

1.2.2 Koloa

Ecosystem Restoration Management Unit Plan

OIP Year 5-9, Oct. 2011 – Sept. 2016

MU Koloa

Overall OIP Management Unit Goals:

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

1.2.2.1 Background Information

Location: Summit of Northern Koolau Mountains

Land Owner: Hawaii Reserves Inc.

Land Managers: OANRP

Acreage: 164 acres

Elevation Range: 1950 ft - 2400 ft

Description: The Koloa MU is bordered by the Koolau Summit Trail to the south, Kaipapau to the east, and Wailele to the west. The land to the north (makai) lies within the same Koloa gulch, but is separated by a series of waterfalls. The Koloa MU is a wet forest dominated by native vegetation. Perhaps due to its relatively flat topography, lacking the extremely steep walls and deep valleys like that of Kaipapau, the Koloa MU has a large number of IP taxa, including in situ populations of *Chamaesyce rockii*, *Cyanea koolauensis*, and *Viola oahuensis*. The Koloa MU can be accessed via the Kawailoa and Laie trails, however due the length of these trails, OANRP uses helicopters to access the MU to do management.

Native Vegetation Types

Koolau Vegetation Types
<u>Wet forest</u>
<u>Canopy includes</u> : <i>Metrosideros</i> spp., <i>Cheirodendron</i> spp., <i>Cibotium</i> spp, <i>Ilex anomala</i> , <i>Myrsine sandwicensis</i> , and <i>Perrottetia sandwicensis</i> .
<u>Understory includes</u> : Typically covered by a variety of ferns and moss; may include <i>Dicranopteris linearis</i> , <i>Melicope</i> spp., <i>Cibotium chamissoi</i> , <i>Machaerina angustifolia</i> , <i>Nertera granadensis</i> , <i>Hedyotis centranthoides</i> , <i>Nothoperanema rubiginosa</i> , <i>Sadleria</i> sp. and <i>Broussaisia arguta</i> .
NOTE: For future MU monitoring purposes vegetation type is mapped based on theoretical pre-disturbance vegetation. Alien species are not noted.

Wet Forest Vegetation types and views of Koloa



From Northern LZ looking NW towards Laie.



From the northern fenceline looking east



From the NW corner looking SE.

OIP Rare Resources

Organism Type	Species	Pop. Ref. Code	Population Units	Management Designation	Wild/Reintroduction
Plant	<i>Chamaesyce rockii</i>	KOL-A,B, D,E,G,H,I,L	Kaipapau, Kawainui to Koloa and Kaipapau, and Kawainui	MFS/T2	Wild
Plant	<i>Cyanea acuminata*</i>	KOL-L	None	MFS/T1	Wild
Plant	<i>Cyanea koolauensis</i>	KOL-B,C,D, E,H,L,N	Kaipapau, Koloa, and Kawainui	MFS/T1	Wild
Plant	<i>Cyrtandra viridiflora</i>	KOL- B,C,H,K	Kawainui and Koloa	MFS/T2	Wild
Plant	<i>Hesperomania arborescens</i>	KOL-A,D	Kamananui to Kaluanui	MFS/T1	Wild
Plant	<i>Huperzia nutans</i>	KOL-B	Koloa and Kaipapau	MFS/T1	Wild
Plant	<i>Myrsine judii</i>	KOL-B	Kaukonahua toKamananui- Koloa	MFS/T2	Wild
Plant	<i>Phyllostegia hirsuta</i>	KOL-A	Koloa	MFS/T1	Wild
Plant	<i>Viola oahuensis</i>	KOL-A,B,C, D,	Koloa	MFS/T2	Wild
Snail	<i>Achatinella livida</i>	KLO-B	Northern GU B	MFS/T2	Wild

MFS = Manage for Stability

* = Population Dead

T1 = Tier

MRS = Manage Reintroduction for Genetic Storage

GU = Geographic Unit

T2 = Tier 2

Other Rare Taxa at Koloa MU

Organism Type	Species	Status
Plant	<i>Cyanea humboldtiana</i>	Endangered
Plant	<i>Joinvillea ascendens ssp. ascendens</i>	Candidate
Plant	<i>Lobelia gaudichaudii ssp. gaudichaudii</i>	Species of Concern
Plant	<i>Cyanea calycina</i>	Species of Concern
Plant	<i>Cyanea lanceolata</i>	Candidate
Plant	<i>Myrsine fosbergii</i>	Candidate
Plant	<i>Zanthoxylum oahuenses</i>	Endangered

Locations of rare resources at Koloa

Map removed, available
upon request

Rare Resources at Koloa



MU Threats to OIP MFS Taxa

Threat	Taxa Affected	Localized Control Sufficient?	MU scale Control required?	Control Method Available?
Pigs	All	No	Yes	Yes, MU will be fenced
<i>Euglandina rosea</i>	<i>Achatinella livida</i>	Unknown	Unknown	Limited to hand removal and physical barriers
<i>Oxychilus alliarus</i>	<i>Achatinella livida</i>	Unknown	Unknown	Limited to hand removal and physical barriers
Slugs	<i>Chamaesyce rockii</i> , <i>Cyrtandra viridiflora</i> , <i>Cyanea acuminata</i> , <i>Hesperomania arborescens</i> , <i>Myrsine judii</i> , <i>Phyllostegia hirsuta</i> , <i>Viola oahuensis</i> , <i>C. koolauensis</i> , <i>C. humboldtiana</i> and <i>Lobelia gaudichaudii</i> <i>ssp.gaudichaudii</i>	Yes	No	Yes, Sluggo is available for local control if area has been surveyed by an experienced malacologist to determine whether rare snails are present
Ants	Unknown	Unknown	Unknown	Some available, depends on species
Weeds	All	No	Yes	Yes
Fire	None	N/A	N/A	Yes
Rats	All	Yes	No	Currently being developed

Management History

- 1993: HIHNP conducts rare resource surveys along Koolau Summit Trail through Koloa
- 1997: First OANRP record of an endangered plant in Koloa.
- 1998: First OANRP record of *A. livida*.
- 1998: Incipient weed taxa *Hedychium coronarium* and *H. gardnerianum* control begins.
- 2002: Predator control around *A. livida* begins.
- 2005: Last sighting of *H. coronarium* and *H. gardnerianum* in Koloa.
- 2009: MU Fenceline scoped. MU fence construction begins.
- Sept. 2011: MU fence construction begins and WCA boundaries are drawn. Container cabin flown to Puu Kainapuaa to serve as fence contractor campsite. When the eastern fenceline is completed, the container cabin will be flown to the site of the old Kahuku Cabin, and will be used to facilitate staff work trips.

1.2.2.2 Ungulate Control

Identified Ungulate Threats: Pigs

Threat Level: High

Primary Objective:

- Maintain MU as ungulate free.

Strategy:

- Maintain the fenced area as ungulate-free by maintaining fence and using transects to monitor for sign.

Monitoring Objectives:

- Conduct quarterly fence checks and fences across streams after storms.
- Note any pig sign while conducting day to day actions within fenced MU.

Management Responses:

- If any pig activity is detected in the fence area, implement snaring program. (Snares still remain within the MU, but not set. If ungulate sign is detected they will be reset.)

Fence Completions:

- Fence construction started September 2011 and is scheduled to be completed before the end of the calendar year or beginning of 2012.

Maintenance Issues:

The MU fence is 4.5 kilometers long and encompasses 164 acres. The major threats to the perimeter fence include fallen trees, vandalism, stream crossings, and flooding. Waterfalls in Koloa provide excellent natural barriers against ungulates and strategic areas for the fence to tie into to avoid the need to cross streams and create fence sections that are vulnerable to extreme weather events such as flooding. Special emphasis will be placed on checking the fence after extreme weather events. Monitoring for ungulate sign will occur during the course of other field activities. The fence will be kept clear of vegetation (especially grasses) to facilitate quarterly monitoring. This weed control is discussed in the Weed Control section.

Ungulate Management Locations at Koloa

Map removed, available
upon request

1.2.2.3 *Weed Control*

Weed Control actions are divided into 4 subcategories:

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

These designations facilitate different aspects of MIP/OIP requirements.

Vegetation Monitoring

Vegetation monitoring protocols used in other MUs may not be feasible in Koloa MU. Due to the relatively intact condition of the Northern Koolau summit region, current monitoring practices would increase traffic through the MU and may negatively impact the area by introducing weedy species normally found in the fence corridors and trails. Possible alternatives to transect monitoring may be

aerial monitoring surveys, remote vegetation mapping, or a combination of both. Utilizing new technologies and methodologies to develop vegetation monitoring protocols is a priority for this MU.

Objectives:

- Develop vegetation monitoring protocol for Koloa MU.
- Conduct vegetation monitoring for Koloa MU every three years.
- Produce vegetation map every three years for comparative analysis of weeding efforts.

Surveys

Army Training: No. The Army conducts helicopter training in Kawaiiloa, immediately south and West of Koloa. Also, soliders may hike the summit trail, although this is uncommon.

Other Potential Sources of Introduction: OANRP staff, public hikers, rats, and birds.

Survey Locations: landing zones, summit trail, camp sites, high traffic areas (fencelines and cabin).

Management Objective:

- Prevent the establishment of any new invasive alien plant or animal species through regular surveys along trails, LZs, campsites and other high traffic areas (as applicable).

Monitoring Objectives:

- Quarterly surveys of LZs (if used, LZ Norton once annually).
- Quarterly survey of Kahuku Cabin campsite (if used).
- Annual survey of the Koolau Summit Trail/fenceline.
- Note unusual, significant or incipient alien taxa during the course of regular field work.

Management Responses:

- Novel alien taxa found will be researched and evaluated for distribution and life history. If taxa found to pose a major threat, control will begin and will be tracked via ICAs.

Surveys are designed to be the first line of defense in locating and identifying potential new weed species. Koloa currently remains unaffected by highly invasive weed species that infect surrounding areas, such as *Angiopteris evecta* in Kaipapau to the east, and *Falcataria moluccana* and *Leptospermum scoparium* in Waialele, Kaiwikoele, and Kawainui. OANRP currently control *F. moluccana* and *L. scoparium* in the surrounding areas to prevent their spread west into the Koloa MU.

Incipient Taxa Control (ICAs)

Management Objectives:

- As feasible, eradicate high priority species identified as incipient invasive aliens in the MU by 2014.
- Conduct seed dormancy trials for all high priority incipients by 2014.
- Identify potential paths of contamination and develop strategies to decontaminate gear when working in densely infested incipient areas.

Monitoring Objectives:

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

Management Responses:

- If unsuccessful in preventing immature plants from maturing, increase ICA revisit interval.

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. Staff will compile this information for each ICA species.

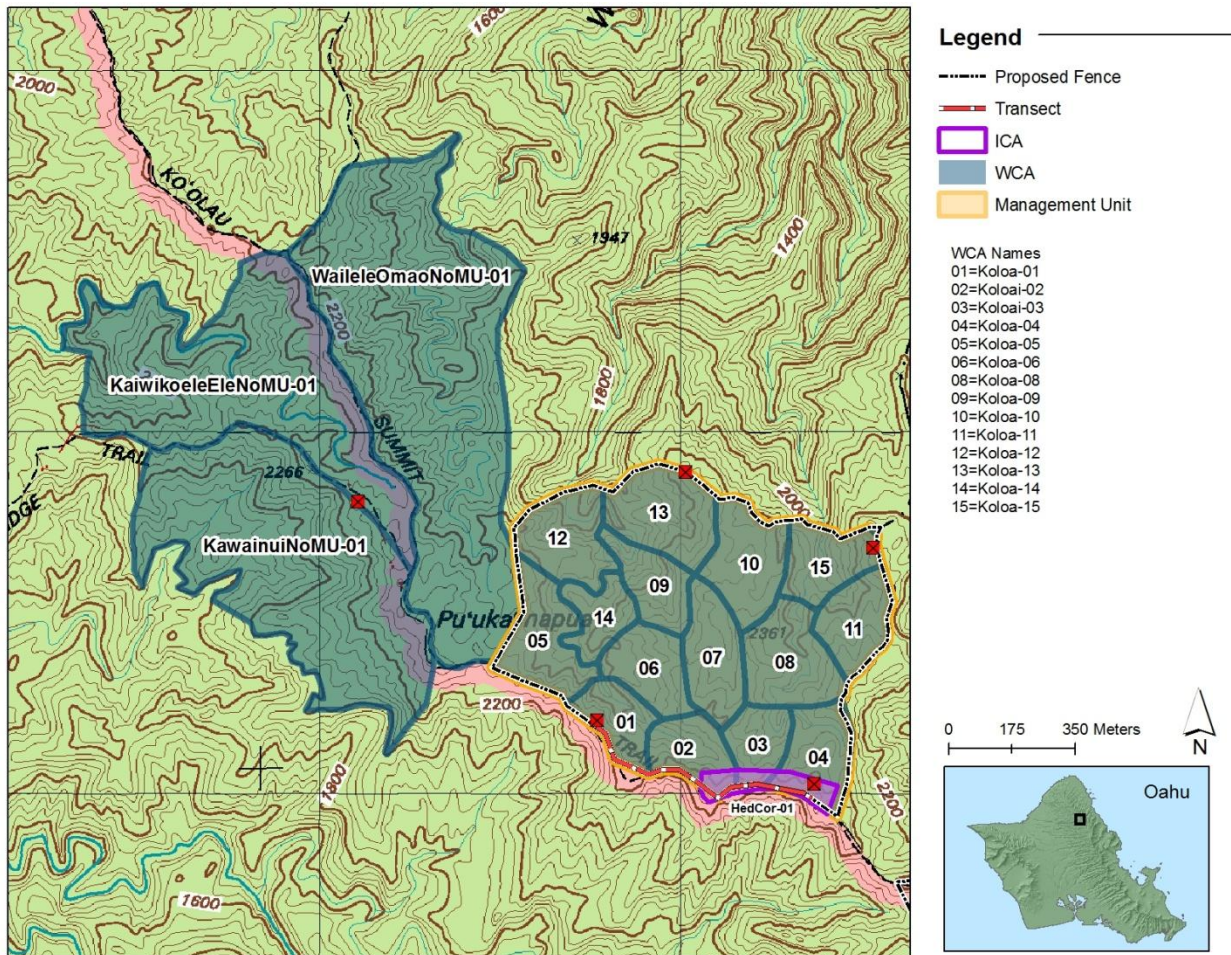
The table below summarizes invasive taxa at Koloa. While the list is by no means exhaustive, it provides a good starting point for discussing which taxa should be targeted for eradication in an MU. ICAs are not designated for every species in the table below; however, occurrences of all species in the table should be noted by field staff. All current ICAs are mapped. Three management designations are possible: Incipient (small populations, eradicable), Control Locally (significant threat posed, may or may not be widespread, control feasible at WCA level), and Widespread (common weed, may or may not pose significant threat, control feasible at WCA level).

Summary of Target Taxa

Taxa	Management Designation	Notes	No. of ICAs
<i>Andropogon virginicus</i>	Control locally	<i>A. virginicus</i> tends to show up along trails and cliffs. Target to keep off cliffs as difficult to control in steep areas.	0
<i>Angiopteris evecta</i>	Control locally	Incidental observations of <i>A. evecta</i> around the MU have been made. Plants seen should be GPSed and removed manually on discovery. The adjacent Kaipapa'u MU is infested with this taxa, which feeds spores into Koloa. Control is a high priority. Control any plants found during regular weed sweeps. Also control plants seen outside the MU, if near the fence.	0
<i>Clidemia hirta</i>	Widespread	<i>C. hirta</i> is a well established part of the Koolau vegetation type. OANRP do not currently target it for control, except in the vicinity of rare taxa	0
<i>Erigeron karvinskianus</i>	Control locally	Status of this species in the MU is unknown. Note locations of <i>E. karvinskianus</i> during regular control work. Evaluate whether species should be a target once have additional distribution information. This taxa is a threat to open cliff communities.	0
<i>Falcataria moluccana</i>	Control locally	Not known in Koloa at this time, but known from adjacent area in Kawainui. Target for control during regular weed sweeps.	0
<i>Hedychium coronarium</i>	Incipient	There is one site of this taxa in Koloa along the Summit trail. No plants have been found for 5 years. The ICA will be checked annually, until staff determine that there is no seed bank present.	1
<i>Leptospermum scoparium</i>	Control locally	Not known in Koloa at this time, however control at surrounding areas Waialele, Kaiwikoele, and Kawainui, is ongoing to prevent the spread of <i>L. scoparium</i> into Koloa.	0
<i>Melaleuca quinquenervia</i>	Control locally	A few trees were treated in adjacent Waialele gulch by KMWP in 2010. If seen in the MU, this taxa will be targeted during regular weed sweeps.	0

<i>Pterolepis glomerata</i>	Widespread	This Melastome is ubiquitous across the Koolaus. It thrives in disturbed areas, particularly pig wallows. NRS do not currently target it for control.	0
<i>Psidium cattleianum</i>	Widespread	Patches scattered across Koloa. Primary target of WCA sweeps. The largest and thickest stands tend to be in gulches and draws. In areas with difficult terrain, staff will investigate alternative control techniques, such as Herbicide Ballistic Technology and aerial ball spraying.	0
<i>Setaria palmifolia</i>	Not present	None known from MU. If any <i>S. palmifolia</i> is found, it will be evaluated for control as an ICA	0
<i>Sphaeropteris cooperii</i>	Control locally	No plants known in MU, but individuals known from scattered locations across the Koolaus. <i>S. cooperii</i> will be targeted during regular weed sweeps.	0

Incipient and Weed Control Areas



Ecosystem Management Weed Control (WCAs)

OIP Goals:

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

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

Management Responses:

- Increase/expand weeding efforts if MU vegetation monitoring (conducted periodically, interval and technique to be determined) indicates that goals are not being met.

Koloa is dominated by native taxa, and may already meet the goal of 50% or less cover of alien vegetation across the MU. The major weed threat in the MU is *P. cattleianum*, which has the potential to form dense monotypic stands, and is a dominant presence in other areas of the Koolau Mountains. Weed control in Koloa will focus on conducting ground sweeps across all walkable portions of the MU, targeting *P. cattleianum* and other weeds (listed in the Summary Target Taxa table above). The entire MU has been divided into Weed Control Areas (WCAs) to assist in tracking and scheduling control efforts. WCAs will be weeded on a rotational basis given the difficulty of access, terrain, and limited staff resources. Staff will use aerial and ground surveys to guide control efforts

The WCAs that are most accessible, have the gentlest terrain, the most rare resources, and the fewest weeds will be prioritized for control.

In general, weed sweeps involve all staff lining up and walking in a phalanx across a WCA, treating every target weed seen. In the dense and often steep terrain of the Koolaus, this method is modified, with some staff acting as ‘spotters’ from ridges and other vantage points, directing other staff to the target weeds. Binoculars are critical for this spot-and-treat method. The goal of a sweep is to survey and achieve complete coverage of a WCA.

WCA: Koloa-01

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: Weed sweeps can be performed in this WCA from the Summit Trail north and down to the river. However the North side of the stream is too steep to do sweeps. To minimize the impact to the area, and for safety concerns of our staff, sweeps will be done via Spot-and-treat method: spotting from open ridges with binoculars and directing other staff to the plants for treatment (as described above).

WCA: Koloa-02

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: This WCA is the most fragile in the MU, and contains large populations of *V. oahuensis*, *C. rockii*, *C. humboltiana*, *C. calycina*, and the *H. nutans*, among others. To minimize the impact to the area, sweeps will be done via Spot-and-treat method with extreme care taken to minimize disturbing native habitat.

WCA: Koloa-03

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: This WCA is home to a large population of *C. rockii*, and consists of many small ridges and gulches. Weed sweeps can be performed across the entire WCA.

WCA: Koloa-04

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: This WCA surrounds the camp site, borders the Kaipapau MU, and consists of more Endangered species than any other WCA. Plants found in this WCA include *C. calycina*, *C. koolauensis*, *C. viridiflora*, *H. arbuscula* sp., *L. gaudichaudii* ssp. *gaudichaudii*, *V. oahuensis*, *Z. oahuensis*, and a large population of *C. rockii*. Half of this WCA is relatively open and weed sweeps in this area can be completed quickly with no damage to the Endangered taxa. In the other half, to minimize the impact to the area, weed sweeps will be done via Spot-and-treat method.

WCA: Koloa-05

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: This WCA is the most southwest in the MU and consists of many small gulches and ridges. Weed sweeps can be performed in this entire WCA from the Summit Trail to the north, and from the west fence line to the East boundary, which is the river.

WCA: Koloa-06

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: Part of this WCA consists of extremely degraded pasture like habitat which makes weed sweeps quick. This WCA would benefit greatly from common plant reintroductions. The area likely will benefit from being pig-free, and native vegetation may recover on its own, otherwise sweeps for *P. cattleianum* and tree weed will be conducted. Photopoints should be installed to document any potential recovery.

WCA: Koloa-07

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: Part of this WCA consists of extremely degraded pasture like habitat which makes weed sweeps quick. This WCA would benefit greatly from common plant reintroductions. The area likely will benefit from being pig-free, and native vegetation may recover on its own, otherwise sweeps for *P. cattleianum* and tree weed will be conducted. Photopoints should be installed to document any potential recovery.

WCA: Koloa-08

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: To minimize impact to the area, and for safety concerns of our staff, sweeps will be done via Spot-and-treat method: spotting from open ridges with binoculars and directing other staff to the plants for treatment.

WCA: Koloa-09

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: This WCA is steep. To minimize the impact to the area, and for safety concerns of our staff, sweeps will be done via Spot-and-treat method, and may be a candidate for remote/aerial control techniques.

WCA: Koloa-10

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: This WCA for the most part is relatively flat; full weed sweeps can be used.

WCA: Koloa-11

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: To minimize the impact to the rare plants in this area, and for safety concerns of our staff, sweeps will be done via Spot-and-treat method: spotting from open ridges with binoculars and directing other staff to the plants for treatment. This WCA borders the Kaipapau MU.

WCA: Koloa-12

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: This WCA is the most northwest and is very steep. To minimize the impact to the area, and for safety concerns of our staff, sweeps will be done via Spot-and-treat method: spotting from open ridges with binoculars and directing other staff to the plants for treatment. Area has not been well surveyed yet.

WCA: Koloa-13

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: This WCA is very steep. To minimize the impact to the area, and for safety concerns of our staff, sweeps will be done via Spot-and-treat method: spotting from open ridges with binoculars and directing other staff to the plants for treatment. Area has not been well surveyed yet.

WCA: Koloa-14

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: The West boundary of this MU is the river at the bottom of the west gulch. To minimize the impact to the area, and for safety concerns of our staff, sweeps will be done via Spot-and-treat method: spotting from open ridges with binoculars and directing other staff to the plants for treatment. Area has not been well surveyed yet.

WCA: Koloa-15

Veg Type: Wet Montane

OIP Goal: 25% or less alien cover (rare taxa in WCA).

Target: *P. cattleianum*, tree weeds

Notes: This WCA is the most North East and is very steep. To minimize the impact to the area, and for safety concerns of our staff, sweeps will be done via Spot-and-treat method: spotting from open ridges with binoculars and directing other staff to the plants for treatment. Area has not been well surveyed yet.

WCA: KawainuiNoMU-

Veg Type: Wet Montane

OIP Goal: None (not in MU)

Target: *L. scoparium*, *A. evecta*

Notes: This WCA is steep and comprised of many small ridges and gulches. To minimize the impact to the area, and for safety concerns of our staff, sweeps will be done via Spot-and-treat method: spotting from open ridges with binoculars and directing other staff to the plants for treatment.

WCA: KaiwikoeleEleNoMU-01

Veg Type: Wet Montane

OIP Goal: None (not in MU)

Target: *L. scoparium*, *A. evecta*

Notes: This WCA once held a large population of *L. scoparium* but has since been swept a few times. Remnant seedlings and immature plants continue to sprout and will require additional visits to maintain the low numbers left in this area. This WCA is relatively easy to work in as it is generally flat and not as heavily vegetated as the surrounding areas.

WCA: WaialeleOmaoNoMU-01

Veg Type: Wet Montane

OIP Goal: None (not in MU)

Target: *L. scoparium*, *A. evecta*

Notes: This WCA has been swept in the past, but continues to produce *L. scoparium* plants. This WCA has extremely steep walls as well as has a relatively flat gulch bottom with a stream running through the center. To minimize the impact to the area, and for safety concerns of our staff, sweeps will be done via Spot-and-treat method: spotting from open ridges with binoculars and directing other staff to the plants for treatment

1.2.2.4 Rodent Control

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

Threat level: High

Current control method: Bait station & snap trap grids (localized control)

Seasonality: Year-round.

Number of control grids: 1

Acceptable Level of Activity: No MU-wide control program planned currently. Acceptable level of activity at localized sites is unknown.

Available tools: Rodenticide /Bait Stations, Aerial Broadcast, Hand Broadcast, Snap Traps, Tracking Tunnels, Chew Tabs

Primary Objective:

- To maintain rat/mouse populations to a level that facilitates stabilized or increasing snail and plant populations across the MU by the most effective means possible.

Management Objective:

- Continue to maintain bait station and snap trap grids (localized control) around individual *A. livida* populations in the short term. Try to implement self-resetting snaps for local control.
- Implement rodent control if determined necessary for protection of plant populations. Monitor susceptible species for evidence of rodent impacts.

Monitoring Objectives:

- Trap data and tunnels will be used to guide efforts to control rats.

Rodent Control:

- OANRP currently controls rodents around the *A. livida* population twice a quarter. Also, tracking tunnels are placed along the summit trail throughout the MU and are currently checked once a quarter to determine how effective a small bait grid around the population is. If new snail populations are found in the MU, we will evaluate the need for rat control and install additional grids if needed.

1.2.2.5 Slug Control

Species: Slugs (multiple species assumed present but no collections to date)

Threat level: High

Current control method: Localized

Seasonality: Wet season (September-May)

Number of species: *Cyrtandra viridiflora*, *Cyanea acuminata*, *Phyllostegia hirsuta*, *Viola oahuensis*, *C. koolauensis*

Acceptable Level of Activity: No control program planned currently and threshold not determined for threats.

Primary Objective:

- Reduce slug population to levels where germination and survivorship of rare plant taxa are unimpeded.

Monitoring Objective:

- Determine slug species present and estimate baseline densities using traps baited with beer.
- Determine monitoring methods for *C. humboldtiana* and *Lobelia gaudichaudii* ssp. *gaudichaudii*
- If Sluggo is deployed, monitor efficacy via beer traps.
- Annual census monitoring of slug densities during wet season.

Management Objectives:

- If slug numbers are high enough to damage native plants, survey areas for the presence of rare snails. If no rare snails are present begin slug control using Sluggo at the label rate.
- Additional threats will be assessed and control options weighed.

1.2.2.6 Predatory Snail Control

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

Threat level: High

Control level: Unknown (need to do surveys)

Seasonality: Year-round

Number of sites: 1(*Achatinella livida*), but no control currently underway.

Acceptable Level of Activity: No activity tolerated in proximity to *A. livida*

Primary Objectives:

- Eradicate predatory snail populations to a level optimal for *A. livida* survival.
- Scope jail locations for *A. livida*

Monitoring Objective:

- Annual or every other year census monitoring of *A. livida* population(s) to determine population trend.
- Annual searches for predatory snails to confirm absence/presence in proximity to *A. livida*.

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).

1.2.2.7 Ant Control

Species: Unknown

Threat level: Unknown

Control level: Only for new incipient species

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

Number of sites: No ants have been observed at Koloa. Suggested sites to survey in the future are the Koloa cabin, and the Northern LZ which is adjacent to the *A. livida* population.

Acceptable Level of Activity: Unknown

Primary Objectives:

- Determine what ant species are present and monitor these sites over time.

Monitoring Objective:

- Continue to sample ants at human entry points Koloa cabin, Northern LZ, and Koolau Summit Trail at a minimum of once a year. Use samples to track changes in existing ant densities and to alert OANRP to any new introductions.

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 with AMDRO.

1.2.2.8 Fire Control

Threat Level: Low.

Available Tools: Fuelbreaks, Visual Markers, Helicopter Drops, Wildland Fire Crew.

Management Objective:

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

Preventative Actions:

Koloa is a wet montane forest with a very low threat of fire. No preventative actions are needed.

Action Table

Action Type	Actions	OIP Year 5 Oct 2011- Sept 2012				OIP Year 6 Oct 2012- Sept 2013				OIP Year 7 Oct 2013- Sept 2014				OIP Year 8 Oct 2014- Sept 2015				OIP Year 9 Oct 2015- Sept 2016			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Vegetation Monitoring	Conduct baseline vegetation monitoring across MU																				
	Conduct MU vegetation monitoring every 3 years																				
General Survey	Survey Koloa Cabin LZ whenever used, no more than once per quarter. If not used, do not need to survey.																				
	Survey Northern LZ whenever used, no more than once per quarter. If not used, do not need to survey.																				
	Survey Koloa/Kaiapapau LZ whenever used, no more than once per quarter. If not used, do not need to survey.																				
	Survey Koloa Midridge LZ whenever used, no more than once per quarter. If not used, do not need to survey.																				
	Survey the Kahuku Cabin campsite whenever used, no more than once per quarter. If not used, do not need to survey.																				
	Survey the transect along the fenceline/Koolau summit trail between Kahuku Cabin and Northern LZ annually.																				
	Survey LZ Norton/Kainapuaa annually																				
General WCA	GPS boundaries of all current WCAs																				
	Install photopoints at select locations in WCA 6 and 7. (Re-take annually, or every 3-5 years).																				

Action Type	Actions	OIP Year 5 Oct 2011- Sept 2012				OIP Year 6 Oct 2012- Sept 2013				OIP Year 7 Oct 2013- Sept 2014				OIP Year 8 Oct 2014- Sept 2015				OIP Year 9 Oct 2015- Sept 2016			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
ICA	KLOA-HedCor-01: Monitor/control Hedcor in Kahuku cabin vicinity annually.		█				█				█				█				█		
	KLOA-HedCor-01: Survey area around known locations; check out mini gulches. Easiest to do with 4 people. Define ICA. GPS.		█																		
WCA'S Koloa-01 (Northern LZ)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.										█										
Koloa-02 (Hupnut site)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.									█											
Koloa-03 (Between Hupnut WCA and Camp WCA)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years..				█																
Koloa-04 (Cabin WCA)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.			█																	
Koloa-05 (South West WCA, West of Northern LZ WCA)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.																█				
Koloa-06 (Mid ridge to bottom of West gulch)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.															█					
Koloa-07 (Mid ridge to Puu 2361)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.														█						
Koloa-08 (Puu 2361 across East gulch)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.											█									

Action Type	Actions	OIP Year 5 Oct 2011- Sept 2012				OIP Year 6 Oct 2012- Sept 2013				OIP Year 7 Oct 2013- Sept 2014				OIP Year 8 Oct 2014- Sept 2015				OIP Year 9 Oct 2015- Sept 2016							
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3				
Koloa-09 (Mid ridge to bottom of West gulch, North of 6)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.																					/			
Koloa-10 (Midridge to 2361 ridge)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.																	/							
Koloa-11 (Kaipapau side)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.												/												
Koloa-12 (North West corner with huge waterfall)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.						/																/		
Koloa-13 (Mid ridge to WCA 12)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.							/																/	
Koloa-14 (West river towards Mid ridge)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.								/																/
Koloa-15 (North East Corner)	Conduct canopy weed control across WCA. Focus effort around rare plant sites. Re-sweep every 3-5 years.																								
KawainuiNoMU-01	Monitor/control LepSco north of Koloa, west of summit trail. Coordinate efforts with KMWP, if possible. Focus on stopping southern spread of LepSco. Sweep LepSco areas every 3 years, but revisit hotspots annually (as needed).						/	/	/		/				/								/	/	/

Action Type	Actions	OIP Year 5 Oct 2011- Sept 2012				OIP Year 6 Oct 2012- Sept 2013				OIP Year 7 Oct 2013- Sept 2014				OIP Year 8 Oct 2014- Sept 2015				OIP Year 9 Oct 2015- Sept 2016			
		4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
KaiwikoeleEleNoMU-01	Monitor/control LepSco at Kainapuaa, between summit trail and Kawaioloa trail. Coordinate efforts with KMWP, if possible. Focus on stopping southern spread of LepSco. Sweep LepSco areas every 3 years, but revisit hotspots annually (as needed).																				
WaileleOmaoNoMU-01	Monitor/control LepSco north of Koloa, east of summit trail. Coordinate efforts with KMWP, if possible. Focus on stopping southern spread of LepSco. Sweep LepSco areas every 3 years, but revisit hotspots annually (as needed).																				
Ungulate Control	Fence and cabin construction																				
	Monitor fence integrity quarterly																				
	Set up and check snares until pig free																				
Rodent Control	Restock bait boxes and snap traps																				
	Implement localized rodent control if determined to be necessary for the protection of rare plants.																				
Ant Control	Conduct surveys for ants at 2 human entry points (Hunter’s Cabin, Mokuleia Trailhead)																				
	Implement control if deemed necessary																				
Predatory Snail Control	Determine whether <i>O. allarius</i> is present in proximity to <i>A. livida</i>																				
	If predatory snails are found begin hand-removal or exclosure construction																				
Slug Control	Determine slug species present and estimate baseline densities to help guide future control if deemed necessary																				

Hatching=Quarter Scheduled