1.3.3 Lower Ohikilolo  

Ecosystem Restoration Management Plan  

MIP Year 7-11, Oct. 2010 – Sept. 2015  

MU: Lower Ohikilolo  

**Overall MIP Management Goals:**  

- Form a stable, native-dominated matrix of plant communities which support stable populations of IP taxa.  
- Control ungulate, rodent, fire, and weed threats to support stable populations of IP taxa. Implement control methods by 2013.  

**Background Information**  

**Location:** Northern Waianae Mountains  

**Land Owner:** US Army Garrison Hawaii  

**Land Manager:** Oahu Army Natural Resources Program (OANRP)  

**Acreage:** 10.5  

**Elevation Range:** 100 – 400ft.  

**Description:** Lower Ohikilolo MU is located in the Makua Military Reservation (MMR). It lies in the southwestern corner of Makua valley, on the bottom section of Ohikilolo ridge that curves to parallel the ocean. This MU is accessed via the Makua firebreak road and consists of rocky cliffs. While the MU is home to large populations of endangered plants, the overall landscape is highly degraded and weedy, and very fire-prone. The majority of rare taxa management is focused on reducing fuel loads to minimize the risk of fire. Overall, Lower Ohikilolo is dominated by *Panicum maximum* which requires substantial labor to manage. Thus NRS will not manage the entire MU to the same level. Weed control will be focused only around the rare plant populations which consist mostly of weedy grasses and shrubs. However, as a consequence of recent OANRP weeding actions, the WCA’s are increasingly being dominated by native shrubs and plants including the endangered *Chamaesyce celastroides* var. *kaenana* and *Hibiscus brackenridgeii* subsp. *mokuleianus* populations.  

### Native Vegetation Types  

<table>
<thead>
<tr>
<th>Waianae Vegetation Types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lowland Dry Shrubland/ Grassland</strong></td>
</tr>
<tr>
<td><strong>Canopy includes:</strong> <em>Erythrina sandwicensis, Myoporum sandwicense, Dodonaea viscosa, Santalum ellipticum, Melanthera tenuifolia, Hibiscus brackenridgeii</em> subsp. <em>mokuleianus.</em></td>
</tr>
<tr>
<td><strong>Understory includes:</strong> <em>Heteropogon contortus, Sida fallax, Eragrostis variabilis, Abutilon incanum, Leptecophylla tameiameiae, Chamaesyce celestroides, Waltheria indica, Bidens</em> sp.</td>
</tr>
<tr>
<td><strong>NOTE:</strong> For MU monitoring purposes vegetation type is mapped based on theoretical pre-disturbance vegetation. Alien species are not noted.</td>
</tr>
</tbody>
</table>
Vegetation Types at Lower Ohikilolo

Lower Ohikilolo MU.  
*C. celastroides* var. *kaenana* patch

Picture taken from the upper section of the *H. brackenridgei* subsp. *Mokuleianus*, showing the terrain of the MU.

### MIP/OIP Rare Resources

<table>
<thead>
<tr>
<th>Organism Type</th>
<th>Species</th>
<th>Pop. Ref. Code</th>
<th>Population Unit</th>
<th>Management Designation</th>
<th>Wild/Reintroduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td><em>Chamaesyce celastroides</em> var. <em>kaenana</em></td>
<td>MMR-D</td>
<td>Makua</td>
<td>Manage for Stability</td>
<td>Wild</td>
</tr>
<tr>
<td>Plant</td>
<td><em>Hibiscus brackenridgei</em> subsp. <em>mokuleianus</em></td>
<td>MMR-A MMR-F</td>
<td>Makua</td>
<td>Manage for Stability</td>
<td>Wild Augmentation</td>
</tr>
<tr>
<td>Plant</td>
<td><em>Melanthera tenuifolia</em></td>
<td>MMR-D</td>
<td>Ohikilolo</td>
<td>Genetic Storage Collection</td>
<td>Wild</td>
</tr>
</tbody>
</table>

MFS = Manage for Stability  
GSC = Genetic Storage Collection
## Locations of Rare Resources at Lower Ohikilolo

**Map removed, available upon request**

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### MU Threats to MIP Taxa

<table>
<thead>
<tr>
<th>Threat</th>
<th>Taxa Affected</th>
<th>Localized Control Sufficient?</th>
<th>MU scale Control required?</th>
<th>Control Method Available?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs</td>
<td>All</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Goats</td>
<td>All</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Rats</td>
<td>All</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Ants</td>
<td>All</td>
<td>Yes</td>
<td>No</td>
<td>Toxicants exist, but are not effective for all species</td>
</tr>
<tr>
<td>Weeds</td>
<td>All</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Fire</td>
<td>All</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Note: Localized control is distinct unit within the MU separated by geographic or fence barrier*
Other Rare Taxa at Lower Ohikilolo MU

<table>
<thead>
<tr>
<th>Organism Type</th>
<th>Species</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td><em>Capparis sandwicensis</em></td>
<td>Species of concern</td>
</tr>
<tr>
<td>Plant</td>
<td><em>Spermolepis hawaiiensis</em></td>
<td>Endangered</td>
</tr>
</tbody>
</table>

Rare Resources at Lower Ohikilolo

*Hibiscus brackenridgei* subsp. *mokuleianus*  
*Chamaesyce celastroides* var. *kaenana*

*Spermolepis hawaiiensis*  
*Melanthera tenuifolia*
Management History

- 1970: Fire from military training burns Makua Valley
- 1984: Fire from military training burns Makua Valley
- 1995: Escaped prescribed fire in Makua burns part of the valley
- 1998: Fire burns part of Lower Ohikilolo MU.
- 1998: Live fire training ceased as a result of a law suit by Malama Makua.
- 2000: Perimeter fence was completed that separates Makua Valley from the adjoining Ohikilolo Ranch.
- 2001: *H. brackenridgei* subsp. *mokuleianus* and *Chamaesyce celastroides* var. *kaenana* found at MU.
- 2001: Grass control begins.
- 2003: Escaped prescribed fire in Makua burns half of the valley.
- 2003: A breach in the fence allows goats to cross over into Makua Valley. Goats are removed and fence is repaired.
- 2006: Breach in the fence is repaired and goats are caught.
- 2007-2008: Needed repairs are made in the Ohikilolo ridge fence, goats continue to breach some areas of the fence.

Ungulate Control

**Identified Ungulate Threats: Pigs and Goats**

**Threat Level:** High

**Primary Objective:**

- Maintain all of Makua valley as goat free.

**Secondary Objective:**

- Control pigs if they affect endangered plants in this MU.

**Strategy:**

- Ohikilolo ridge fence creates a barrier for goat access from Ohikilolo Ranch and Makaha Valley, while pig activity in the area has historically been minimal.

**Monitoring Objectives:**

- Conduct Ohikilolo Ridge fence checks quarterly (Blue team) and monitor fence for fire damage and vandalism.
- Monitor for pig sign while conducting management actions in the MU.

**Management Responses:**

- Implement pig control via snaring if localized damage to plants is observed.

**Maintenance Issues**

- The major threats to the Ohikilolo Ridge fence include fire, vandalism, and erosion.
Weed Control

Weed Control actions are divided into 4 subcategories:

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

These designations facilitate different aspects of MIP/OIP requirements.

Vegetation Monitoring

Objectives:

- Due to small size and highly degraded nature of MU, transect protocols implemented at other MUs are not appropriate here. Instead, we assume current alien vegetation management practices are sufficient to decrease fuels and increase the rare plant populations. Recruitment of new rare
taxa seedlings and increase of native plant vegetation will be monitored to determine if time intervals between scheduled weeding are sufficient.

**Surveys**

**Army Training:** Yes

**Other Potential Sources of Introduction:** Public visitors, Natural Resource Management staff, Makua access events, close proximity to road.

**Survey Locations:** Roads, Fences, and LZ’s.

**Management Objective:**

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

**Monitoring Objectives:**

- Firebreak road survey annually
- Survey army LZ’s annually
- Annual surveys of fencelines and main access trail. Additionally, during course of regular planned actions for endangered taxa, unusual weeds encountered will be noted.

**Management Responses:**

- New weeds found during surveys and will be added as ICA’s if they are deemed a serious threat to the MU. MMR-NoMU firebreak road surveys and LZ’s are managed, as weed control of these areas is necessary to prevent fire from reaching endangered taxa.

**Incipient Taxa Control (ICAs)**

**Management Objective:**

- As feasible, eradicate high priority species identified as incipient invasive aliens in the MU by 2015.
- Seed dormancy trials for *P. setaceum*.

**Monitoring Objective:**

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

**Management Responses:**

If unsuccessful in preventing immature plants from maturing, increase ICA revisitation 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. NRS will compile this information for each ICA species. ICA species include *Pennisetum setaceum* and *Caesalpinia decapetala*. During regular actions, the occurrence of *P. setaceum* ICA is monitored, and *C. decapetala* is checked during the firebreak road survey.
The table below summarizes incipient invasive taxa at Lower Ohikilolo. Appendix 3.1 of the MIP lists significant alien species and ranks their potential invasiveness and distribution. Each species is given a weed management code: 0 = not reported from MU, 1 = incipient (goal: eradicate), 2 = control locally. While the list is by no means exhaustive, it provides a good starting point for discussing which taxa should be targeted for eradication in an MU. NRS supplemented and updated Appendix 3.1 with additional target species identified during field work and communication with NARS staff. In many cases, the weed management code assigned by the MIP has been revised to reflect field observations. ICAs are not designated for every species in the table below; however, occurrences of all species in the table should be noted at Lower Ohikilolo.

### Summary of Potential ICA Target Taxa

<table>
<thead>
<tr>
<th>Taxa</th>
<th>MIP Weed Code</th>
<th>Discussion/Notes</th>
<th>No. of ICAs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Original</td>
<td>Revised</td>
<td></td>
</tr>
<tr>
<td>C. decapetala</td>
<td>1</td>
<td>1 Old point found on road survey. Monitor for future spread on survey.</td>
<td>1</td>
</tr>
<tr>
<td>P. setaceum</td>
<td>1</td>
<td>1 Monitor/control PenSet in Lower Chamaesyce patch annually. Only 1 plant ever found here in 2006.</td>
<td>1</td>
</tr>
</tbody>
</table>

Staff working around *C. celastroides*
**Ecosystem Management Weed Control (WCAs)**

**MIP Goals:**
- Within 2m of rare taxa: 0% alien vegetation cover without harming rare taxa
- Within 50m of rare taxa: 0% alien canopy, 10% or less alien grasses, 25% or less alien understory
- Throughout the remainder of the MU: 50% or less alien vegetation cover

**Management Objectives:**
- Throughout remainder of MU (Priority 2) to reach 50% or less alien vegetation cover. This is the tan shaded area on the WCA map (see above)

**Management Responses:**
- Increase/expand weeding efforts if current management is insufficient to stop weed spread or shorter intervals are needed between weeding efforts

Weed control in Lower Ohikilolo by OANRP has mostly been conducted around populations of wild and reintroduced rare plants. The overall weed management strategy for the MU is focused on fuel reduction of large patches of *Panicum maximum* and *Rhynchelytrum repens*. A 20m buffer around the outside of
each WCA will be cleared as an additional weed control strategy, where removal of *Leucaena leucocephala* will be a priority. Herbicide control of weeds is varied, with Fusilade, a grass-specific herbicide, used around rare taxa, along with hand-pulling weeds. Roundup is applied to the remainder of the WCA; while Oust, a pre-emergent herbicide, is applied downslope of rare taxa to suppress the seed bank after initial knockdown of weeds using Roundup. To prevent re-sprouts of *L. leucocephala* in the extended buffer area around the WCA’s, Garlon is applied. Much of the native cover in Lower Ohikilolo is dominated by *Dodonaea viscosa, Waltheria indica, Abutilon incanum, Sida fallax,* and *Santalum ellipticum*. *D. viscosa* are numerous throughout the MU and provide shade for a break in monotypic areas of *P. maximum*. The MU is very weedy except for patches around *D. viscosa*, and these weeds include *P. maximum, L. leucocephala, Leonotis nepetifolia, R. repens,* and *Acacia farnesiana*.

**Lower Ohikilolo WCA-01** (Lower Chacel)

*Veg Type:* Dry Shrubland/Grassland  
*MIP Goal:* Less than 25% non-native cover  
*Targets:* *P. maximum, L. leucocephala, L. nepetifolia*

**Notes:** *C. celastroides var. kaenana* is centered in this WCA. This area is very steep with exposed rock faces, with the bottom of the WCA tapering off to a flat area. Weedy grasses are prevalent throughout the WCA, especially near the top and bottom. The WCA is very dry with limited overstory and is dominated by non-native *P. maximum, L. leucocephala, L. nepetifolia, R. repens,* and *A. farnesiana,* and the natives *W. indica, A. incanum, S. fallax*. Overstory taxa are limited to the native *D. viscosa*. Treatment of weeds is done by backpack sprayer and handpulling around managed taxa. A change in weed composition from *P. maximum* and *R. repens* to monotypic *L. nepetifolia* has recently occurred following the application of Oust near the bottom of the patch.

**Lower Ohikilolo WCA-02** (Upper Chacel)

*Veg Type:* Dry Shrubland/Grassland  
*MIP Goal:* Less than 25% non-native cover  
*Targets:* *P. maximum*

**Notes:** *C. celastroides var. kaenana* is centered in this WCA. This area is very steep with exposed rock faces leading up to the ridgeline. Large *D. viscosa* are filling in the WCA following control of monotypic *P. maximum*. The WCA is dominated by non-native *P. maximum, L. leucocephala, L. nepetifolia, R. repens,* and *A. farnesiana,* and the natives *W. indica, S. ellipticum, A. incanum*. Overstory taxa are limited to the native *D. viscosa*. Treatment of weeds is done by backpack sprayer and handpulling around managed taxa.

**Lower Ohikilolo WCA-03** (Hibbra Patch)

*Veg Type:* Dry Shrubland/Grassland  
*MIP Goal:* Less than 25% non-native cover  
*Targets:* *P. maximum*

**Notes:** *H. brackenridgei* is centered in this WCA, which is the largest in the MU. The topography is a combination of rocky cliff faces and rocky slopes, with a mix of rocky and deep soils. Hand weeding is done around emerging seedlings, as well as backpack spraying for large grass areas. This WCA is
dominated by grasses *P. maximum* and *R. repens*. The overstory contains more mature *D. viscosa* than the other WCA’s, most of which have newly emerged since weed control began. As with the other WCA’s in this MU, the area is very dry, steep, and rocky. Additional weeds include *L. leucocephala, L. nepetifolia, R. repens, B. pilosa, A. farnesiana* and *A. adenophora*.

**Lower Ohikilolo WCA-04 (Roadway)**

**Veg Type:** Dry Shrubland/Grassland  
**MIP Goal:** Less than 50% non-native cover  
**Targets:** *P. maximum*

**Notes:** The roadside stretches beneath WCA’s 1, 2, and 3. These areas are dominated by *P. maximum* and *L. nepetifolia*. The goal of this MU is to expand the road fuel break and protect the entire MU from fire. Additional weeds include *L. leucocephala, L. nepetifolia, R. repens, B. pilosa, A. farnesiana* and *A. adenophora*. Trials of herbicide mixtures have also been conducted along this WCA. Control of weeds in this WCA is generally done using a powersprayer. Annual road surveys are conducted to monitor the spread of target weeds across WCA’s.

**Rodent Control**

**Species:** *Rattus rattus* (Black rat), *Rattus exulans* (Polynesian rat), *Mus musculus* (House mouse)  
**Threat level:** Unknown  
**Current control method:** None  
**Seasonality:** N/A  
**Number of control grids:** None  

**Primary Objective:**
- To implement rodent control if determined necessary for the protection of rare plants.

**Monitoring Objective:**
- Monitor rare plants (*C. celestroides* var. *kaenana* and *H. brackenridgei* subsp. *mokuleianus*) populations to determine impacts by rodents.

**MU Rodent Control:**
- Currently no rodent control is conducted by OANRP around these taxa since rodents are not deemed a threat at this time. If rare plants are determined to be impacted adversely by rodents OANRP will evaluate the use of localized rodent control for the protection of these species.

**Ant Control**

**Species:** Unknown  
**Threat level:** Unknown  
**Control level:** Unknown  
**Seasonality:** Varies by species, but nest expansion observed in late summer, early fall  
**Number of sites:** One; *Chamaesyce celastroides* var. *kaenana* population
Acceptable Level of Ant Activity: Unknown, systematic ant sampling not yet undertaken

Primary Objective: Collect data on species present and control if ant densities are high enough to threaten rare resources.

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

Monitoring Objective:
• Sample ants at Chamaesyce celastroides var. kaenana population. Use samples to track changes in existing ant densities and to alert OANRP to any new introductions.
• Look for evidence of ant tending of aphids or scales on rare plants.

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

Standardized surveys have not yet taken place.

Fire Control

Threat Level: High


Management Objective:
• To prevent fire from burning any portion of the MU at any time.

Preventative Actions

Fire control in the Lower Ohikilolo MU is focused on fuel-break construction and management. Backpack spraying of herbicide is used to control grasses and weeds while reducing the fuel load of the area. The threat of fire is high due to the large fuel load and hot, dry climate, and many fires are intentionally set by vandals along the Farrington Highway, near the MU. These fires are set regularly and create a high risk of burning over Ohikilolo Ridge and into the MU area. Future weed control along the ridge on the outside of the MU fence will be implemented during scheduled WCA spraying to limit the risk of fire burning over the ridge and into the MU. Removal of the most fire prone weeds (A. farnesiana, L. leucocephela and P. maximum) remains a high priority within the MU. Sprayed areas with large patches of dead grass are also weedwacked to reduce standing dead vegetation and create a buffer around endangered taxa. Plans are in place to cut an additional 20m buffer, extending the entire weed control area around each managed plant population. 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 fire. OANRP will maintain red-carded staff to assist with fire response.
C. celastroides area burned by 2003 Makua fire. Lower Ohikilolo fire view from the North.

View of Lower Ohikilolo fire from C-Ridge
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>General Survey</td>
<td>Survey both north and south firebreak roads.</td>
<td></td>
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<tr>
<td></td>
<td>Range control LZ survey</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Water catchments: repair/maintain as needed. 3 catchments in MU.</td>
<td></td>
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</tr>
<tr>
<td>ICA</td>
<td>PenSet-01: Monitor/control PenSet in Lower Chamaesyce patch annually. Only 1 plant found here. Pick and remove from field any potential mature fruit. CaeDec-01: Monitor for future spread, old point/road survey</td>
<td></td>
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</tr>
<tr>
<td>Lower Ohikilolo-01: Lower Chacelkae</td>
<td>Control grasses and herbaceous weeds across entire WCA (excluding marked rare plant zones) quarterly, as needed. Goals: maintain low fuel levels, encourage native recruitment. Primary control methods: spraying, weedwhacking. Only use Oust downslope of endangered plants. Control weeds in marked rare plant zones quarterly/as needed. Exercise extreme care when working/spraying around rare taxa and seedlings; use Fusilade, handpulling, NO Oust. Control woody weeds (LeuLeu, Acafar) across the entire WCA annually. Goal: reduce/maintain coverage at 0%.</td>
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<tr>
<td>Lower Ohikilolo-02: Upper Chacelkae</td>
<td>Control grasses and herbaceous weeds across entire WCA (excluding marked rare plant zones) quarterly, as needed. Goals: maintain low fuel levels, encourage native recruitment. Primary control methods: spraying, weedwhacking. Only use Oust downslope of endangered plants.</td>
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<td></td>
<td>Control weeds in marked rare plant zones quarterly/as needed. Exercise extreme care when working/spraying around rare taxa and seedlings; use Fusilade, handpulling, NO Oust. Control woody weeds (LeuLeu, Acafar) across the entire WCA annually. Goal: reduce/maintain coverage at 0%.</td>
<td>4 1 2 3</td>
<td>4 1 2 3</td>
<td>4 1 2 3</td>
<td>4 1 2 3</td>
<td>4 1 2 3</td>
</tr>
<tr>
<td></td>
<td>Control grasses and herbaceous weeds across entire WCA (excluding marked rare plant zones) quarterly, as needed. Goals: maintain low fuel levels, encourage native recruitment. Primary control methods: spraying, weedwhacking. Only use Oust downslope of endangered plants. Create/maintain buffer fuel break around entire LowerOhikilolo-03. ADD NEW WCA IF THIS ACTION COMPLETED</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Lower Ohikilolo-03: Hibbra patch</td>
<td>Control weeds in marked rare plant zones quarterly/as needed. Exercise extreme care when working/spraying around rare taxa and seedlings; use Fusilade, handpulling, NO Oust.</td>
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<tr>
<td></td>
<td>Control woody weeds (LeuLeu, Acafar) across the entire WCA annually. Goal: reduce/maintain coverage at 0%.</td>
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<tr>
<td>Lower Ohikilolo-04: Roadway</td>
<td>Control grasses, broadleaves along road corridor quarterly, as needed. Goal: maintain fuel break along road. Use powersprayer.</td>
<td></td>
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<tr>
<td>Rodent Control</td>
<td>Monitor rare plants for predation by rodents</td>
<td></td>
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<td></td>
<td>Implement localized rodent control if determined to be necessary for the protection of rare plants</td>
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</tr>
<tr>
<td>Ant Control</td>
<td>Sample ants at <em>Chamaesyce celseoides</em> var. <em>kaenana</em> population</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>If ants exceed acceptable level begin control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ungulate Control</td>
<td>Melten MMR-D fence: Fence maintenance</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Melten MMR-D fence: Fence monitor</td>
<td></td>
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</tbody>
</table>

Hatching = Quarter Schedule