

# **Ecosystem Restoration Management Plan**

**MIP Year 15-19, Oct. 2018 – Sept. 2023**

## **MU: Pahole**

### **Overall MIP Management Goals:**

- Form a stable, native-dominated matrix of plant communities which support stable populations of IP taxa.
- Control ungulate, weed, predatory snail, rodent, and slug threats in the next five years to allow for stabilization of IP taxa. Implement all control methods by 2023.

### **Background Information**

Location: Northern Waianae Mountains

Land Owner: State of Hawaii (State)

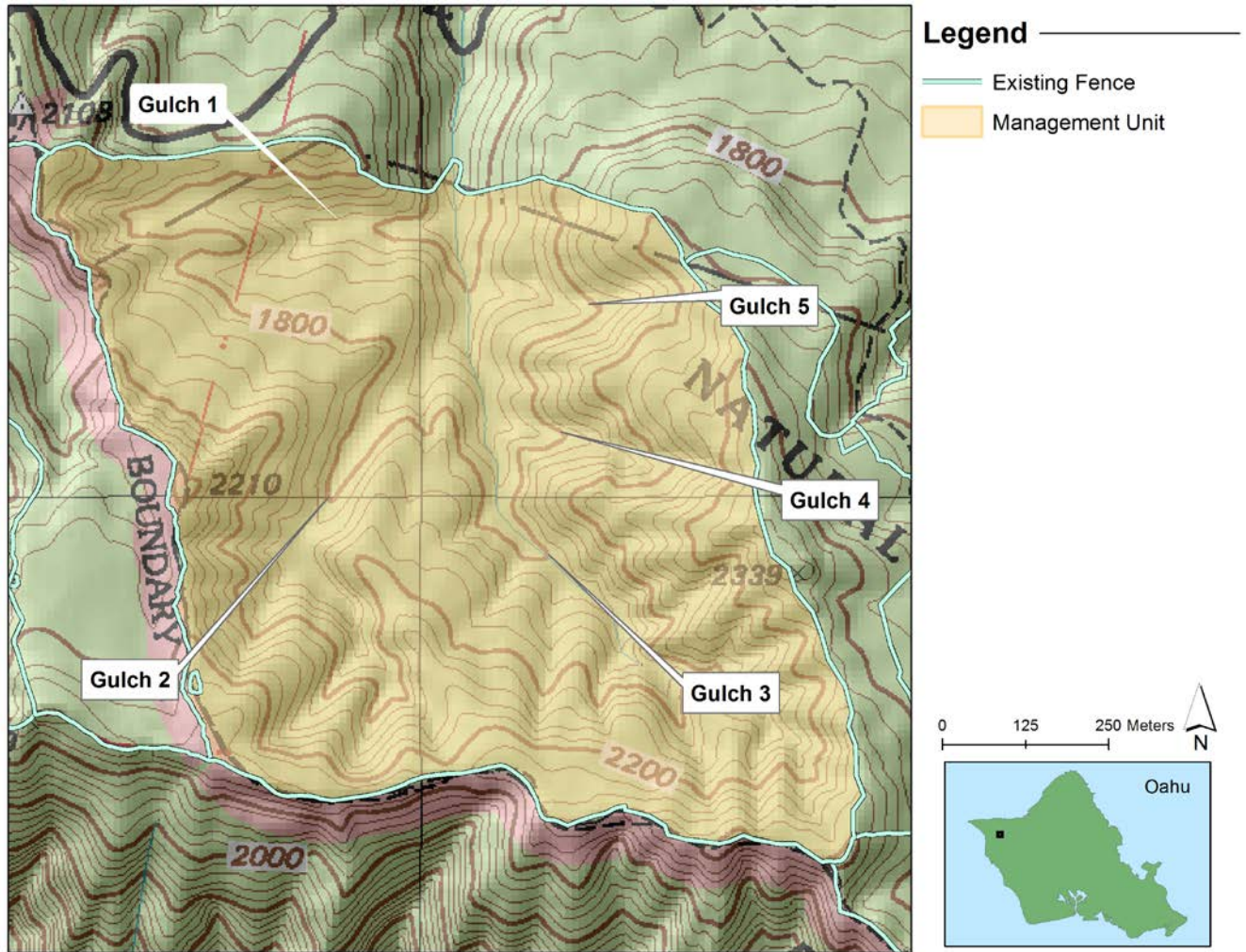
Land Managers: State of Hawaii: Natural Area Reserves System (NARS), Army Natural Resource Program - Oahu (OANRP)

Acreage: 215 acres

Elevation Range: 1,500-2,400 ft.

Description: Pahole MU is the most western of three main gulches located in the Pahole Natural Area Reserve (NAR). Going from west to east within the NAR, the major gulch systems include Pahole, Kapuna and Keawapilau. Kahanahaiki MU borders the west and Makua Military Reservation borders the south of Pahole MU. The Pahole MU itself is 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 gulches 4 and 5 end 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 MU can be accessed two ways: through the gulch via Mokuleia Forest Reserve Access Road (a.k.a. Pahole Rd. or from the ridge via the Kahanahaiki overlook trail.

**Map of Pahole showing gulch system**



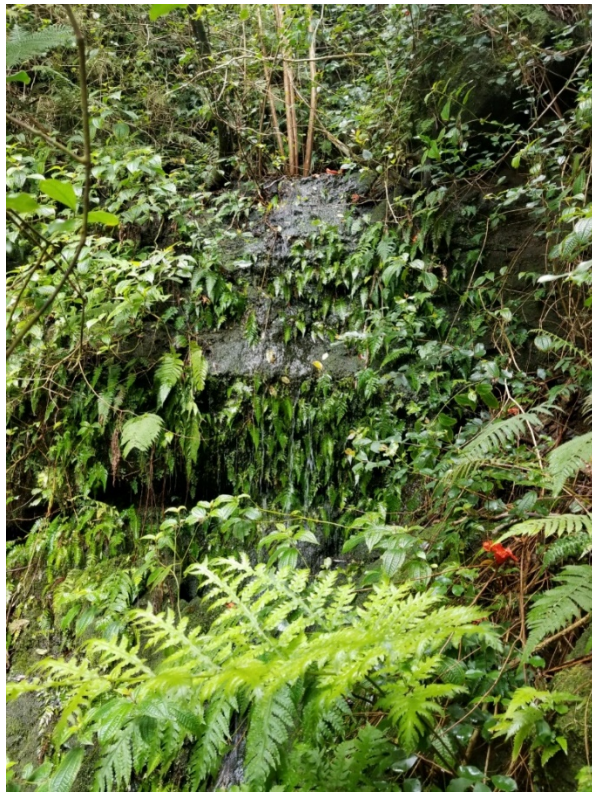
**Native Vegetation Types**

Wai'anae Vegetation Types		
Mesic mixed forest	Mesic ridge/crest	<u>Canopy includes:</u> 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>Bohea elatior</i> , and <i>Santalum freycinetianum</i> var. <i>freycinetianum</i> . <u>Understory includes:</u> <i>Microlepidia strigosa</i> , <i>Sphenomeris chinensis</i> , <i>Alyxia stellata</i> , and <i>Coprosma</i> spp.
	Mesic slope	<u>Canopy includes:</u> <i>Diospyros sandwichensis</i> , <i>Sapindus oahuensis</i> , <i>Nestigis sandwichensis</i> , <i>Planchonella sandwichensis</i> , <i>Antidesma platyphylum</i> , and <i>Pisonia</i> spp. <u>Understory includes:</u> <i>A. stellata</i> , <i>Psydrax odorata</i> , and <i>Bidens</i> spp.
	Mesic gulch	<u>Canopy includes:</u> <i>Pisonia</i> spp., <i>Charpentiera tomentosa</i> , <i>Psychotria</i> spp, and <i>D. hillebrandii</i> <u>Understory includes:</u> <i>Diplazium sandwichensis</i> , <i>Microlepidia strigosa</i> and <i>Tectaria gaudichaudii</i> , <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.		

### Terrain and Vegetation Types at Pahole



Pahole gulch from Kahanahaiki/Pahole trail crossover (Looking south).



Mesic gulch



## MIP/OIP Rare Resources at Pahole

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 West Makaleha	MFS	Wild*
Plant	<i>Cenchrus agrimonioides</i> var. <i>agrimonioides</i>	PAH-A†,B,C,D†,E,F†,T	Kahanahaiki and Pahole	MFS	Both
Plant	<i>Cyanea grimesiana</i> subsp. <i>obatae</i>	PAH-A*,B,C†,D†	Pahole to West Makaleha	MFS	Both
Plant	<i>Cyanea longiflora</i>	PAH-A,B,C*,G,H,I,J†	Pahole	MFS	Both
Plant	<i>Cyanea superba</i> subsp. <i>superba</i>	PAH-A,B	Pahole to Kapuna	MFS	Reintroduction, Wild*
Plant	<i>Cyrtandra dentata</i>	PAH-A,B,C,D,E,F,G	Pahole to Kapuna to West Makaleha	MFS	Wild
Plant	<i>Delissea waianaensis</i>	PAH-B,C,E, F**	Kahanahaiki to Keawapilau	MFS	Both
Plant	<i>Euphorbia herbstii</i>	PAH-E*,F,G,H*,I*,R†, S†	Kapuna to Pahole	MFS	Both
Plant	<i>Flueggea neowawraea</i>	PAH-A*,C,D	Kahanahaiki to Kapuna	MFS	Both
Plant	<i>Kadua degeneri</i> subsp. <i>degeneri</i>	PAH-A,B	Kahanahaiki to Pahole	MFS	Wild
Plant	<i>Nototrichium humile</i>	PAH-A*	Pahole	GSC	Wild
Plant	<i>Phyllostegia kaalaensis</i>	PAH-A*,B*	Pahole	MFS	Reintroduction* Wild*
Plant	<i>Plantago princeps</i> var. <i>princeps</i>	PAH-A	Pahole	GSC	Wild
Plant	<i>Schiedea kaalae</i>	PAH-A*,B*,C†,D*,E*	Pahole	MFS	Reintroduction Wild*
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  
GSC= Genetic Storage Collection

\*= Extirpated  
†=Reintroduction not yet done

\*\*= Seed Sow

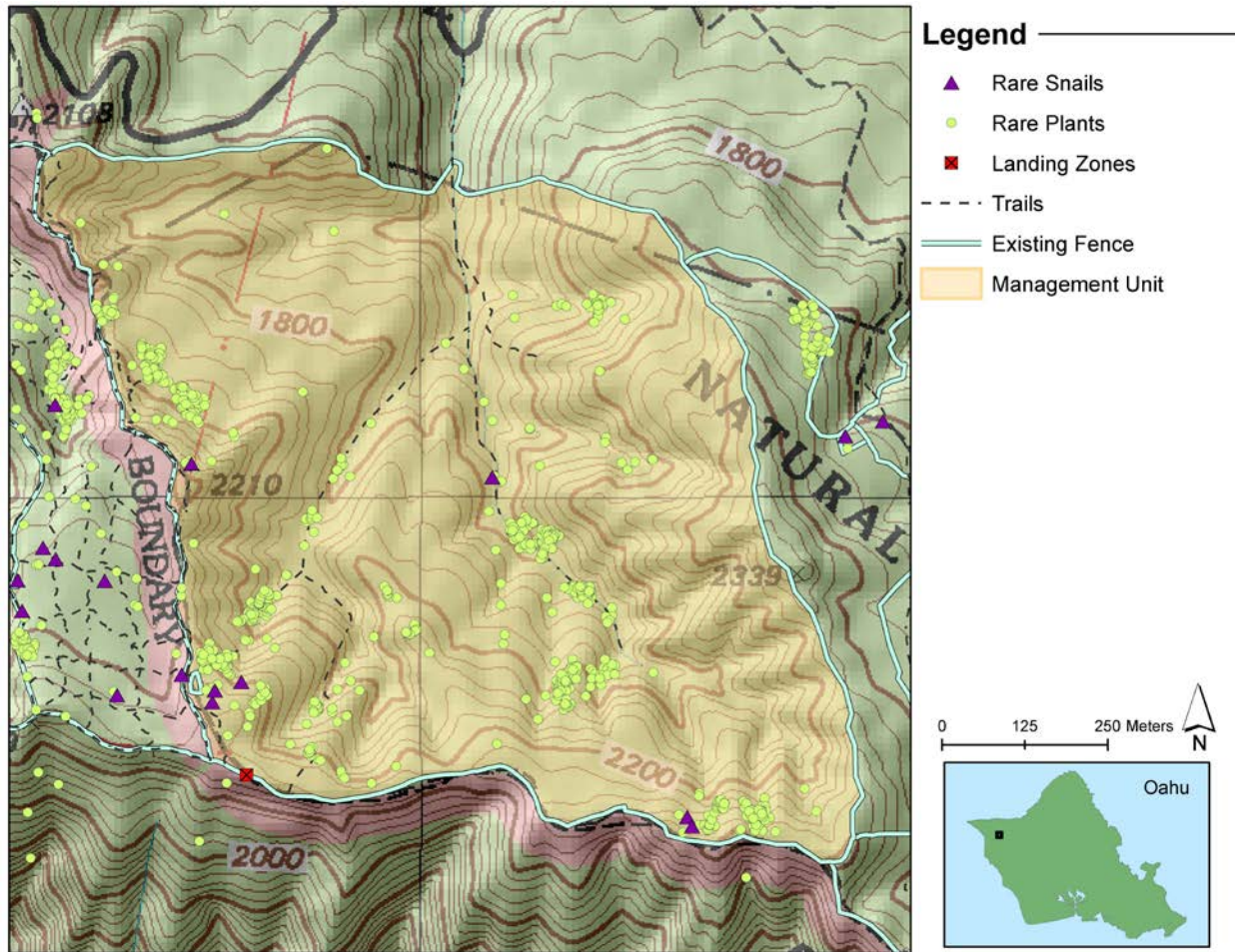
## Other Rare Taxa at Pahole

Organism Type	Species	Status
Plant	<i>Asplenium dielfalcatum</i>	Endangered
Plant	<i>Bonamia menziesii</i>	Endangered
Plant	<i>Dissochondrus biflorus</i>	At Risk
Plant	<i>Exocarpos gaudichaudii</i>	At Risk
Plant	<i>Labordia kaalae</i>	At Risk
Plant	<i>Lobelia yuccoides</i>	At Risk
Plant	<i>Neraudia melastomifolia</i>	At Risk
Plant	<i>Nothoestrum longifolium</i>	Endangered
Plant	<i>Pteralyxia macrocarpa</i>	Endangered
Plant	<i>Polyscias kawaiensis</i>	At Risk
Plant	<i>Urera glabra</i>	Vulnerable

## Rare Resources at Pahole

*Euphorbia herbstii**Kadua degeneri* subsp. *degeneri**Cyanea longiflora**Schiedea obovata*

**Locations of Rare Resources at Pahole**



**Threats to MIP/OIP MFS Taxa**

Threat	Rare Taxa Affected	Management Strategy	Current Status, 2018
Pigs	All	Fence	No animals within fence.
Weeds	All	Focus on rare taxa sites primarily, across MU secondarily	Regular maintenance required several times per year. Weeds are both an understory and canopy threat across whole MU.
Black Rat	<i>Achatinella mustelina</i> , <i>Cyanea grimesiana</i> subsp. <i>obatae</i> , <i>Euphorbia herbstii</i> , <i>Cyanea longiflora</i> , <i>Cyanea superba</i> subsp. <i>superba</i> , <i>Delissea waianaensis</i>	Localized grids near select resources	Trap grids maintained by Native Ecosystems Protection and Management (NEPM).
Black twig borer (BTB) <i>Xylosandrus compactus</i>	<i>F. neowawraea</i> , <i>A. macrococcus</i> var. <i>macrococcus</i>	Monitor. Research new control methods.	Effective methods for control not available at this time.
Jackson's Chameleon	<i>Achatinella mustelina</i> , <i>Drosophila montgomeryi</i>	Predator-proof snail enclosure	No viable tools to control outside snail enclosure.

### Threats to MIP/OIP MFS Taxa (Continued)

Threat	Rare Taxa Affected	Management Strategy	Current Status, 2018
Slugs	<i>Cyanea grimesiana</i> subsp. <i>obatae</i> , <i>Euphorbia herbstii</i> , <i>Cyanea longiflora</i> , <i>Delissea waianaensis</i> , <i>Schiedea nuttallii</i> , <i>Schiedea obovata</i>	Molluscicide treatment at chosen rare taxa sites.	FerroxxAQ, a molluscicide is applied every 6 weeks to control slugs.
Rosy Wolf Snail	<i>Achatinella mustelina</i>	Predator-proof snail enclosure	No viable tools to control outside snail enclosure.
Ant	Possible threat to all rare plant taxa. Ants known to farm Hemipterian pests	Survey rare taxa sites, and human entry point. Areas that have high risk of accidental ant introduction	Annual surveys conducted.

### Management History

- 1981: Established as a NAR by the Governor's Executive Order 3098.
- 1989: First weeding begins by the State of Hawaii Division of Forestry and Wildlife (DOFAW).
- 1996: First recorded rare plant monitoring by OANRP.
- 1998: Pahole MU fence completed.
- 1998: Snail enclosure built.
- 1999: All pigs were removed by NARS staff.
- 2000: First outplanting in Pahole.
- 2003: Fire started in Makua reaches 150 m from the western portion of the MU.
- 2002: OANRP begins extensive weed control in addition to previous small scale efforts.
- 2006: Several small pigs breach the fence and were able to breed before detection.
- 2007-2008: OANRP partners with NARS to conduct herbicide trials on silky oak (*Grevillea robusta*).
- 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.
- 2012: Fence supplemented with skirting and Fickle Hill Deer Fence to prevent smaller piglets from breaching.
- 2013: DOFAW begins distribution of strawberry guava biocontrol agent, *Tectococcus ovatus*, a scale insect.
- 2014: OANRP conducts *D. waianaensis* seed sow trial.
- 2017: Mokuleia fire burns within 1500 m north of MU.
- 2018: First *C. longiflora* outplanting in Pahole.
- 2018 WCAs redrawn to include all of MU, and allow easier tracking of incidental weed control.



## **Ungulate Control**

Species: *Sus scrofa* (pigs)

Threat Level: High

Management Objectives:

- Maintain MU as ungulate free.
- Prevent ungulate ingress into enclosure.

Strategy and Control Methods:

- Exclusion of all ungulates from MU via large-scale fencing. The PAH-A fence was completed in 1998.
- Supplemented with skirting and Fickle Hill Deer Fence to prevent smaller piglets from breaching fence in 2012.
- Conduct quarterly fence checks.
- Note any pig sign while conducting day to day actions within fenced MU.
- If any pig activity is detected, work with the Ungulate Manger to implement hunting or snaring.

Discussion: There is a perimeter fence around this 215 acre MU with one major gulch crossing. The major threats to the perimeter fence include fallen trees and vandalism. There have been relatively few incidences of vandalism in the past; most of the fence damage is caused by fallen trees. At the gulch crossing there is a breakaway which is constructed in such a way to allow water to pass under without opening access to pigs. It also makes repairs to the stream section of the fence convenient if there is an extreme flash flooding event. Three sides of Pahole is protected by a shared fence from other MUs, Kahanahaiki, Kapuna, and Makua. Makua to the west, and to the south Kapuna are not ungulate free, control is ongoing at these sites. Kahanahaiki to the west of the MU has been ungulate free for many years. These fences adds extra protection to the Pahole MU; only leaving the north and east sides directly exposed to ungulate pressure.

Quarterly checks (including maintenance) of the fence's integrity will be conducted, as well as monitoring for ungulate sign during the course of other field activities. Fences are also checked after extreme weather events. Special emphasis will be placed on monitoring the breakaway anytime there is an extreme amount of rainfall in the area. Given the moderate size of the fence, it is especially important to maintain unit as ungulate free. As with any large MU, it would take a great effort to remove ungulates once inside the unit.



## 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

Vegetation monitoring across Pahole was first completed by Patricia Welton, a University of Hawaii Graduate student. The State's Pahole NAR Management Plan (2016) summarizes this study, stating:

- Native Vegetation - Native plants are dominant and there is 60% or more of native tree canopy cover
- Mixed Native/Non-Native - Native and nonnative species are co-dominant
- Nonnative – Mixed native/nonnative associations as well as forests dominated by nonnative species.

Non-native species dominant in these areas include the following:

- Java Plum Forest
- Christmas Berry Forest
- Eucalyptus Forest
- Silk Oak Forest
- Koa Haole Thicket
- Guava – Strawberry Guava Forest
- Kukui Forest

In 2018, a student from the University of Hawaii began locating and monitoring the thirty year old plots to compare vegetation changes since the last reading. However, only a subset of plots within Pahole MU were located, and analyses of vegetation change within the MU using such a small sample size are dubious.

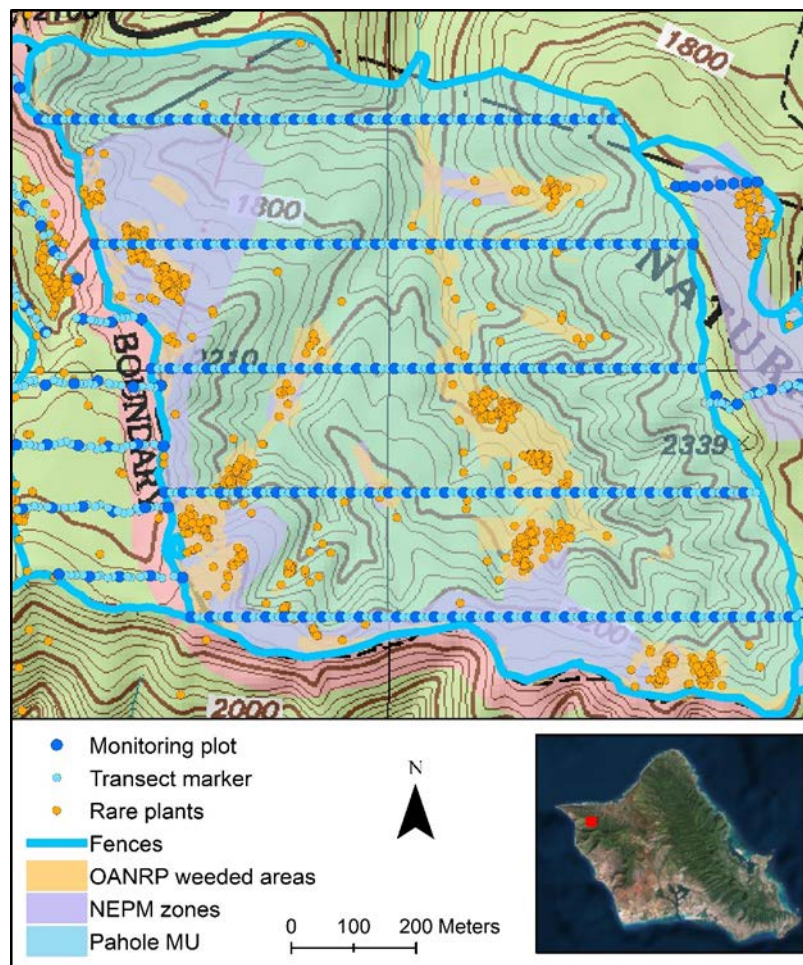
In 2018, the State approved OANRP plans to implement large scale MU-based vegetation monitoring. Belt-plot monitoring is slated to start in 2021 with follow-up readings every five years. With this method, permanent plots measuring 5 x 10 m are generally located at regular intervals along transects that are marked with flagging tape and metal tags every 10 m. Transects are placed at regular intervals. Areas too steep to monitor along transects are either diverted around or skipped. Transects would randomly traverse Native Ecosystems Protection and Management (NEPM) zones, OANRP managed areas, and areas that do not receive direct management (see map below).

Given the large size and diversity at Pahole MU, approximately 150 plots would be necessary to detect change with reasonable statistical power. Within plots, understory (0 – 2 m above ground level (AGL), including low branches from canopy species) and canopy (> 2 m AGL, including epiphytes) vegetation are recorded by percent cover for all species present. Percent cover categories are recorded in 10% intervals between 10 and 100%, and on finer intervals (0-1%, 1-5%, and 5-10%) between 0 and 10% cover. Understory recruitment (defined as seedlings or saplings < 2 m AGL) data for tree species may also be recorded. Only absolute cover changes  $\geq 10\%$  are recognized, with  $\alpha = 0.05$ . Analyses include either Wilcoxon's signed-rank test or Friedman's tests with Bonferroni adjusted post-hoc pairwise comparisons for cover and richness data, McNemar's tests for frequency data, and generalized linear modeling for the influence of weed control efforts (using shapefiles of areas weeded and restoration areas) on cover change as well as the influence of non-native cover change on changes in native cover, etc.

Belt-plot monitoring was chosen for Pahole because it would document vegetation percent cover, frequency, and species richness. It also allows for data comparison across multiple MUs, as this same method is used in other MUs.

The State has also inquired about doing small-scale vegetation monitoring to track changes in vegetation cover within Pahole NEPM zones. OANRP has offered to assist in demonstrating the point intercept method for NEPM staff. When small-scale vegetation monitoring of NEPM zones will begin has not been determined.

### Proposed transect and plot lines for belt-plot monitoring\*



\*Map does not represent final locations of transects or plots, which will be determined at a later time.

## Surveys

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

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.
- Drive Mokuleia Access Trail (Pahole Road), from the bottom gate to the Nike site annually. GPS roads driven to document extent of survey in a given year. The OANRP Blue Team is responsible for this action, although use of the road is shared by many within and outside of the program.
- Survey one weed transects annually. This includes the access trail from the parking area to the Gulch 2/3 split.
- Quarterly surveys of the Nike site and Kahanahaiki overlook LZs (if used).
- Any significant alien taxa found will be researched and evaluated for distribution and life history. If found to pose a major threat, control will begin and tracked via ICAs.

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.

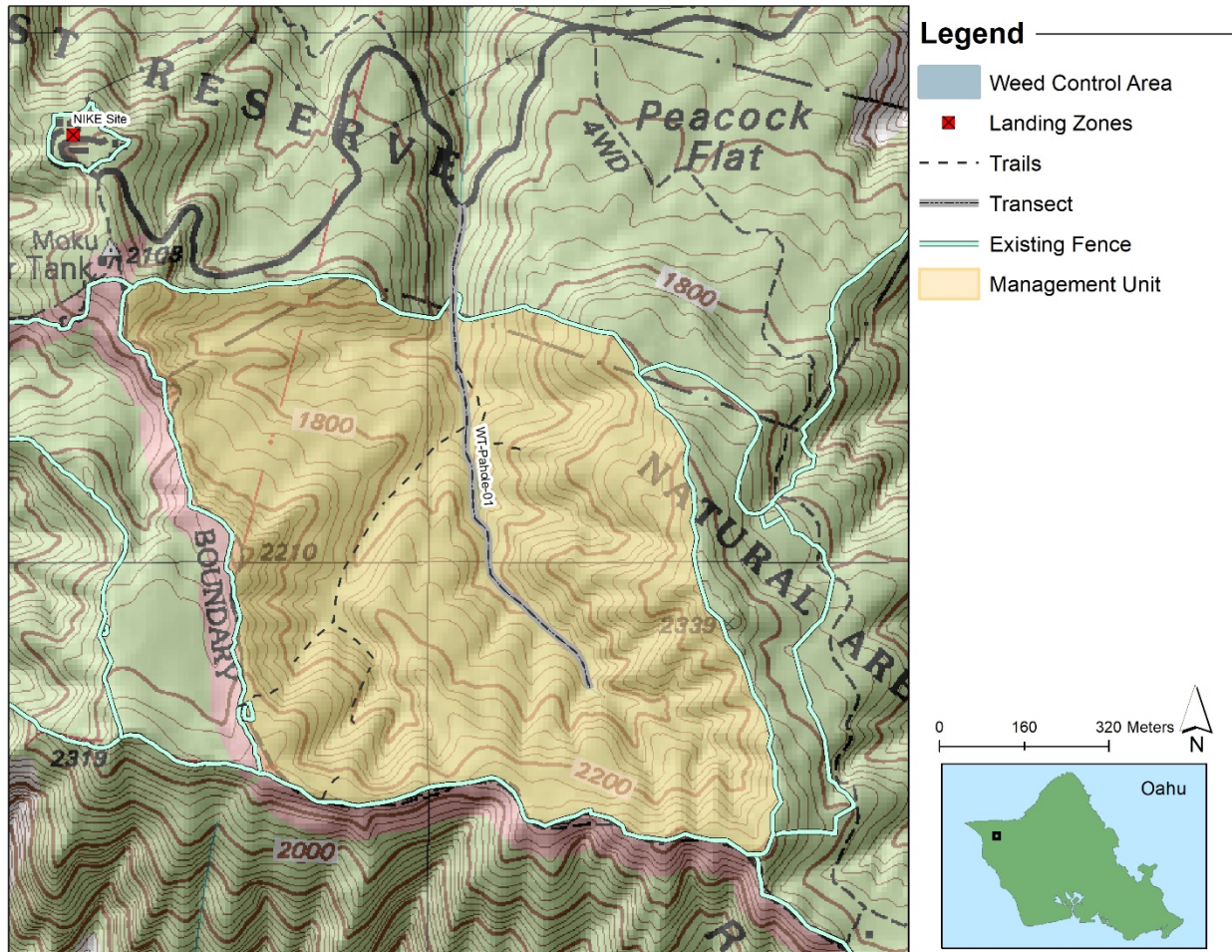
In Pahole, one road survey is conducted on the paved section of the Mokuleia Access Trail (Pahole Road). Although the OANRP Blue Team is responsible for conducting this survey, many use this road as a thoroughfare or for recreational activities (hiking, biking, exercising, etc.). For this reason, the possibility of spreading unwanted weeds near and/or into the unit is high. In addition to road surveys, the road is sprayed with herbicide as needed to maintain visibility around tight corners as well as keep unwanted weeds off the road to prevent them from spreading.

One weed transect survey is done annually, which covers the gulch bottom on the main access trail. Part of the survey starts outside the management unit and continues into the unit, which could help as a comparison as to what can be found inside versus outside the fence.

The Nike site is used on occasion as an LZ to access Ohikilolo, Makua, and other nearby LZs. The LZ will be surveyed once a quarter, if used. There are no camp sites in Pahole.



### Survey Locations Map



### 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, location, 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, and frequent visits.

**Incipient Weed Photos***Tecoma capensis**Elephantopus mollis**Pterolepis glomerata***Summary of ICAs**

<b>Taxon</b>	<b>ICA Code</b>	<b>Control Discussion</b>
<i>Albizia chinensis</i>	PaholeNoMU-AlbChi-01	Commonly known as Chinese Albizia. Two trees first observed at this site near Peacock Flats gate on the mauka side of the road in July of 2009 and were controlled. No plants have been observed since. Control technique: Clip and drip with 20% triclopyr and surfactant. Has not been seen since 2010.
<i>Angiopteris evecta</i>	Pahole-AngEve-01	Commonly known as the giant fern/mules foot fern. <i>A. evecta</i> dominates wet gulches. Widespread outside MU, and only a few spots known in MU. Found growing near wet waterfalls and gulch bottoms in Gulches 5, 4, 3, and 2. Stipules from the frond bases can form new plants; caution should be taken to avoid controlling the plant in any way that encourages vegetative reproduction. Plants under the height of 10 cm are difficult to identify, but are of less concern given they take at least two years before becoming reproductive, and can be treated on subsequent visits when larger and more identifiable. Literature suggests that it takes many years for <i>A. evecta</i> to become mature. Visiting these ICA's once a year allows several chances to detect plants before they become mature and is acceptable to achieve eradication. Control technique: foliar with 10% triclopyr and water for small individuals, cut-stump with 20% triclopyr and surfactant for larger individuals. Application of 10-15 ml imazapyr to the top of brain and/or new crozier is also effective.
	Pahole-AngEve-02	
	Pahole-AngEve-03	
	Pahole-AngEve-04	
	Pahole-AngEve-05	
	Pahole-AngEve-06	

## Summary of ICAs (Continued)

Taxon	ICA Code	Control Discussion
<i>Axonopus compressus</i>	Pahole-AxoCom-01	Commonly known as carpet grass and is used for turf and pasture lands. Unusual to see in the forest setting, might have been an intentional planting. Medium size population located at the top of the Switchbacks near the water catchment and has recently been found in new areas along the trail. The population is recorded under the Kahanahaiki MU as an ICA. Recent control using a 2% concentration has shown little results. In the upcoming years we will be implementing new methods of control. New Control technique: Hand digging out, foliar spray with 0.58% Fusliade with added surfactant, if these techniques show little results a 1% foliar spray of Polaris will be used.
<i>Cryptostegia madagascariensis</i>	PaholeNoMU-CryMad-01	Commonly known as rubber vine. A patch of 6 matures and 1 immature first found at this site along the Pahole Road, down in pasture lands below ranch gate on 7-16-09. More plants may be present on pasture land, but since they are far from the MU and access to private land may be difficult, control will be focused only along the road. Control technique: Clip and drip with 20% triclopyr and surfactant as needed to keep <i>C. madagascariensis</i> off of the road.
<i>Dicliptera chinensis</i>	Pahole-DicChi-01	Three immature plants first found at this site in June of 2011 in Gulch 3 between the lower and middle populations of <i>Cyanea superba</i> subsp. <i>superba</i> . <i>D. chinensis</i> grows vegetatively, and does not spread easily. Plants have not been seen since 3-11-13, where a small 8x5 foot patch was controlled. Control technique: hand pull or foliar spray with 2%-5% glyphosate and water.
<i>Ehrharta stipoides</i>	Pahole-EhrSti-02	Commonly known as weeping rice grass. Identification of this shade-loving grass can be difficult while the plant is immature. Ehrsti can also be easily mistaken for <i>Festuca bromoides</i> . Species present both in and outside of MU. Control needed to prevent greater spread of this species. Five ICAs have been successfully eradicated, in and outside of the MU. However, one ICA still remains inside the Pahole Snail Enclosure. Control technique: standard glyphosate foliar spray.
<i>Elephantopus mollis</i>	Pahole-EleMol-01	Commonly known as soft elephant's foot. Aster from South America. Widespread in the Koolau mountain range, with very few locations in the Waianae range. 1 immature plant was found in the middle of the Kahanahaiki/Pahole ridge fence trail in August of 2016. Another individual was found on Maile flats near the chipper site around the same time. None have been found along the ridge trail since the original sighting. However, sightings of <i>E. mollis</i> at both locations within the same time frame could suggest future incursion. Staff must be vigilant to prevent spread in the MU. High priority to control to prevent further spread of this species throughout the Waianae range. Control technique: hand pull, or clip and drip with 20% triclopyr and surfactant.
<i>Pterolepis glomerata</i>	Pahole-PteGlo-01	Commonly known as false meadowbeauty. Really aggressive weed that needs intense management and monitoring to eradicate. Widespread in the Koolau mountain range. Relatively few locations in the Waianae range. First found at this site along the Makua lookout trail. High priority to control to prevent further spread of this species throughout the Waianae range. As Pteglo is in the family Melastomataceae, the taxon does have a very persistent seed bank, so use of pre-emergent is necessary. Control technique: hand pull, or foliar application with 2% glyphosate and water. Sulfomet (pre-emergent) should also be applied to the site at a minimum of twice



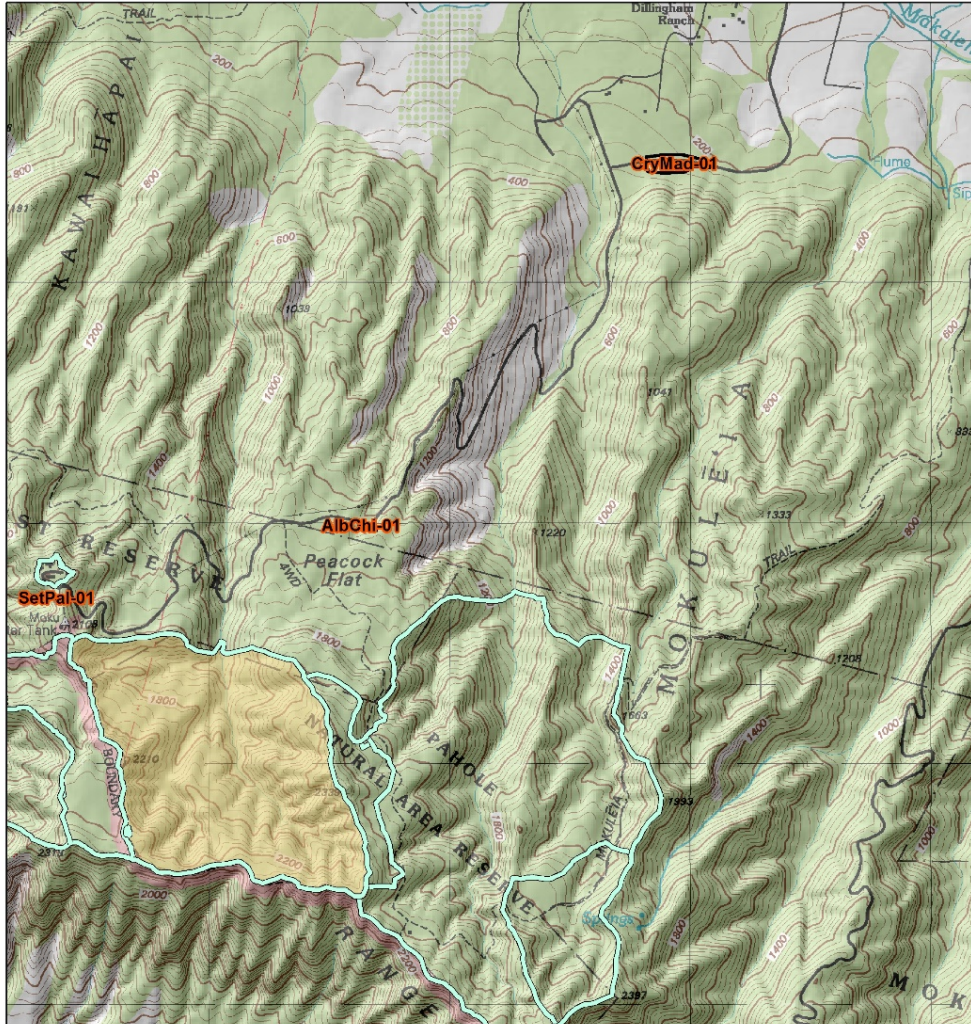
**Summary of ICAs (Continued)**

<b>Taxon</b>	<b>ICA Code</b>	<b>Control Discussion</b>
		per year, which may involve spraying bare ground. Control of surrounding weeds is essential to clear the search area and aid in detection. Effectively delimiting population and regular updating population area (occasional searching outside of known population) is critical in making sure populations don't expand unnoticed.
<i>Rhodomyrtus tomentosa</i>	Pahole-RhoTom-01	Commonly known as downy rose myrtle. 1 mature plant was found along the rim on the Pahole fenceline in October of 2013 and has not been seen since. Taxa is widespread in the Kaneohe area, where it forms dense monocultures. Also highly invasive on Kauai. High priority to control to prevent further spread of this species throughout the Waianae range. Control technique: cut-stump with 20% triclopyr and surfactant.
<i>Setaria palmifolia</i>	Pahole-SetPal-01	Commonly known as palm grass. 1 small seedling was found along the trail near the fenceline above SchNut.PAH-D switchbacks population in August of 2016 and has not been seen since. Small patch was found outside fence, very close to trailhead in June of 2010 and has not been seen since. <i>S. palmifolia</i> is a shade tolerant grass and that can form dense patches with dense root masses that can form mats. Control technique: handpull and remove plant material, or spray with glyphosate.
	PaholeNoMU-SetPal-01	
<i>Tecoma capensis</i>	Pahole-TecCap-01	A prolifically growing vine, commonly known as Cape honeysuckle. <i>T. capensis</i> first found in February 2004 at this site along the south Kapuna/Pahole rim fenceline at the top of the ridge dividing gulch 2 and 3. <i>T. capensis</i> was last seen and controlled on 4-23-18. Potential for invasiveness has been observed elsewhere and is difficult to control. Staff suspect vegetative growth from roots left underground. Detection of small plants is also difficult in thick understory vegetation. Control technique: hand pull small individuals or clip and drip with 20% triclopyr and surfactant. Treat both ends if plant is stuck and growing up into a tree. A cocktail mixture of 1% aminopyralid, 2% triclopyr, and surfactant may also be used. Remove vegetative material from the field.




ICAs Eradicated at MU: *Ehrharta stipoides* (Pahole-EhrSti-01, Pahole-EhrSti-03, Pahole-EhrSti-04, Pahole-EhrSti-05; PaholeNoMU-EhrSti-01); *Rubus argutus* (MMR-RubArg-05)

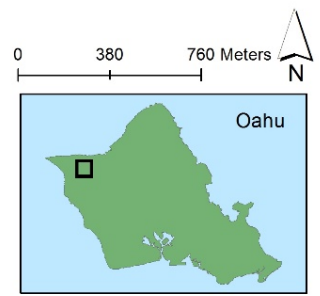
ICAs Discontinued at MU: *Triumfetta semitriloba* (Pahole-TriSem-01 and Pahole-TriSem-02)

### PaholeNoMU Incipient Control Areas Map

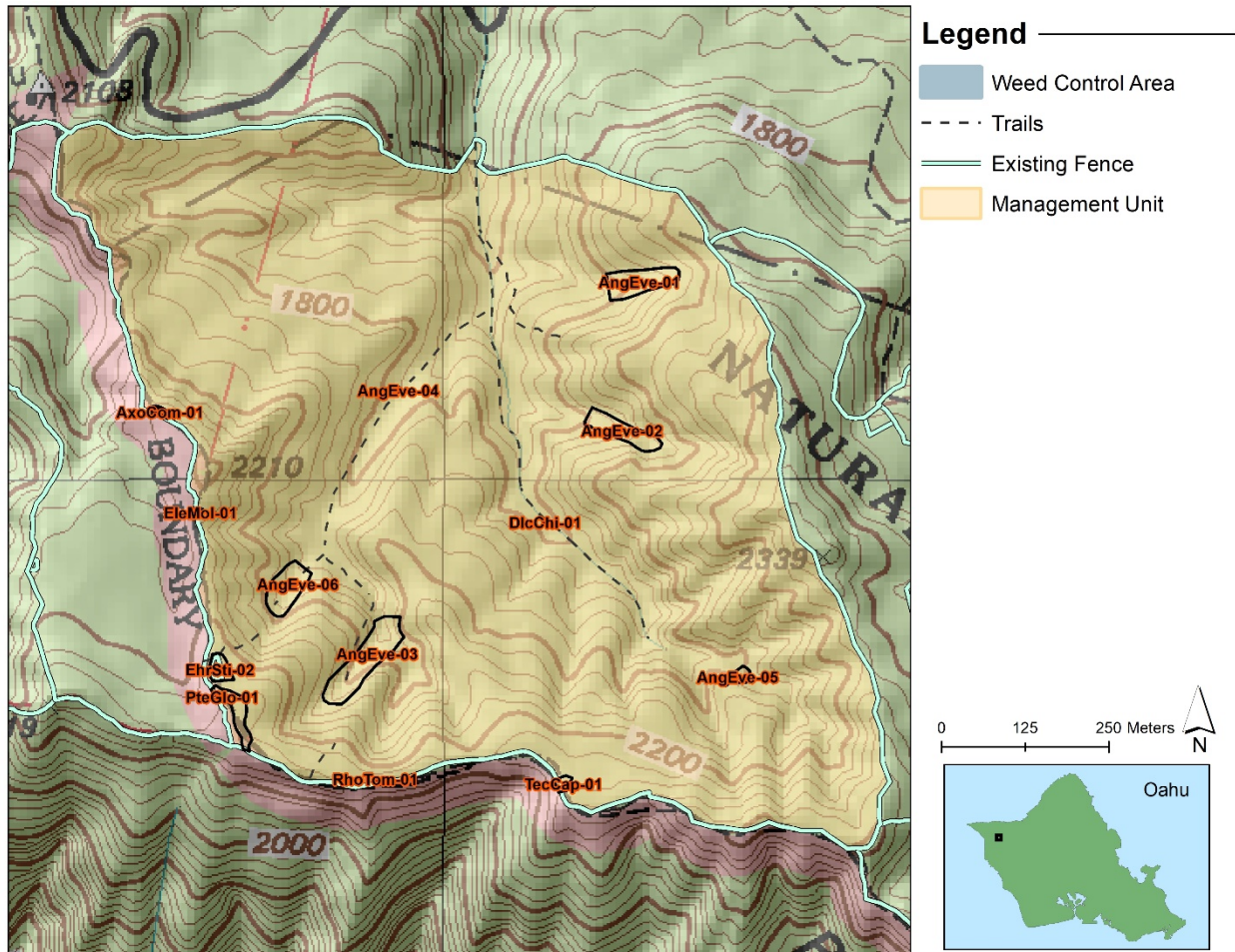


**Legend**

-  Incipient Control Area
-  Existing Fence
-  Management Unit



### Pahole Incipient Control Areas Map



### Ecosystem Management Weed Control

All weed control geared towards general habitat improvement is tracked in geographic units called Weed Control areas, or WCAs. The goals, strategies, and techniques used vary between WCAs, depending on terrain, quality of native habitat, and presence or absence of rare taxa.

#### MIP Goals:

- Within 2m of rare taxa: 0% alien vegetation cover except where 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:

- Work together with NEPM and NARS to define cohesive goals.
- Work towards making native canopy and understory dominant in rare plant areas, particularly reintroduction sites.
- Reduce grass cover in priority work areas.



- Reduce the frequency and cover of *S. campanulata* and *G. robusta*.

**Discussion:** During this revision of the ERMUP the WCAs were redrawn to cover the entire area of the MU. Previously the WCAs were divided into smaller sizes that just encompassed our rare taxa populations. There are three separate access points in Pahole, one is located at the Mokuleia Nike Missile Site, another is located at the bottom of the Pahole gulch on the Pahole road, and on occasion staff access the MU from the Kapuna trailhead. Three of the WCAs (mauka) are accessed from either the Nike Missile Site or the Kapuna trailhead. The rest are accessed from the Pahole road.

The vegetation in Pahole consists of weedy gulches (*P. cattleianum*, *C. hirta*, *R. rosifolius*, and non-native grasses) and intact native habitat on the ridges and North-facing mauka sections. Weed control in Pahole has mainly been around rare plant populations. Besides large scale *Toona ciliata* sweeps, and *G. robusta* trials by the State, as well as *Psidium cattleianum* removal by OANRP, there has been no major canopy management in Pahole, per NAR restrictions. However, in recent years staff have noticed large *Spathodea campanulata* in the gulches. If not controlled, rapid spreading and deep shading within the gulches can occur. *Spathodea campanulata* is also wind dispersed, which could lead to greater repercussions if mature seeding trees are left within the unit. Staff have also recognized large *G. robusta* on ridges where many rare plant populations exist.

Quantifying native/non-native species within Pahole has been difficult with no recent vegetation monitoring data. However, knowledge from staff on the ground has led management efforts where and when they are needed, mainly focusing around rare plant populations. Localized weed control will continue around rare plant populations until data from vegetation monitoring can be analyzed and management goals can be made. Vegetation monitoring is slated to start in 2021. NARS staff and volunteers have been working in small restoration areas within the management unit, mainly in Pahole-01. OANRP does not work in these restoration sites, however, habitat improvement efforts will help to work towards NARS management goals, as well as OANRP goals. There has been one restoration site along the Kahanahaiki/Pahole ridge trail near a *C. agrimonioides* var. *agrimonioides* outplanting site. A total of 20 plants (*A. koa*, *K. affinis* and *M. lessertiana*) were planted in a small area (366 m<sup>2</sup>) in December 2017 and area currently doing well. There are no plans for other restoration work in Pahole, but OANRP is open to future restoration efforts.

The table below summarizes invasive weeds found at Pahole, 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:

Taxa	Distribution	Notes
<i>Acacia mearnsii</i>	Restricted	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.
<i>Achyranthes aspera</i>	Localized	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.
<i>Blechnum appendiculatum</i>	Widespread	Groundcover found in wet areas and near rare plant populations. Spreading is vegetative, but can inhibit recruitment with thick clump formation below native plants. OANRP will control near rare plants to encourage recruitment.

**Summary of Target Taxa (Continued)**

<b>Taxa</b>	<b>Distribution</b>	<b>Notes</b>
<i>Cenchrus clandestinus</i>	Restricted	Known 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.
<i>Grevillea robusta</i>	Widespread	Not targeted by OANRP. NARS staff are currently treating large trees. Will continue communication with NARS staff to assess help needed.
<i>Montanoa hibiscifolia</i>	Widespread	Known from multiple locations across MU, and appears to be widespread. Will be a targeted during weed sweeps at all weed control areas and all occurrences will be GPSed.
<i>Passiflora suberosa</i>	Localized	Observed on fenceline border of Kahanahaiki and Pahole. NARS staff has observed an incursion of <i>P. suberosa</i> throughout the MU and recent vegetation monitoring in neighboring Kahanahaiki and Kapuna shows an increase in frequency and distribution. Vegetation monitoring in Pahole will help determine distribution and frequency. Always target species during weed control efforts,
<i>Rubus argutus</i>	Localized	One plant found on East rim of Pahole. Successful eradication at this site in May 2017 as an ICA (MMR-RubArg-05). Listed as a target since no longer considered an ICA. NARS staff have found more plants in their work areas and are actively controlling it. There is zero tolerance for this species within the NAR.
<i>Spathodea campanulata</i>	Localized	Found in gulch bottoms. Control during flowering season when large mature trees can be spotted from a far distance.
<i>Sphaeropteris cooperi</i>	Restricted	Small infestation along gulch bottom trail. One mature found on 3-4-10 within the MU, but many individuals are North of the Nike site, outside the MU. Control by cutting if found during weed sweeps or opportunistically.
<i>Tibouchina herbacea</i>	Restricted	One seedling was found by state employees. If found again, this species would be of serious concern and control would be high priority as an ICA. As a member of the family Melastomataceae, the seed bank would likely be extremely persistent.
<i>Zingiber zerumbet</i>	Restricted	One population along the trail to gulch 5, before SchKaa outplanting site. Used to be considered an ICA, but there is low priority for control and can be done opportunistically.

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 Pahole. This is a lower priority MU for restoration actions. The state is mainly working on restoration in many of the sites OANRP works in.

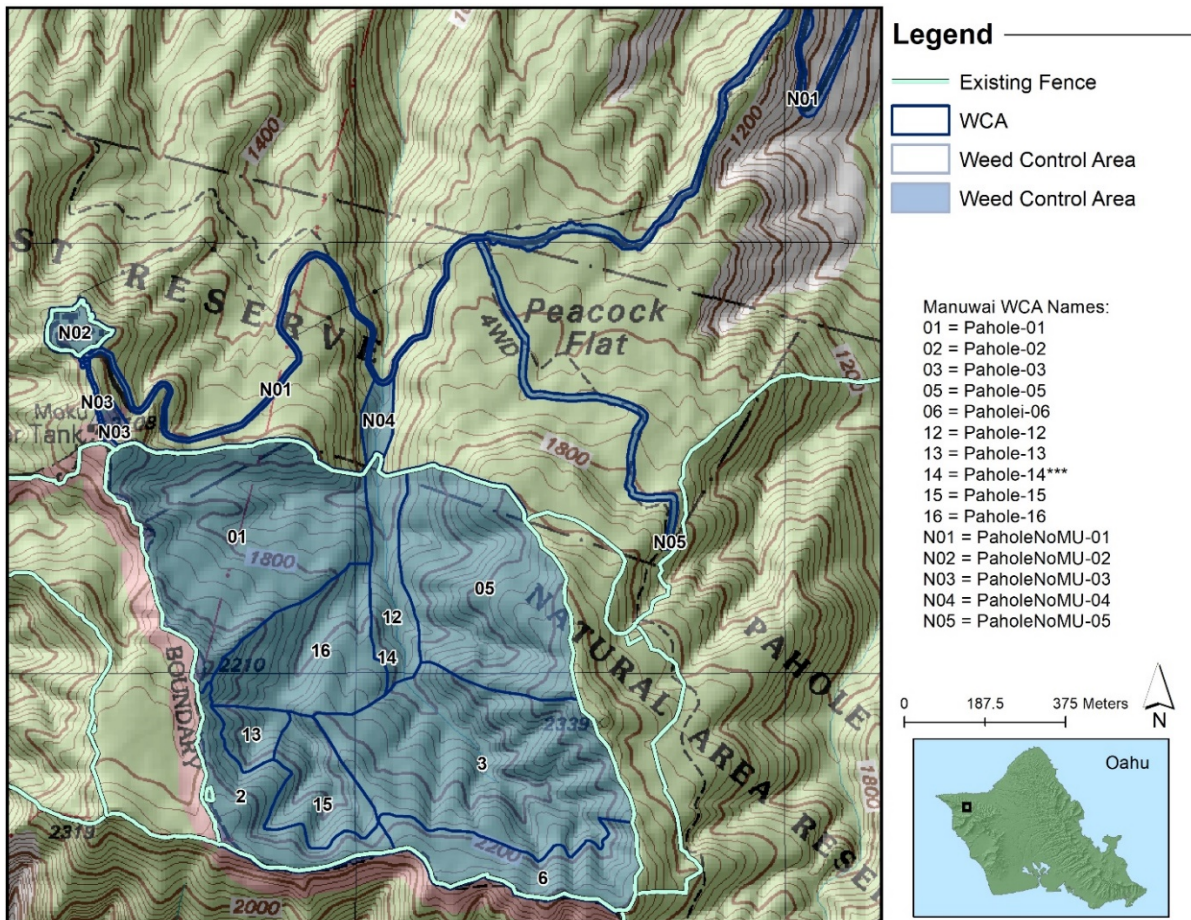
**Taxa Considerations for Restoration Actions:**

<b>Native Taxon</b>	<b>Outplant?</b>	<b>Seedsow/ Division/ Transplant?</b>	<b>Notes</b>
<i>Acacia koa</i>	Yes	Seedsow	Tree. Grow from 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>Dodonea visoca</i>	Yes	No	Small tree. Grow from seed.

**Taxa Considerations for Restoration Actions (Continued)**

Native Taxon	Outplant?	Seedsow/ Division/ Transplant?	Notes
<i>Hibiscus arnottianus</i>	Yes	No	Tree. Fast-growing. Grow from cuttings.
<i>Kadua affinis</i>	Yes	Seedsow	Small tree. Grow from seed.
<i>Metrosideros polymorpha</i>	Yes	No	Tree. Slow-growing. Grow from cuttings or seed.
<i>Microlepia strigosa</i>	Maybe	Division	Fern. Survives transplanting in mesic environments.
<i>Myrsine lessertiana</i>	Yes	No	Tree. Grow from cuttings or seed.
<i>Nestegis sandwicensis</i>	Yes	No	Tree. Grow from cuttings.
<i>Pipturus albidus</i>	Yes	Seedsow/Transplant	Small tree. Fast growing. Known to grow from seed sows.
<i>Pisonia</i>	Yes	Seedsow/Transplant	Tree. Fast growing. Easy to propagate. Some located just outside of Kamaili Mauka. Know to grow from seed sows.
<i>Planchonella sandwicensis</i>	Yes	No	Tree. Grow from cuttings or seed. Slow growing.
<i>Psydrax odorata</i>	Yes	No	Tree. Grow from cuttings.

**Weed Control Areas at Pahole**



\*\*\*Pahole-14 encompasses the entire MU to track all trail and fence weed control actions.



**WCA Pahole-01 (Gulch 1)**

Veg Type: Mesic slope

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *Schinus terebinthifolius*, *Psidium cattleianum*, *Montanoa hibiscifolia*, *R. rosifolius*, and *C. hirta*

Notes: This WCA encompasses Gulch 1 which includes the Kahanahaiki/Pahole cross over on the North West of the MU to Puu 2210 and down the ridge to the gulch bottom. This is a large WCA, where priorities focus on understory and gradual control around rare plant taxa, grass control and canopy control. There is a large patch of *Microlepia strigosa* in the area encompassing the *Delissea waianaeensis* outplanting and controlling understory weeds may help this native understory expand. Habitat near the *Schiedea nuttallii* outplanting site is an intact native forest. Native canopy (*A. koa* and *M. polymorpha*) provides filtered light to support a thriving understory below (*S. nuttallii*, *Alyxia stellata*, *Kadua affinis*, *Asplenium caudatum*, *Coprosma foliosa* and *Dianella sandwicensis*). Many areas along the rim just need periodic grass spray and minimal weeding of alien understory. OANRP should start *Blechnum 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 (Upper elevation Gulch 2)**

Veg Type: Mesic slope/ridge

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, *M. hibiscifolia*, *R. rosifolius*, and *C. hirta*.

Notes: This large WCA spans the north facing slope along the valley rim and includes the area from the Pahole Snail enclosure to the *Kadua degeneri* subsp. *degeneri* population. The area surrounding the large *Cenchrus agrimonioides* var. *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. *K. degeneri* subsp. *degeneri*, *Cyanea longiflora*, and *Plantago princeps* var. *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. To mitigate this concern, outplants of *Acacia koa* will be considered following any significant canopy removal actions.

**WCA Pahole-03 (Gulch 3 Eupher, Cyasup, Cenagragr)**

Veg Type: Mesic slope

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, *M. hibiscifolia*, *R. rosifolius*, and *C. hirta*.

Notes: This WCA spans the lower reaches of gulch 3, neighboring Pahole-06 which spans the higher elevations of gulch 3. The WCA includes the gulch bottom *Cyanea superba* subsp. *superba* outplants, as well as *Euphorbia herbstii* outplants. The overstory consists mainly of large *P. cattleianum* stands and in most areas of the gulch, little light is able to penetrate through to the gulch bottom. Groundcover in the gulch is partially comprised of native taxa such as *M. strigosa*, *Asplenium macrei*, and *A. kaulfussii*. Control of non-native understory and ground cover, such as *Rubus rosifolius* and *B. appendiculatum* will

promote seedling recruitment, especially for *C. superba* subsp. *superba* and *E. herbstii*. *M. hibiscifolia* will be targeted wherever seen in the gulch. This WCA also includes ridge habitat that divides the major gulches. The ridge dividing Gulches 2 and 3 includes the in-situ population of *C. agrimonioides* var. *agrimonioides* among other native grasses such as *Panicum nephilophilum*. Non-native grasses are also on the ridge, including *Melinis minutiflora*. Control is implemented as necessary and careful care is taken to reduce impacts to the native grasses if spraying is needed. Directly downslope of the *C. agrimonioides* var. *agrimonioides* population is a large stand of *P. cattleianum*. This should be replaced slowly with *A. 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*-PAH-A population. Weed control will focus on the various rare taxa sites described here.

### WCA Pahole-05 (Gulch 4 and 5)

Veg Type: Mesic Gulch

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *S. terebinthifolius*, *P. cattleianum*, *R. rosifolius*, and *C. hirta*.

Notes: The rare taxa in this WCA include *Schiedea kaalae*, *C. agrimonioides* var. *agrimonioides* and *Cyanea grimesiana* subsp. *obatae*. *Phyllostegia kaalaensis* was reintroduced to gulch 4, but failed to maintain a population. In Gulch 5 there are *S. kaalae* and *C. grimesiana* subsp. *obatae* outplants in the gulch bottom. A small population of *Zingiber zerumet* is restricted to a small patch in Gulch 5. It is a target species and will be controlled as needed. In both Gulches 4 and 5 non-native taxa are the most dominant canopy species, including: *P. cattleianum*, *P. guajava*, *Aleurites molucanna* and *S. terebinthifolius*. The moist, dark gulch bottom is suitable habitat for *A. evecta*, other non-native ferns, and native ferns like *M. strigosa*. A mix of native and non-native shrubs exist in the gulch bottom including: *R. rosifolius*, *C. hirta*, *Buddleja asiatica*, and *Alyxia stellata*. Although there is a failed *P. kaalaensis* reintroduction in Gulch 4, other rare taxa can be found there, like *Cyrtandra dentata*. If *P. kaalaensis* is reintroduced to this site again, continual weeding of *R. rosifolius* and *B. appendiculatum* will be necessary, especially in the vicinity of the plants. It would be prudent to target the non-native understory and then gradually aim towards non-native canopy removal. 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, especially around rare plant populations.

The ridge dividing Gulches 4 and 5 has a reintroduced population of *C. agrimonioides* var. *agrimonioides* PAH-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* var. *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-06 (Upper elevation Gulch 3/Cyalon-A and I)

Veg Type: Mesic slope

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *P. cattleianum*, *R. rosifolius*, and *C. hirta*.

Notes: This WCA stretches from the eastern side of Gulch 3 up to the Pahole rim. This WCA is extremely sensitive due to steep, wet banks with *Cyanea longiflora*, a primary managed IP taxa, recruitment. 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. Additional rare taxa in the WCA include populations of *C. longiflora*, *C. dentata*, one population of *S. nuttallii*, and a small localized population of *Achatinella mustelina*. All of these plant populations are evenly dispersed among the WCA. The canopy consist of *M. polymorpha*, *A. koa*, *Cibotiumglaucum*, *A. platyphyllum*, and the understory consists of *A.stellata* , *Dicranopteris linearis*, *Asplenium ssp.*, *Clidemia hirta*, and *B. appendiculatum*.

#### **WCA Pahole-12 (Gulch bottom/access trail)**

Veg Type: Mesic Gulch

MIP Goal: Less than 50% non-native cover

Targets: All weeds, focusing on *P. cattleianum*, *M. hibiscifolia*, *Toona ciliate*, *R. rosifolius*, *C. hirta*, and *Triumfetta semitriloba*.

Notes: The WCA spans the main gulch bottom. There are no rare taxa within this WCA, but this large drainage is the most commonly used corridor that leads to the five gulches in Pahole, each of which contains rare managed taxa. The moisture of this gulch environment allows for a lush, generally native filled understory consisting of native ferns. One of the goals is to focus our attention on *M. hibiscifolius* sweeps, as well as searching for other target weeds including *T. ciliata*, *Triumfetta semitriloba*, and *Passiflora 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 by prioritizing treatment along these high-use corridors.

#### **WCA Pahole-13 (Gulch 2 Eupher)**

Veg Type: Mesic Gulch

MIP Goal: Less than 25% non-native cover

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

Notes: *E. herbstii* PAH-F is managed within this WCA. *E. herbstii* growing in areas with open canopy or on slopes die more than plants with intermediate to closed canopies or in gulch bottoms, suggesting that drastic light changes are a concern in this WCA. Selective canopy control of *P. cattleianum* and *S. terebinthifolius* will be implemented to prevent major light changes around the *E. herbstii* population. Understory weeds such as *C. hirta*, *B. appendiculatum*, and *R. rosifolius* inhibit *E. herbstii* recruitment and frequent control is necessary. The bottom of Gulch 2 which includes Pahole-13 and Pahole-16 should be swept for *M. hibiscifolius*, *T. ciliata*, and *T. semitriloba* at least once a year.

#### **WCA Pahole-14 (Fencline/trail)**

Veg Type: Mesic Gulch

MIP Goal: Less than 50% non-native cover

Targets: All weeds, especially those encroaching or breaching the fence line, focusing on non-native grasses (*U. maxima* and *M. minutiflora*), *P. cattleianum*, and *T. semitriloba*.

Notes: WCA 14 encompasses the entire Pahole fence including the Hypalon. It is important to maintain and clear the fenceline in this area that spans from gulch to ridge top. Occasionally staff remove large fallen trees off the fence to maintain its integrity. Spraying grass and treating the thick invasive

understory weeds will be done as needed in order to keep weeds at a manageable size and will keep the fence clear for maintenance checks.

### **WCA Pahole-15 (Gulch 2 Cyalon-J)**

Veg Type: Mesic slope/ridge

MIP Goal: Less than 25% non-native cover

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

Notes: This WCA spans the back of Gulch 2 where terrain is very steep. Intensive weed effort to remove large *A. moluccana*, *P. cattleianum* and *S. terebinthifolius* cleared area for the most recent *C. longiflora* outplanting in Pahole. Selective removal of non-native trees, along with restoration efforts will be implemented. A mix of native and non-native understory occurs in this WCA. Lack of light in the gulch bottom encourages fern growth including *Angiopteris evecta*. Control is being implemented at this ICA (Pahole AngEve-03) to prevent plants from reaching maturity, as sweeps are done once per year.

### **WCA Pahole-16 (Gulch 2 Fluneeo)**

Veg Type: Mesic Gulch

MIP Goal: Less than 25% non-native cover

Targets: All weeds, focusing on *P. cattleianum*, *M. hibiscifolia* and non-native grasses (*Oplismenus hirtellus*, *Paspalum conjugatum*)

Notes: *Fluggea neowawraea* is the managed taxa within this WCA and the reintroduction site is in the bottom of Gulch 2. Aggressive canopy control is necessary, since *F. neowawraea* has high light level requirements. As canopy species are removed non-native grasses, such as *O. hirtellus* and *P. conjugatum* need to be controlled regularly. Other understory species of concern are *C. hirta*, *B. appendiculatum*, and *R. rosifolius*, which should be controlled regularly. The bottom of Gulch 2, which includes Pahole-13 and Pahole-16 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 *U. maxima*.

Notes: The goal of this WCA is to maintain the Pahole road and control/reduce of target weeds as a traffic safety issue. OANRP staff sprays grass and herbaceous weeds along the road from Peacock Flats gate to the ranch gate as needed. Often, a power sprayer and weed whackers 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, particularly since 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 to prevent the spread of weeds to other areas. Weed control is focused around the LZ, OANRP greenhouses, the upper building at Nike, and anywhere else needed. Some common weeds found on these WCA sites include: *P. cattleianum*, *P. guajava*, *S. terebinthifolius*, *R. rosifolius*, *C. hirta*, *Leucaena leucocephala*, *M. minutiflora*, *U. maxima* and *Erigeron karvinskianus*. OANRP horticultural staff maintain this WCA with the help of the Green Team as needed

### **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 grasses (*M. minutiflora*, *U. maxima*)

Notes: This WCA is located from Pahole Road (Nike building gate) to the Kahanahaiki/Pahole trail crossover. The managed rare taxa here are reintroduced *C. agrimonioides* var. *agrimonioides* and *S. obovata* in a steep terrain habitat. The canopy is predominately *S. terebinthifolius*, and is very open. The area is an exposed ridge top, and therefore, not much ground cover is present. Target understory and gradual canopy removal. As canopy species are removed non-native grasses, such as *M. minutiflora* and *U. maxima* need to be controlled regularly. This WCA spans the main trail and maintenance will be as needed.

### **WCA Pahole No MU-04 (Fig Gulch)**

Veg Type: Mesic Gulch

MIP Goal: Less than 50% non-native cover

Targets: All weeds, focusing on *M. hibiscifolius*, *T. semitriloba*, *P. cattleianum*, and *Achyranthes aspera*.

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*, *T. semitriloba* and *A. aspera* to prevent these species from establishing 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. stellata* and *M. strigosa* and there are no rare taxa in the immediate area. Weed sweeps for *M. hibiscifolia* are ongoing while conducting other MU actions and weed sweeps. Trail maintenance will be as needed for safe thoroughfare.

## **Small Vertebrate Control**

Species: *Rattus rattus* (Black rat), *Rattus exulans* (Polynesian rat), *Mus musculus* (House mouse), *Lophura leucomelanos* (Kalij Pheasant).

Threat Level: High threat from *Rattus spp.* to all members of the Campanulaceae including *Cyanea* & *Delissea* species. High threat to all *Schiedea* species. High for *A. mustelina*. Threat level unknown for *Lophura leucomelanos* (Kalij Pheasant) on frugivory of Campanulaceae, but fruit consumption and physical stem damage have been documented on video.

Seasonality/Relevant Species Biology: OANRP manages rats seasonally or year-round, depending on whether the rare taxa require protection seasonally or year-round. For example, *Achatinella mustelina* are protected from predation year round with a small grid around the Pahole snail enclosure.

Management Objectives:

- Mitigate threat of vertebrate activity on managed plant and snail populations.

Strategy and Control Methods:

- Monitor rare plant (*C. superba* subsp. *superba*, *C. grimesiana*, *D. waianaensis*, *E. herbstii*, *S. obovata*, *S. kaalae* and *S. nuttallii*.) populations, as well as other native species for evidence of rodent impacts.
- There are no immediate plans for a large scale trapping grid in Pahole. If rodent damage on rare taxa is observed, staff will deploy a rapid response grid of Good Nature A24 traps.
- There are no plans to mitigate the effects of frugivory by *Lophura leucomelanos* (Kalij Pheasant) and other non-native birds at this time, however OANRP will continue to support research.

Discussion: Currently Goodnature A24 automatic rat traps are our greatest conservation tool for rodent control. The bait development of Goodnature A24's has vastly improved. The longevity has increased enough for OANRP staff to check once a quarter. Because of this new efficiency we may be able to expand protection to more areas for less cost. It would be worth evaluating if larger grids should be installed at some sites that have isolated or territory based grids.

There is a smaller grid deployed around the Pahole NAR tree snail enclosure which is maintained every four months by OSEPP (Oahu Snail Extinction Prevention Program.). The enclosure is an older design constructed to keep out the predator snail *Euglandina rosea*, but not rodents. Plans are underway by the State to construct an updated version of the snail enclosure with rodent/predatory snail barriers in place.

Additional rat control/research is ongoing at the Kahanahaiki MU which is directly adjacent to the Pahole MU. Most current experiment in Kahanahaiki involved a trial with the rodent birth control product ContraPest, which could have overlapping effects into Pahole. 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. We are considering dropping the status of *C. superba* subsp. *superba* in the Pahole to Kapuna PU when a new PU is established (Palikea) with a completed outplanting; therefore, rodent control is a low priority around this species. There are no immediate plans for a large scale trapping grid in Pahole.

Since 2016 research has been done by the Vertebrate Introductions and Novel Ecosystems (VINE) Hawaii project to examine [1] how the structure and dynamics of seed dispersal networks vary across ecological contexts, [2] how seed dispersal competence of non-native species varies across ecological contexts to influence ecosystem functioning, and [3] how ecosystem functioning is maintained across new spatial and temporal extents through non-native birds. As part of the project motion-detection cameras are set up in the field to record the types of non-native frugivores and the different species of plants they visit. One of the cameras had detected *Lophura leucomelanos* (Kalij Pheasant) frugivory on *Delissea waianaensis* (PAH-C) while producing heavy damage to the plant. This was the first recorded threat of the Kalij on *D. waianaensis*, currently the problem is being investigated for the feasibility of control in the future. However, the presence of *D. waianaensis* seedlings in Pahole and in neighboring Kahanahaiki far from any known populations, could suggest that a frugivore is moving the seeds around. The VINE Hawaii project continues to collect data on non-native avian frugivores and study the viability of seeds through the avian digestive system.



Two rats consuming fruits from a population of *D. waianaensis*

## Slug Control

Species: *Deroceras leave*, *Limax maximus*, *Veronicella cubensis*, *Meghimatium biliniatum*

Threat Level: High threat to all members of the Campanulaceae including *Cyanea* & *Delissea* species. High threat to all *Schiedea* species. Unknown threat to all other rare plant species, but could be a threat to *Euphorbia herbstii* seedlings.

Seasonality/Relevant Species Biology: Slugs are seasonally abundant during the wet season. In Pahole, slugs are present year round, though less active in the hottest months (July and August).

### Management Objectives:

- Eradicate slugs locally to ensure germination and survivorship *C. grimesiana*, *D. waianaensis*, *E. herbstii*, *S. obovata*, *S. kaalae*, and *S. nuttallii*.
- Ensure no rare snails are adversely impacted by slug control.
- Assess slug activity over time.
- Survey annually to ensure rare snails do not migrate into slug treatment areas.

### Strategy and Control Methods:

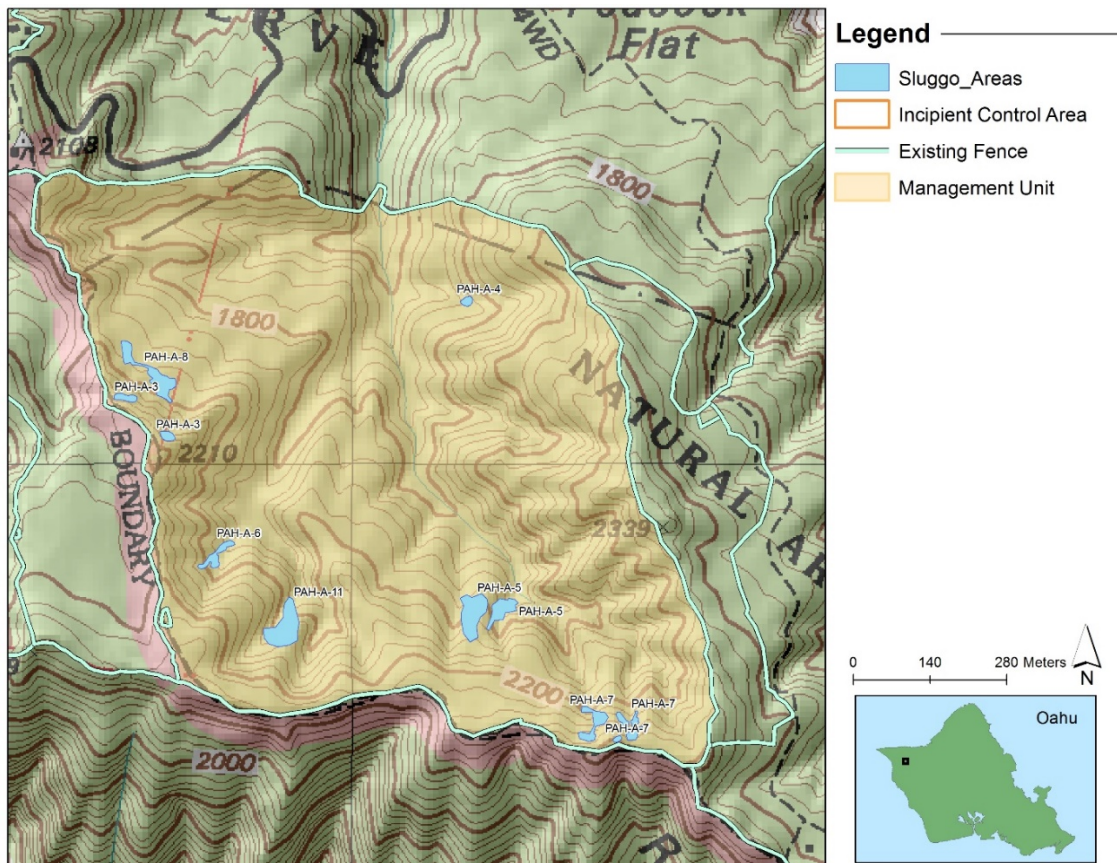
Slug Control Areas (SLCAs) have been delineated around rare taxa locations. These include not only the target plant but a buffer of 10 meters to kill slugs entering the rare plant vicinity. Apply FerroxxAQ every 6 weeks. A buffer of at least 5 meters from vulnerable plants is recommended. 10 meters is optimal.

- Prior to any control, day and nighttime surveys must be conducted in the proposed control area to ensure there are no rare snails in the area.
- If rare snails are found in an established SLCA, treatment will be halted. Rare snails will be relocated to the MU snail enclosure. The site then will be resurveyed (day and night) to ensure no rare snails are present before treatment is resumed. Annual day and night surveys will be conducted at the SLCA for two years after the last rare snail sighting.
- Slug activity will be noted using baited pitfall traps set once a year in the wet season. Staff will also record and note any damage to target plants caused by slug feeding.

**Slug Control Area Locations Table**

SLCA Code	Plant population reference codes	Date slug control began
PAH-A.2	CyaSupSup.PAH-A	2014-01-13/discontinued 2015-06-10
PAH-A.3	SchNut.PAH-D, SchNut.PAH-E and SchObo.PAH-E	2014-01-13
PAH-A.4	CyaGriOba.PAH-D, SchKaa.PAH-C, SchKaa.PAH-A	2015-09-16
PAH-A.5	EupHer.PAH-R and EupHer.PAH-G	2015-06-10
PAH-A.6	EupHer.PAH-F, EupHer.PAH-S and	2015-06-10
PAH-A.7	CyaLong.PAH-I, CyaLong.PAH-A and SchNut.PAH-A	2015-10-12
PAH-A.8	DelWai.PAH-C and CyaSub.PAH-B	2017-09-26
PAH-A.11	CyaLong.PAH-J	2018-03-11

**Slug Management Map**





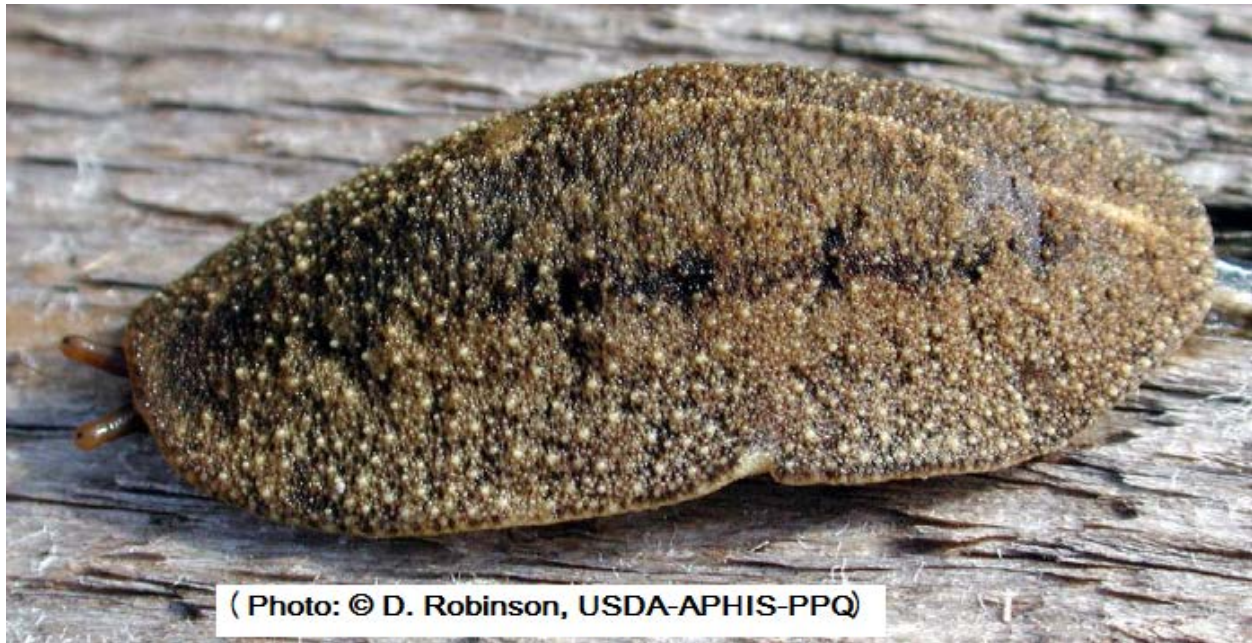
### Slug Photos



*Deroceras laeve*, grey garden slug.  
This is the most common slug in the MU.



*Limax maximus* (leopard slug) with eggs  
This is the second most common slug in the MU.



*Veronicella cubensis* (Cuban slug). This slug is rare in the MU, it is restricted to the area above the road.

### Discussion:

During annual rare plant monitoring, we will inspect plants for herbivory. If present, this will be noted. Indication that slugs are responsible includes the following: lower leaves closer to the ground are more damaged, slime is present, and leaf margins are consumed before the interior of the leaf (unless the midrib is resting on the ground while the margins are curled).

If slug herbivory is suspected, check for rare native snails within 20 meters of the rare plants before proceeding with a slug control program.

Sample slugs in the vicinity using baited beer traps. If the number of slugs captured per trap over two weeks exceeds one slug per trap, and, if no rare native snails are present, apply commence applying FerroxxAQ every 6 weeks year round.

Cyasupsup.PAH-A site is discontinued due to the designation of this population. It transitioned from a MFS population to GS. The new MFS for the

## Ant Control

Species: *Solenopsis genimata*, *S. papuana*, *Paratrechina bourbonica*, *Leptogenys falcigera*.

Threat Level: Low

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.

Strategy and Control Methods:

- Sample ants at human entry points using the standard survey protocol (Plentovich and Krushelnycky 2009). 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 campsite, LZ, rare taxa sites, DZ, and fence lines 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 during annual rare plant monitoring.

**Ant Survey Site Table**

Site description	Reason for survey
Hypalon Fence	Human entry point. High risk of accidental ant introduction
<i>Achatinella mustellina</i> snail enclosure	Human entry point. High risk of accidental ant introduction



### Ant Photos



*S. papuana* or the thief ant is the most common ant in the MU.

**Discussion:** 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. From 2008-2014 ants were sampled in high risk areas using the following method:

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 for later identification.

Standardized surveys have taken place in Pahole for 10 years. All species found listed at the beginning of this section.

## **Black-Twig Borer (BTB) Control**

Species: *Xylosandrus compactus*

Threat Level: High

Seasonality/Relevant Species Biology: Peaks have been observed from October-January

Management Objectives:

- During annual rare plant monitoring, look for signs of twig boring and damage at the rare plant populations commonly impacted by BTB (*Flueggea neowawraea*).

Strategy and Control Methods:

- If rare plant taxa that are monitored show any sign of boring, report to Rare Plant Manager immediately.
- If there is an urgency to collect any plant material (i.e. seed, cuttings, and saplings) for genetic storage, collect material.

Discussion: The current control method available for BTB involves the deployment of traps equipped with high-release ethanol bait. However, it is unclear whether this method reduces BTB damage to target plants. Therefore, this control method is not used to control BTB in the field. Since this control method is not effective, OANRP will continue to investigate other control methods. If there is a rare plant population threatened by BTB and there is an urgency to have the genetic material, OANRP staff will collect any plant material to prevent losing the plant founder altogether.

## **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 nearby the western and southern side of this MU. In past fires have come close to the MU, both from fires set by the military, by arsonists along Farrington Hwy, or nearby farm lands.

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:

- Reduce fuel loads within the MU, along the road, and along the fenceline.
- If a fire occurs, conduct a post-fire survey, including mapping the perimeter of the fire and document damage via photos.



### Fire Photos



2003 fire near Pahole NAR's western boundary



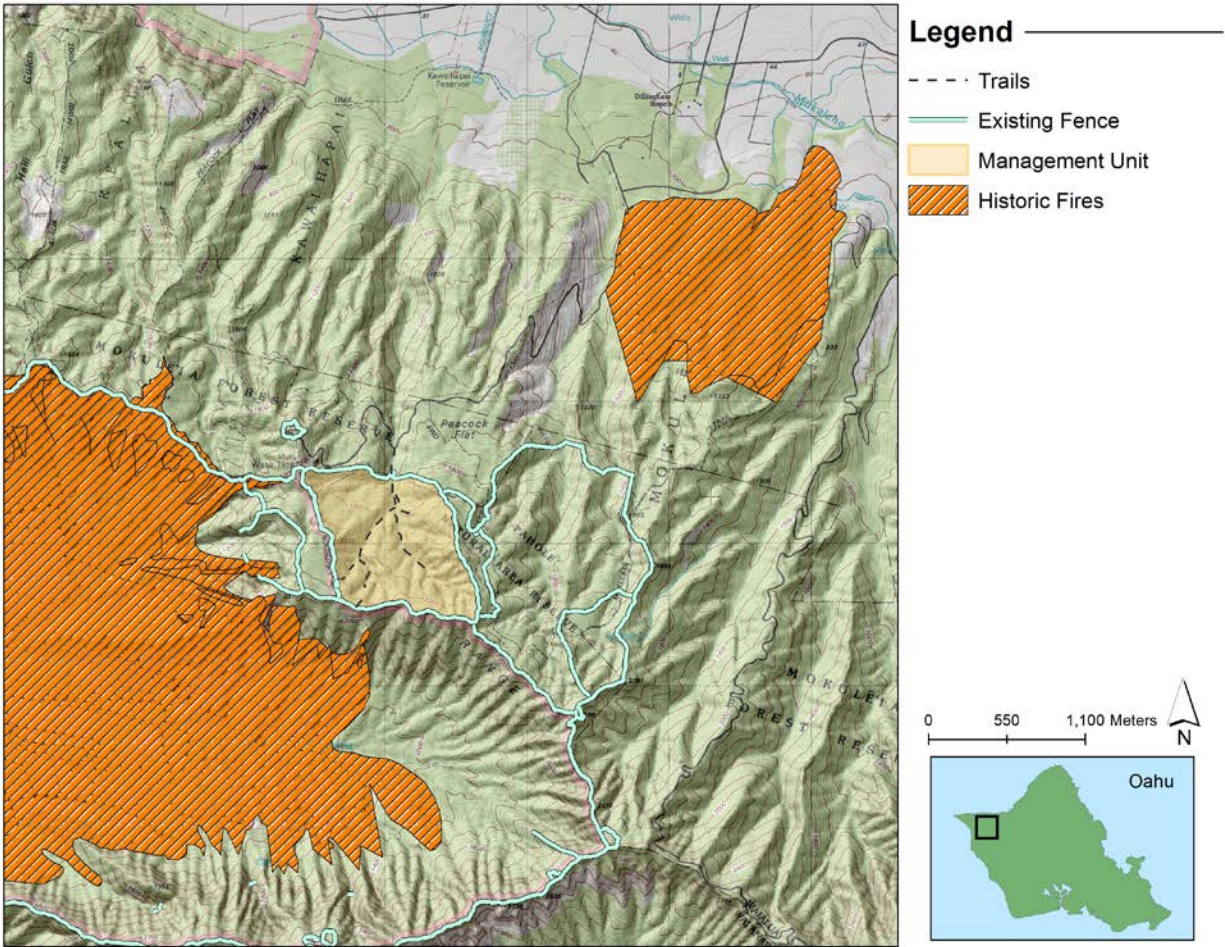
2017 fire near Pahole NAR's eastern boundary.

**Discussion:** The western and southern side of the Pahole MU falls into 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, as well as, dry pasture lands to the north. In 2003, a prescribed burn got outside of the prescription area and got within 150m of the Pahole NAR's western boundary. Since early 2000's, the military has changed its vegetation suppression strategies, moving from prescribed burns to mowing/spraying most of the vegetation. There have been several fires in Makua since then that have started from arsonist from Farrington Highway. Though none of these fires reached the MU they still had potential to get into the management unit. Below the Pahole NAR are farm lands and grassy gulches. In 2017 a fire burned private and state land in Mokuleia, which was ignited by a farm vehicle on one of the agriculture lots. Though no taxa were impacted, it could have potentially got into Pahole gulch.

Fire prevention to this MU depends on fire measures put in place in Makua Valley, as well as, other surrounding land owners. 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 Biological Opinion, 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.

### Fire Management Map



Previous Fires near Pahole MU

### 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 code, or WCA code. Cells with **X** 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 ID	Action Type	Taxon Code	Action Site Code	Actions	MIP Year 15 Oct 2018- Sept2019				MIP Year 16 Oct 2019- Sept2020				MIP Year 17 Oct 2020- Sept2021				MIP Year 18 Oct 2021- Sept2022				MIP Year 19 Oct 2022- Sept2023			
					4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
5764	Ant Monitoring	None	None	Sample ants at two human entry points where Gulch 2 intersects Hypalon fence and at the Achatinella mustellina snail enclosure. Monitoring protocol: place 10 open vials containing SPAM, peanut butter and honey throughout the area to be sampled. Close vials after one hour and place in freezer for ID. Do not sample on rainy days.				X				X				X				X				X
7828	Common Collections	None	None	ActionComments Obs/Collect common native plants for restoration use throughout Pahole MU. Collect from Pahole MU and/or appropriate nearby locations. General action for collections not specified for that year. Action includes monitoring phenology.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

**Action Table (Continued)**

Action ID	Action Type	Taxon Code	Action Site Code	Actions	MIP Year 15 Oct 2018- Sept2019				MIP Year 16 Oct 2019- Sept2020				MIP Year 17 Oct 2020- Sept2021				MIP Year 18 Oct 2021- Sept2022				MIP Year 19 Oct 2022- Sept2023			
					4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
3477	Fence Monitor/ Maintenance	None	PAH-A	All fence monitoring and maintenance actions. Maintenance is defined as any minor repair work or that is LESS THAN 100m.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7635	Slug Control	CyaLong	PAH-A-11	Gulch 2, CyaLong.PAH-J 2018. Vince already surveyed the area and it is clear of native snails so Sluggo may be used. Area needs to be mapped following outplanting. Based on the area he surveyed, 1.5 lbs. of FerroxxAQ should be applied every 6 weeks	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5717	Slug Control	SchNut	PAH-A-3	Warning potential AchMus above and near SchNut.PAH-E. Apply 4 Lbs. of FerroxxAQ every 6 weeks at Pahole site 3 (SchNut.PAH-D, E). This is the area before the Pahole switchbacks on the trail to the makua overlook. You will need 4 lbs. of FerroxxAQ, 2 lbs are used on the Scheidea's on your left before the switchbacks, 2 are used on the SchNuts on the switchbacks	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X



**Action Table (Continued)**

Action ID	Action Type	Taxon Code	Action Site Code	Actions	MIP Year 15 Oct 2018- Sept2019				MIP Year 16 Oct 2019- Sept2020				MIP Year 17 Oct 2020- Sept2021				MIP Year 18 Oct 2021- Sept2022				MIP Year 19 Oct 2022- Sept2023			
					4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
6935	Slug Control	SchKaa	PAH-A-4	Gulch 5, Discontinue? Put 2 lbs. Sluggo at the CyaGriOba.PAH-D and and 1 lbs at the SchKaa.PAH-C. You will pass SchKaa.PAH-A on your way to site.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5757	Slug Control	EupHer	PAH-A-5	Gulch 3, 4 Lbs. FerroxxAQ needed for this site which includes a mix of EupHer.PAH-R, EupHer.PAH-G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6938	Slug Control	EupHer	PAH-A-6	Gulch 2, EupHer.PAH-S, Sluggo related activities. Snail survet completed. Mapped for Sluggo and slugs sampled. Area recieves 3 lbs. Sluggo	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X













Action Table (Continued)

Action ID	Action Type	Taxon Code	Action Site Code	Actions	MIP Year 15 Oct 2018- Sept2019				MIP Year 16 Oct 2019- Sept2020				MIP Year 17 Oct 2020- Sept2021				MIP Year 18 Oct 2021- Sept2022				MIP Year 19 Oct 2022- Sept2023			
					4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
				zone. Target Bleapp right around Cyasup.																				
3483	Weed Control	None	Pahole-05	Control weeds across Schkaa/Cyagri reintro zone in Gulch 5 every 6 months. Target understory weeds, especially weedy ferns. Conduct minimal canopy weeding to prevent light regime changes. Always treat MonHib and record #s treated.	X		X		X		X		X		X		X		X		X		X	
3484	Weed Control	None	Pahole-05	Control understory and canopy weeds around Cenagr reintro every 6 months/year.		X		X		X		X		X		X		X		X		X		X
5027	Weed Control	None	Pahole-05	Sweep gulch at least once a year, focusing on significant weeds, particularly MonHib, TooCil, TriSem. Known MonHib hotspots in Gulch 4; GPS and flag locations of mature plants, and track number/reproductive status of plants treated.	X				X				X				X				X			
7833	Weed Control	None	Pahole-06	Control weeds around native forest patches, across WCA, annually. Target Monhib, Trisem, select understory weeds and			X				X				X				X				X	











**Action Table (Continued)**

Action ID	Action Type	Taxon Code	Action Site Code	Actions	MIP Year 15 Oct 2018- Sept2019				MIP Year 16 Oct 2019- Sept2020				MIP Year 17 Oct 2020- Sept2021				MIP Year 18 Oct 2021- Sept2022				MIP Year 19 Oct 2022- Sept2023			
					4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
7369	Weed: Incipient Control	AngEve	Pahole- AngEve- 04	Monitor/Control AngEve in mid part of gulch 2 every other year. Prevent any plants from reaching maturity.							X								X					
7469	Weed: Incipient Control	AngEve	Pahole- AngEve- 05	Monitor/Control AngEve in gulch 3 every other year. Prevent any plants from reaching maturity. Wider surveys needed at this site.							X								X					
7802	Weed: Incipient Control	AngEve	Pahole- AngEve- 06	Monitor/Control AngEve in gulch 2 EupHer reintro site annually, then every other year. Prevent any plants from reaching maturity.			X				X								X					
2799	Weed: Incipient Control	AxoCom	Pahole- AxoCom- 01	Monitor/control AxoCom at top of switchbacks quarterly/twice a year. Spray or remove via digging. Note, 1% glyphosate does not appear to be very effective (2018).	X	X	X	X	X	X		X	X	X		X	X	X		X	X	X		X
6180	Weed: Incipient Control	DicChi	Pahole- DicChi-01	Monitor/control DicChi at big rock site annually. Pick and remove from field any potentially mature fruit. Roots from veg matter. Use pre-emergent herbicide.			X				X				X				X				X	
3623	Weed: Incipient Control	EhrSti	Pahole- EhrSti-02	Monitor/control EhrSti at state snail jail quarterly, both inside and outside snail jail. Sweep entire ICA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X



**Action Table (Continued)**

Action ID	Action Type	Taxon Code	Action Site Code	Actions	MIP Year 15 Oct 2018- Sept2019				MIP Year 16 Oct 2019- Sept2020				MIP Year 17 Oct 2020- Sept2021				MIP Year 18 Oct 2021- Sept2022				MIP Year 19 Oct 2022- Sept2023			
					4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
				each time. Pick and remove from field any potentially mature fruit. Use pre-emergent herbicide. This species is cryptic and can be difficult to id.																				
7540	Weed: Incipient Control	Elemol	Pahole- EleMol-01	Monitor/treat at Pahole/Kahanahaiki ridge trail site, 2-4x year. Pick and remove from field any potentially mature fruit.	X		X		X		X		X		X		X		X					
2797	Weed: Incipient Control	PteGlo	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. Remove soil as feasible.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6550	Weed: Incipient Control	RhoTom	Pahole- RhoTom- 01	Monitor/control RhoTom at East rim fence site annually. Pick all fruit and remove from field.			X				X				X				X				X	
7319	Weed: Incipient Control	SetPal	Pahole- SetPal-01	Monitor/control SetPal at top of switchbacks near water catchment quarterly. Spray. Flag location to facilitate revisitation. Pick and remove from field any potentially mature fruit.	X		X		X		X		X		X		X		X					

Action Table (Continued)

Action ID	Action Type	Taxon Code	Action Site Code	Actions	MIP Year 15 Oct 2018- Sept2019				MIP Year 16 Oct 2019- Sept2020				MIP Year 17 Oct 2020- Sept2021				MIP Year 18 Oct 2021- Sept2022				MIP Year 19 Oct 2022- Sept2023			
					4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
2798	Weed: Incipient Control	TecCap	Pahole- TecCap- 01	Monitor/control TecCap at East rim fence site by fence tag 84 every 6 months. Treat all roots with herbicide; majority of plants finding now appear to be resprouts from previous handpulling control efforts.	X		X		X		X		X		X		X		X		X			
6261	Weed: LZ Survey	None	LZ- MOKFR- 189	Survey Nike Upper LZ whenever used, not to exceed once per quarter. If not used, do not need to survey.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
5958	Weed: Transect Survey	None	WT- Pahole-01	Survey Pahole gulch 3 access trail, from parking area on road, up to Chaher gulch split; annually.		X				X				X			X			X				
TBD	Vegetation Monitoring	None	None	Conduct belt plot monitoring.													X							