced *C. agrimonioides* var. *agrimonioides*, *S. nuttallii*, and *S. obovata* in the area, the WCA was expanded to include weed control around these new taxa. Dominant target weeds are *P. cattleianum*, *P. guajava*, *S. terebinthifolius*. There have also been rare sightings along the trail of the weed *A. mearnsii*. Unfortunately, there are few large patches of *P. cattleianum* in the first half of the WCA. There is no native canopy in the immediate vicinity that would be able to fill the void if the *P. cattleianum* were to be removed. Many native species line the trail as well, *M. polymorpha*, *A. koa*, *A. oliviformis*, *B. torta*. The majority of the area has minimal canopy cover, and thus there is an abundance of light reaching down to the understory.

WCA Pahole-11 (Pahole Fenceline)

Veg Type: Mesic Gulch

MIP Goal: Less than 50% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, *M. hibiscifolia* and shrubs.

Notes: WCA 11 encompasses the Pahole fence particularly the North and East portions of the fence including the Hypalon. It is important to maintain and clear the fenceline in this area that spans from gulch to ridge top. Occasionally remove large fallen trees off of the fence to maintain the integrity of the fence. Spraying grass and treating the thick invasive understory will be done as needed in order to keep weeds at a manageable size. Periodic sweeps for *M. hibiscifolius* will be conducted annually, as well as general sweeps for other target weeds. The majority of this WCA's canopy consists of *P. cattleianum*, yet there is a significant portion of native taxa in the understory. Weed control will be conducted as needed to keep the fence line clear and facilitate fence line checks.

WCA Pahole-12 (Main Gulch)

Veg Type: Mesic Gulch

MIP Goal: Less than 50% non-native cover

Targets: All weeds, focusing on *P. cattleianum*, *M. hibiscifolia* and shrubs.

Notes: The Pahole main gulch entrance has no rare taxa in the immediate area of this WCA. The moisture of this gulch environment allows for a lush, generally native filled understory consisting of native ferns. This large drainage is the most commonly used corridor that leads to the five gulches in Pahole, each of which contains rare managed taxa. One the most vital goals here is to focus our attention on *M. hibiscifolius* sweeps, as well as searching for other target weeds including *T. ciliata*, *T. semitriloba* and *P. edulis*, which became a potential threat a year ago. Due to the fact that this gulch is the main pathway used to access the other gulches, it is pertinent to halt any further transport of the previously mentioned weeds.

WCA Pahole-13 (Back of Gulch 2)

Veg Type: Mesic Gulch

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *P. cattleianum*, *M. hibiscifolia* and shrubs.

Notes: *C. herbsteii* F-population and *F. neowawraea* is the managed taxa within this WCA. Weed control efforts, around the rare taxa, are targeted on understory and gradual canopy weed control, while at the same time preventing major light changes to the micro-environment. Understory species of concern are *C. hirta*, *B. appendiculatum*, and *R. rosifolius*. It is critical to control the minimal amount of weedy groundcover because there is abundance of native seedling recruitment. The overstory consisting of native and non-native species is not dense and allows for significant light to penetrate down below. The gulch should be swept for *M. hibiscifolius*, *T. ciliata*, and *T. semitriloba* at least once a year.

WCA Pahole No MU-01 (Pahole Road)

Veg Type: Mesic Forest

MIP Goal: N/A

Targets: Roadside weeds, focusing on *P. maximum*.

Notes: The goal of this WCA is to maintain the Pahole road and control/reduce of target weeds as a safety issue. OANRP staff sprays grass and herbaceous weeds along road from Peacock Flats gate to the ranch gate as needed. Often, a power sprayer and weedwackers are used. These actions are shared between teams. Maintenance and weed control on other parts of the road occurs occasionally. It is important to prevent spread of weeds on road that it is utilized by several organizations: OANRP, State, HECO (Hawaiian Electric Company), Verizon Wireless, and HPD (Hawaii Police Department), as well as public hunters and hikers.

WCA Pahole No MU-02 (Nike Site)

Veg Type: Mesic Flat

MIP Goal: N/A

Targets: All weeds.

Notes: The goal of this WCA is to control weeds around the Nike site facility. Weed control is focused around the LZ, OANRP greenhouses, the upper building at Nike including the octagon where we fly loads off of, and anywhere else needed. Some common weeds found on these WCA sites include: *P. cattleianum*, *P. guajava*, *S. terebinthifolius*, *R. rosifolius*, *C. hirta*, *L. leucocephala*, *M. minutiflora*, *P. maximum*.

WCA Pahole No MU-03 (Cenagragr Reintro Outside Fence)

Veg Type: Mesic Slope

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *P. cattleianum*, and shrubs.

Notes: This WCA is located on the east facing slope just below the Pahole trail, just after the Re-veg road cut-off and before the water catchment. The managed rare taxa here are reintroduced *C.*

agrimonioides and *S. obovata* in a steep terrain habitat. The canopy is predominately *S. terebinthifolius*, and very open. The area is an exposed ridge top, and therefore, not much ground cover is present. Target understory and gradual canopy removal.

WCA Pahole No MU-04 (Fig Gulch)

Veg Type: Mesic Gulch

MIP Goal: Less than 50% non-native cover

Targets: All weeds, focusing on *P. cattleianum*, and shrubs.

Notes: This WCA is located between the Pahole fence and the Pahole road. Any target species in this WCA should be killed including *M. hibiscifolius* and *T. ciliate*. No rare taxa are in this WCA and the goal is to prevent these target species from getting established and spreading into the MU. This area is fairly weedy with *M. hibiscifolia* and some *P. suberosa* intermixed along the slopes. The understory is comprised of mostly native taxa, *A. oliviformis* and *M. strigosa* and there are no rare taxa in the immediate area. Weed sweeps for *M. hibiscifolia* are on-going while conducting other MU actions and weed sweeps.

Rodent Control

Species: *Rattus rattus* (Black rat), *Rattus exulans* (Polynesian rat), *Mus musculus* (House mouse)

Threat level: High

Control method: Localized control (bait station and snap trap grids)

Seasonality: Year-round: Snail enclosure: Fruiting season: *C. superba* subsp. *superba*

Number of control grids: 2 (Snail enclosure: 3 bait stations, 6 rat traps & *C. superba* subsp. *superba*: to be determined)

Primary Objectives:

- To maintain rodent populations at a level that facilitates stabilized or increasing plant and tree snail populations by the most effective means possible.

Management Objective:

- Continue to maintain localized bait station and rat trap grid around *Achatinella mustelina* enclosure.
- Establish and maintain a small scale bait station grid around *C. superba* subsp. *superba* populations during the flowering and fruiting season.
- Institute rodent control on a small scale if determined necessary for other rare plant populations (*D. waianaensis*, *C. longiflora*)

Monitoring Objective:

- Monitor *Cyanea superba* subsp. *superba*, *Cyanea grimesiana* subsp. *obatae*, *Cyanea longiflora*, *Delissea waianaensis*, and *Plantago princeps* var. *princeps* to determine the occurrence of fruit/plant predation by rats. Monitor tree snails to determine if rats are impacting the tree snail population within the enclosure.

Localized Rodent Control Actions:

- Localized control consists of bait stations and rat traps deployed around the Pahole NAR tree snail enclosure. Bait stations are maintained every 4 to 6 weeks and rat traps maintained every two weeks. The enclosure is designed to keep out the predator snail *Euglandina rosea*, but not rodents. The localized control is designed to reduce rat predation on tree snails within the enclosure. Additional rat control is ongoing at the Kahanahaiki MU which is directly adjacent to the snail enclosure. The large scale trapping grid at the Kahanahaiki MU, maybe affording additional protection for snails within the enclosure (See Research Chapter: Kahanahaik Large Scale Trapping Grid).
- Monitoring fruit fate of *C. superba* subsp. *superba* during the 2009-2010 fruiting season revealed a high rate of rat predation on fruits within the Pahole MU (See Research Chapter: Kahanahaiki Large Scale Trapping Grid). Rat control will consist of bait stations deployed around plants to reduced fruit predation pressure by rats. Bait stations will be maintained every four weeks during the fruiting season (November-January).

Slug Control

Species: *Deroceras leave*, *Limax maximus*, *Limacus flavus*, *Meghimatium striatum*, *Veronicella cubensis*

Threat level: High

Control level: Localized

Seasonality: Wet season

Number of sites: Currently, no sites within this MU

Primary Objective:

- Eradicate slugs locally to ensure germination and survivorship of rare plant taxa.

Management Objective:

- If additional Special Local Needs labeling for Sluggo is approved by USFWS and HDOA, begin discussion with NARS specialist to identify areas where application would benefit native plants without harming nontarget snails.

Monitoring Objectives:

- Annual census monitoring of *C. superba* seedling recruitment following fruiting events (as this species is vulnerable to slug predation).
- Annual census monitoring of slug densities during wet season.

Effective molluscicides have been identified (Sluggo) and initial control programs are ongoing in Kahanahaiki under an Experimental Use Permit (EUP). Whether slug control is possible in this MU depends upon registration of Sluggo under a Special Local Needs permit. It is not legal to apply under the current label. Should slug control take place, a priority species for eradication would be *Veronicella cubensis*. First found in this area in April 2007, this species has not yet spread outside of this MU. The

Plots to monitor the effect of predator removal (rats) on slug populations were installed in the Pahole MU in June 2009.

Predatory Snail Control

Species: *Euglandina rosea* (rosy wolf snail), *Oxychilus alliarius* (garlic snail)

Threat level: High

Control level: Locally at *Achatinella mustelina* site

Seasonality: Year-Round

Number of sites: One, PAH-A (*A. mustelina*)

Acceptable Level of Activity: Not tolerated within PAH-A *A. mustelina* snail enclosure

Primary Objective: Eliminate predatory snails to promote *A. mustelina* survival.

Management Objective:

- Continue to develop better methods to control predatory snails.
- Keep sensitive snail populations safe from predatory snails via currently accepted methods (such as hand removal of alien snails, construction of barriers which prevent incursion from alien snails).
- Work with NAR staff to maintain predator proof enclosure around the PAH-A *A. mustelina* population.

Monitoring Objectives:

- Annual or every other year census monitoring of *A. mustelina* population(s) to determine population trend.
- Annual search and removal of predatory snails in proximity to *A. mustelina*.

Ant Control

Species: *Solenopsis papuana*, *Leptogenys falcigera* confirmed

Threat level: Low

Control level: Only for new incipient species

Seasonality: Varies by species, but nest expansion observed in late summer, early fall

Number of sites: Two, human entry point where Gulch 2 intersects Hypalon fence and at the *Achatinella mustelina* snail enclosure

Acceptable Level of Ant Activity: Probably acceptable at current levels

Primary Objective: Eradicate incipient ant invasions and control established populations when densities are high enough to threaten rare resources.

Management Objective:

- If incipient species are found and deemed to be a high threat and/or easily eradicated locally (<0.5 acre infestation) begin control.

Monitoring Objective:

- Sample ants at human entry point (Hypalon fence intersection with trail) and at *Achatinella mustellina* site. Use samples to track changes in existing ant densities and to alert OANRP to any new introductions.
- Look for evidence of ant tending of aphids or scales on rare plants.

Ants have been documented to pose threats to a variety of resources, including native arthropods, plants (via farming of Hemipterian pests), and birds. It is therefore important to know their distribution and density in areas with conservation value. This can be accomplished using a survey methodology developed by S. Plentovich (UH Manoa). The protocol for sampling ants appears in Appendix 6-1 (this document).

Standardized surveys have not yet taken place. Opportunistic collection confirms that the following two species are present: *Leptogenys falcigera* and *Solenopsis papuana*. The first species occurs in low numbers and is not considered a threat to native resources. The second is one of the most common ants encountered at higher elevations on Oahu (see Appendix 6-2, this document). Both species are widespread throughout Oahu, therefore any attempt at control would be temporary. While control is not recommended at this time, future surveys are needed to ensure new species are not introduced.

Fire Control

Threat Level: Medium-high

Available Tools: Fuelbreaks, Helicopter Drops, Wildland Fire Crew, Red Carded Staff

Management Objective:

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

Preventative Actions:

Pahole MU falls in the MMR Action Area and is considered medium to high risk of fire due to the close proximity to Makua Valley where the fire threat is high. Fire prevention to this MU depends on fire measures put in place in Makua Valley. As with all other fire prone MUs, the following preventative actions are important: fire prevention signage, trail and LZ maintenance, and reduction of grass and other fuel loads on ridges and fencelines.

The BO, which is a re-initiation of the 1999 review by the U.S. Fish and Wildlife Service (FWS) of Army training in Makua, details several different options for reducing fire threat. Which options are required depends in part on the weapons/ munitions used during training. For now, OANRP will focus on maintaining good communication with the Wildland Fire Working Group to facilitate positive on-the-ground fire response in the event of another catastrophic Makua brushfire that could potentially threaten Pahole MU. OANRP will maintain red-carded staff to assist with fire response.

Action Type	Actions	MIP Year 7 Oct 2010- Sept2011				MIP Year 8 Oct 2011- Sept2012				MIP Year 9 Oct 2012- Sept2013				MIP Year 10 Oct 2013- Sept2014				MIP Year 11 Oct 2014- Sept2015			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
General Survey	Install and maintain transects																				
	Discuss AngEve with NARS staff. Determine whether we should help with control. Survey for AngEve in gulch 5. Define ICA and develop control schedule.																				
ICA	PaholeNoMU-AlbChi-01: Monitor/control AlbChi at Peacock Flats site every 6 months. Pick and remove from field any potentially viable fruit.																				
	PaholeNoMU-CryGran-01: Control infestation along the Pahole road. Work in conjunction with State. DOFAW to assist with monitoring, OANRP to assist with initial knockdown. Monitor to ensure that control method effective. Pick and remove from field any potentially viable fruit.																				
	PaholeNoMU-EhrSti-01: Monitor/control Ehrsti at Kahanahiki/Pahole trailhead quarterly. Spray. Flag location to facilitate revisitation. Pick and remove from field any potentially mature fruit. This species is cryptic and can be difficult to id.																				
	Pahole-EhrSti- 01: Survey and correctly GPS ICA. What is currently drawn on GIS is not accurate: ICA should extend from puu 2210 to pink flag trail (unless any other Ehrsti is found). There should be Target Species points at each of the 2 blue flagged locations. On GIS now																				
	Pahole-EhrSti-01: Monitor/control EhrSti at site near pink cross crossover quarterly. There are two flagged locations between pink trail crossover and puu 2210. Pick and remove from field any potentially mature fruit. This species is cryptic and can be difficult to id.																				

Action Type	Actions	MIP Year 7 Oct 2010- Sept2011				MIP Year 8 Oct 2011- Sept2012				MIP Year 9 Oct 2012- Sept2013				MIP Year 10 Oct 2013- Sept2014				MIP Year 11 Oct 2014- Sept2015			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	Pahole-EhrSti-02: Monitor/control EhrSti at state snail jail quarterly. Sweep entire ICA each time. Pick and remove from field any potentially mature fruit. This species is cryptic and can be difficult to id.																				
	Pahole-EhrSti- 03: Monitor/control Ehrsti at site on Kahanahaiki fence north of switchbacks quarterly. Possibly could have been Vulpia not Ehrsti at site. Pick and remove from field any potentially mature fruit. This species is cryptic and can be difficult to id.																				
	Pahole-PteGlo- 01: Monitor/control PteGlo at site south of state snail jail quarterly. Area was treated with Oust, a preemergent herbicide. Pick and remove from field any potentially mature fruit.																				
	Pahole-TecCap- 01: Monitor/control TecCap at East rim fence site every 6 months. Treat all roots with Garlon; majority of plants finding now appear to be resprouts from previous handpulling control efforts.																				
	Pahole-TriSem- 01: Survey outside of drawn ICA, off fence, on Pahole side; determine if any outliers present and if ICA shape needs to be updated. GPS.																				
	Pahole-TriSem- 01: Monitor/control TriSem along East Rim fenceline quarterly. Pick and remove from field any potentially viable fruit.																				
	Pahole-ZinZer- 01: Monitor/control ZinZer in gulch 5 annually. Treat rhizomes with Escort.																				
Pahole-01: Switchbacks/Schnut reintro	Control weeds around DelSub/CyaSup reintro zone every 6 months. Target understory weeds, gradual canopy weed control.																				
	Control weeds across CenAgr, SchObo reintro zone every 6 months. Target understory, gradual canopy weed control.																				

Action Type	Actions	MIP Year 7 Oct 2010- Sept2011				MIP Year 8 Oct 2011- Sept2012				MIP Year 9 Oct 2012- Sept2013				MIP Year 10 Oct 2013- Sept2014				MIP Year 11 Oct 2014- Sept2015			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	Control weedy grasses across WCA every 6 months/year, as needed. Exercise care when spraying around rare taxa.																				
	Control weeds across SchNut switchbacks reintro zone every 6 months. Target understory, gradual canopy weed control.																				
	Spray grasses along Kahanahaiki/Pahole fenceline quarterly, or as needed.																				
	Control weeds across WCA annually. Focus around native forest patches. Target understory, SchTer, MonHib, gradual canopy control. Do not kill large GreRob; part of NARS trial.																				
	Control weeds around CenAgr reintro every 6 months/year. Target understory and gradual control of canopy weeds.																				
Pahole-02: Cenagragr PAH-A	Control weeds around SchObo, CyaGri reintro zone every 6 months. Target understory weeds and gradual control of canopy weeds to prevent major light changes.																				
	Control weeds around native forest patches, across WCA, annually. Target MonHib, select understory weeds and gradual removal of canopy weeds. Do not kill large GreRob; part of NARS trial.																				
	Spray grasses along Kahanahaiki/Pahole fenceline quarterly, or as needed.																				
	Control weedy grasses across WCA every 6 months/year, as needed. Target MelMin, PasCon, OplHir.																				
	Control weeds around CenAgr and nice forest patches every 6 months. Target MonHib, understory and gradual control of canopy weeds (PsiCat). Do not kill large GreRob; part of NARS trial.																				

Action Type	Actions	MIP Year 7 Oct 2010- Sept2011				MIP Year 8 Oct 2011- Sept2012				MIP Year 9 Oct 2012- Sept2013				MIP Year 10 Oct 2013- Sept2014				MIP Year 11 Oct 2014- Sept2015			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Pahole-03: Cenagragr PAH-B	Control weedy grasses across MU every 6 months/as needed. Target MelMin. Exercise care when working around CenAgr.																				
Pahole-04: Gulch 3 Cyasup reintro/ ChaHer	Control weeds around CyaSup reintro every 6 months. Target understory and gradual canopy weed control (prevent major light change). Understory very weedy; selectively work around CyaSup plants controlling understory to help seedling germination.																				
	Control weeds around ChaHer reintro every 6 months. Target understory and gradual canopy weed control (prevent major light change).																				
	Control weeds around native forest patches and wild ChaHer every 6 months. Target canopy and select understory weeds including <i>Ageratina spp.</i> , <i>Rubus rosifolius</i> , <i>Christella spp.</i> , etc. Target MonHib wherever found in gulch 3. GPS and flag locations of mature MonHib plants. Track number/reproductive status of MonHib trea																				
Pahole-05: Gulch 4	Control MonHib wherever found in gulch 4. GPS and flag locations of mature plants. Track number/reproductive status of plants treated.																				
Pahole-06: East Pahole rim Schnut/Cyalon	Control weeds across WCA once every 1-2 years. Focus around native forest patches and CyaLon. Exercise extreme care when working around CyaLon, rare taxa; sensitive habitat. Pair with rare plant collection trips. Target understory and gradual canopy removal.																				
Pahole-08: Gulch 5	Control weeds across Schkaa/Cyagri reintro zone every 6 months. Target understory weeds, especially weedy ferns. Conduct minimal canopy weeding to prevent light regime changes.																				

Action Type	Actions	MIP Year 7 Oct 2010- Sept2011				MIP Year 8 Oct 2011- Sept2012				MIP Year 9 Oct 2012- Sept2013				MIP Year 10 Oct 2013- Sept2014				MIP Year 11 Oct 2014- Sept2015			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Pahole-09: Cenagragr outplanting site	Control understory and canopy weeds around CenAgr reintro every 6 months.																				
Pahole-10: Pahole Trail Spraying	Control understory and canopy weeds around CenAgr, SchNut, and SchObo reintro every 6 months.																				
Pahole-11: Pahole Fenceline	Spray grasses along Kahanahaiki/Pahole fenceline every 6 months, or as needed.																				
	Clear and Maintain fence. Remove downed trees,spray grass, treat thick understory, as needed. Target all MonHib seen along frence at one time a year.																				
Pahole-12: Main Gulch	Sweep gulch at least once a year, focusing on significant weeds, particularly MonHib, TooCil, TriSem.																				
Pahole-13: Back of Gulch 2	Control weeds around ChaHer every 6 months. Target understory and gradual canopy weed control (prevent major light change). Always target MonHib, TooCil, and TriSem in Pahole.																				
	Sweep gulch at least once a year, focusing on significant weeds, particularly MonHib, TooCil, TriSem.																				
Pahole No MU-01: Pahole Road	Control grass/herbaceous weeds along the Pahole road, from Peacock Flats gate to the Ranch gate quarterly/as needed. Use the power sprayer, weedwack. Alternate this action between teams. Goal: maintain road, public safety, reduce weed spread.																				
Pahole No MU-02: Nike site	Control weeds aound Nike site facility as needed. Focus on LZ, around greenhouse, and anywhere else needed. Coordinate with Horticultural Staff.																				

Action Type	Actions	MIP Year 7 Oct 2010- Sept2011				MIP Year 8 Oct 2011- Sept2012				MIP Year 9 Oct 2012- Sept2013				MIP Year 10 Oct 2013- Sept2014				MIP Year 11 Oct 2014- Sept2015			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Pahole No MU-03: Cenagragr Reintro Outsides Fence	Control weeds around SchObo and CenAgr reintros every 6 months/year. Targe understory weeds and limited canopy weed control																				
Pahole No Mu-04: Fig Gulch	Control target weed species, particularly MonHib, TooCil, and TriSem. Sweep area at least once per year.																				
Ungulate Control	Assist State with elimination of any pig ingress into the fence																				
	Maintain fence integrity																				
	Scoping out portion of fence that needs skirting																				
	Survey areas for ungulate sign.																				
Rodent Control	Establish and maintain small scale bait station grid around <i>C. superba</i> subsp. <i>superba</i> during the fruiting season																				
	Maintain bait stations and rat traps at the Pahole snail enclosure																				
	Monitor rare plants and tree snails for predation by rodents																				
	Implement localized rodent control if determined to be necessary for the protection of rare plants																				
Slug Control	Annual census monitoring of <i>C. superba</i> seedling recruitment following fruiting events (as this species is vulnerable to slug predation).																				
	Annual census monitoring of slug densities during wet season.																				
Predatory Snail Control	Determine if any <i>E. rosea</i> or <i>O. alliarus</i> snails are present at the <i>A. mustelina</i> snail enclosure and remove																				
	Maintain physical barriers (exclosures) to protect <i>A. mustelina</i> from predatory snails																				
Ant Control	Conduct surveys for ants annually																				
	Implement control if deemed necessary																				