

Chapter 2.1: MIP Weed Management

Introduced plant species (weeds) threaten endangered species and native ecosystems by altering habitat and disrupting community structure. Weedy species out-compete native plants for light, space and nutrients. NRS has been conducting weed control on Army land for ten years, and the level of this weed control has increased dramatically over the years, especially with the execution of the MIP.

Explanation of Weed Control Reporting Format

Reporting format was revised to better reflect MIP requirements. First, Makua Section 7 requirements are discussed. Weed actions and relevant discussions are separated into three sections: Survey Report, Incipient Weed Report, and Management Unit (MU) Weed Control Area (WCA) Report.

Notes on Partners

The scope of the MIP necessitates NRS coordination with other agencies. Weed control efforts on land not controlled by the Army are made possible only by the support of the various offsite land owners. Primary partner agencies include The Nature Conservancy (TNC), Plant Extinction Prevention (PEP) staff, Kamehameha Schools (KS), the Board of Water Supply (BWS), and various State of Hawaii agencies, including Natural Area Reserves System (NARS), State Forest Reserves, and State Parks. NRS rely on partner agencies for guidance on the locations of weed control areas as well as types of weed control projects. In particular, NRS work closely with TNC staff to supplement weed control efforts they already conduct throughout the Honouliuli preserve. Hours spent weeding and area weeded by TNC staff are not reported in this document, however both are very valuable in achieving MIP goals and should be considered as such. In general, NRS again expanded the scope of weed control projects across all Management Units. However, negotiations with the State to finalize an MOU limited NRS access to State lands from October 2005 to April 2006. No weed control was done on state lands during this time.

Notes on Database

In the past year, NRS expanded efforts to standardize reporting of weed control data for future analysis by developing a database. The Weed Database tracks all weed related data, including surveys, Incipient Control Area (ICA) information, and WCA information. In particular, it organizes field data including weeding effort, pesticide use, field observations, and information gathered by the monitoring program. Improving monitoring and tracking of weed control efforts will help NRS to ensure efficiency and to direct future weed control actions. Almost all tables included in this chapter were generated using the Weed Database.

Mākua Section 7 Weed Management Overview

In preparation of this section, NRS reviewed existing documents related to Mākua Section 7 consultations including the Makua Biological Assessment (BA), the Makua Mitigation/Stabilization Plan, the Makua Biological Opinion, the MIP and Addendum. None of these documents specify in a detailed manner the Army's weed control requirements but rather outline important areas related to weeds. These areas are: (1) Prevention of Weed Spread, (2)

Surveys to detect new weeds before they become established, (3) Prioritization of weed control areas and projects, (4) Monitoring of MIP related weed control, and (5) Research.

1. Prevention of Weed Spread

One of the two main threats from military training at Mākuā as outlined in the Army's BA was the introduction of weed species. This threat was not only related to inadvertent weed transport between Hawaiian Islands but also from locations beyond Hawai'i. The BA emphasized troop education as an important tool in reducing the number of introductions each year. NRS have prepared educational brochures and have briefed troops upon request regarding this issue, but need to do more. NRS have made great strides in educating support staff working for the Garrison, such as the Range Division road crews, Integrated Training Area Management (ITAM) crew, and contracted road improvement crews, in order to minimize weed spread due to road construction and maintenance. Please see Figures 2.1.1-2.1.3, for examples of media used in briefings. However, this year, staffing changes at ITAM resulted in decreased communication between NRS and ITAM. NRS will seek to reinstitute quarterly meetings to discuss concerns about weed spread between and within training areas. In addition, NRS surveyed the gravel quarry site for noxious pests and no invasive weeds were found. This gravel is being used for Transformation road improvements. In the coming year, NRS plan to review contractor hydromulch and seed use to ensure invasive weeds are not used, continue educational briefings for road crews, and seek out other educational avenues for troops.





Figure 2.1.1 ITAM training card cover.

Arthrostemata, *Arthrostemata ciliatum*

Incipient Invasive

Known From: KTA, SBE, KLOA.
Notify Natural Resources if Find: KLOA





Natural Resources Office: 656-7641

Smoke Bush, *Buddleia madagascariensis*

Incipient Invasive

Known From: SBE. Notify Natural Resources if Find: All Ranges



Natural Resources Office: 656-7641

Figures 2.1.2-2.1.3 Invasive species identification cards.

Mākua related section 7 documents also emphasized gear cleaning infrastructure and procedures for military personnel. This is a weak area for our program and needs improvement. NRS have identified a number of weed species at Army training areas on O‘ahu which may have originated at Pohakuloa Training Area (PTA) on Hawai‘i Island. Many of these introductions may have been prevented if proper cleaning procedures were implemented at PTA. There is a wash rack at PTA for cleaning vehicles, and it is mandated for use prior to shipping vehicles back to O‘ahu. There is a Standard Operating Procedure (SOP) dictating sanitation protocols that the troops are required to follow. This year, the PTA Colonel reissued this SOP at NRS request. A wash rack was recently completed at Schofield Barracks East Range (SBE). It is used primarily by Stryker units training in SBE. The wash rack is well-used, and NRS will seek to ensure that this continues into the future. NRS are pursuing the addition of a settling basin, and in the meantime monitor the site for invasive species. With NRS help, ITAM updated their soldier cards and created posters for the wash racks outlining incipient weed concerns.

In order to reduce weed spread by NRS personnel, NRS have instituted several sanitation policies, described below. Awareness of possible weed problems is the best defense. NRS thinks critically about all field activities and their consequences.

- *Growing and planting.* All plants grown and planted are done so in accordance with MIP sanitization protocols. Sterile media is used to grow all plants and one inch of top soil is removed from plants before outplanting to prevent weed transport.
- *Vehicles.* All vehicles are washed and vacuumed at the end of the week. If a vehicle goes to a site known to have particularly invasive weeds, it is washed at the end of the day. An example of such a site is KTA, which receives heavy military use and is home to a number of habitat-altering invasive weeds.
- *Footwear.* NRS footwear is washed at the end of each work day. Each NRS has two sets of tabis, one dedicated for Wai‘anae and one for Ko‘olau Mountain work.
- *Fencing.* Fencing gear, including panels, posts, and fence rolls, are stored in a weed free storage area until needed. Fencing material is not recycled between management areas.
- *Helicopter operation materials.* Sling nets, straps and swivels are washed whenever they appear dirty. NRS evaluate each Landing Zone (LZ) based on the LZ weed list, and have identified LZs with weeds of concern. They include ‘Ōhikilolo, Ka‘ala, and Palikea. After use at these sites, sling nets are washed.
- *Rat bait.* NRS use Ramik, a brand of rat bait that is not formulated with seeds, but rather with cracked corn, milled grain, and wax. None of these components are a potential source of weeds.
- *Personal gear.* NRS frequently wash backpacks, and other personal gear vectors to prevent spreading weeds. NRS avoid setting gear on incipient invasive taxa.

2. Surveys to detect new weeds before they become established

Regular surveys along potential military introduction corridors were identified as important in all Mākua Section 7 related documents. One of the greatest potentials for weed spread by the military is via vehicles along roads. The large vehicles and machinery used for training, and training support, such as road maintenance, are vectors for weed dispersal within and between ranges. NRS survey roads used most frequently by the military and also by NRS, to observe the distribution of weeds within training ranges. This allows NRS to detect and eradicate new weeds, therefore preventing them from becoming established in those ranges. NRS have been

conducting road surveys on Army installations for more than five years, and occasionally add new roads to ensure that areas with military use are well surveyed. Offsite roads near MUs are also surveyed. These roads may be used primarily by NRS or by other users, including agricultural lessees. This year, NRS added three offsite roads surveys: Ka'ena and Makaha (discussed in MIP Survey Report), and Ka'ala (discussed in OIP Survey Report).

Weed surveys are conducted on LZs for the same reason that they are conducted on roads: military and NRS helicopters serve as vectors for weed spread. NRS conduct surveys on LZs used heavily by military helicopters and at all small NRS LZs when used.

Weed surveys are also conducted along ungulate transects. These transects are generally located along fence lines or major ridges. Pigs and goats are a dispersal vector, and fences are corridors along which vectors like pigs and humans can move. NRS track weed presence along these transects to have a basic understanding of weed distribution. Since ungulate transects are generally monitored quarterly, it is convenient to monitor weeds at the same time along these heavily trafficked corridors.

To combat especially invasive species, NRS perform helicopter surveys to identify the extent of infestations that cannot be mapped from the ground. While performing aerial surveys, a GPS is used to map individual plants. These maps direct plant removal on the ground and greatly facilitate navigation to outlying targets. Detailed information about specific aerial surveys can be found in the MU discussions where these weeds are found.

Unidentifiable taxa are sent to Bishop Museum for identification. Upon identification, survey lists are updated to include these plants, and NRS research the significance of the presence and or spread of this weed. If the weed is incipient, or considered problematic, NRS will work to control it in the same manner as all incipient weeds occurring in MUs. Otherwise, weeds that are new to the survey and are not considered problematic are added to the list, thus tracking the spread of common weeds into new areas.

All survey data is entered into the Weed Database. The database can detect and search for new taxa on a particular survey, and can generate lists of the first observation date for any taxon at any survey location. All data from previous years is in the process of being entered into the database, creating a huge dataset.

3. Prioritization of weed control areas and projects

All the Mākua documents reviewed simply emphasize that weed control projects should be prioritized and plans developed in order to ensure that the projects with the most conservation value begin first. NRS prioritize incipient projects and WCAs containing 'Manage for Stability' PUs.

Incipient Weeds

Priorities for incipient weeds are determined based on the extent of the weed, severity of the weed's potential impact if established, and control possibilities in terms of staff time required and control techniques. The MIP goal for incipient weed control is "total removal". All incipient weeds controlled by NRS are discussed in the Incipient Weed Report. This year, NRS

discuss the results of control by species, rather than area. Each site for each species is defined as an Incipient Control Area, or ICA. ICAs were intentionally drawn to encompass small geographic areas, to better track control efforts, declining plant counts, and eradication potential. Maps of target weed taxa and ICAs are included in the Incipient Weed Report.

NRS reviewed Appendix 3.1, *Priority Weeds for Selected Management Units*, from the Final MIP dated May 2003. In this table, weeds were ranked to express the extent of their distribution by MU. This year NRS reviewed each weed believed to be incipient/targeted for eradication (assigned a number “one” in the table). For a number of taxa, additional information has led to a change in status. For some, the weed management code as referenced in MIP Appendix 3.1 changed because they were found to be more abundant than previously thought and total removal is no longer feasible. In other cases, NRS resurrected particular weed taxa as their threat to rare plant PUs were clarified. Taxa reported as widespread last year are not reported on this year.

A summary of the weeds still believed to be high threats can be found below (Table 2.1.1). The specific sites and or distributions of many of the weeds are still being clarified by NRS. This is mostly the case on offsite areas, where NRS have not seen the species because they have not yet been into the areas where they occur. Where current locations are unknown, NRS aim to work with land managers to determine the locations of all of these weeds, to assess their threat levels, and begin control of the species if determined incipient. Although NRS still strive to achieve a better understanding of the list of weeds in Table 2.1.1, NRS already target several incipient weed species, mostly on Army controlled land. Please refer to the Incipient Weed Report for detailed control discussion.

Table 2.1.1. Summary of Incipient Taxa in Management Units from Appendix 3.1 Final MIP

Management Unit	Incipient Taxa	Comments
‘Ēkahanui	<i>Chrysophyllum oliviforme</i>	Locally common, downlist to level 2.
	<i>Dicliptera chinensis</i>	Locations known. Will evaluate and consider control.
	<i>Ficus macrophylla</i>	Locally common, downlist to level 2.
	<i>Heliocarpus popayanensis</i>	Locations known. Will evaluate and consider control.
	<i>Melaleuca quinquenervia</i>	Locations known. Will target in the coming year.
	<i>Pimenta dioica</i>	Common in north and central ‘Ēkahanui, downlist to level 2, target only in fence
	<i>Schefflera actinophylla</i>	Locations known. Will seek more info from Joel Lau, HBMPB.
	<i>Sphaeropteris cooperi</i>	Some locations known. Will control within fence.
Haili to Keālia	<i>Schefflera actinophylla</i>	Some individuals found. Will control in MU.
Ka‘ena	<i>Agave sisalana</i>	Currently target within MU boundary. See Survey Report
Kaluakauila	<i>Casuarina glauca</i>	Currently targeted along fenceline only.
‘Ōhikilolo	<i>Aracauria columnaris</i>	Currently targeted. See Incipient Weed Report
	<i>Axonopus fissifolius</i>	Widespread, not target for control, downlist to level 2
	<i>Morella faya</i>	Treated in the past. Will monitor known sites.
Upper Kapuna	<i>Ehrharta stipoides</i>	Locations known. Will target in coming year.
	<i>Rubus argutus</i>	Several locations known and targeted. See Incipient Weed Report.
	<i>Setaria palmifolia</i>	Site controlled, presumed extirpated.
	<i>Sphaeropteris cooperi</i>	Widespread below MU. Will control only in course of regular management.
	<i>Toona ciliata</i>	Some locations known. Will target in coming year.
Kahanahāiki	<i>Acacia mearnsii</i>	Currently targeted. See Incipient Weed Report.
	<i>Axonopus compressus</i>	Location known. Treated in the past. Will work towards eradication this year.

	<i>Casuarina glauca</i>	Currently targeted. See Incipient Weed Report.
	<i>Ehrharta stipoides</i>	Currently targeted. See Incipient Weed Report.
	<i>Pennisetum clandestinum</i>	Location known (State land). Population not spreading; no seed produced. Work with State to determine level of control.
	<i>Rubus argutus</i>	Currently targeted. See Incipient Weed Report.
	<i>Sphaeropteris cooperi</i>	Currently targeted when seen. No matures seen for years.
	<i>Triumfetta semitriloba</i>	Currently targeted. See Incipient Weed Report.
Palikea	<i>Acacia mearnsii</i>	Locations known, and does not appear to be spreading. Downlist to level 2.
	<i>Ficus macrophylla</i>	Locations known. Work with TNC to determine level of control.
	<i>Juniperus bermudiana</i>	Locations unknown. TNC feels it is not present within the MU.
	<i>Montanoa hibiscifolia</i>	Locations known. Will work with TNC to determine control
	<i>Schefflera actinophylla</i>	Locations unknown. TNC feels it is not present within the MU
	<i>Sphaeropteris cooperi</i>	Locations known. Will work with TNC to determine control
	<i>Toona ciliata</i>	Locations unknown. TNC feels it is not present within the MU
West Makaleha	<i>Sphaeropteris cooperi</i>	Locations unknown. Work with State to determine level of control
Wai'anae Kai	<i>Chrysophyllum oliviforme</i>	Locations unknown. Will target if deemed necessary
	<i>Coffea arabica</i>	Locally common, downlist to level 2.
	<i>Fraxinum uhdei</i>	Locally common, downlist to level 2.
	<i>Pimenta dioica</i>	Locally common, downlist to level 2.
	<i>Rivina humilis</i>	Locally common, downlist to level 2.
	<i>Syzygium cumini</i>	Locally common, downlist to level 2.
Kaluaa and Waieli	<i>Angiopteris evecta</i>	Known from South Central Kalua'ā, 200m2 area. Will target.
	<i>Ardisia elliptica</i>	Locally common. TNC has controlled 3 acres.
	<i>Mallotus philippensis</i>	Found in Gulch 3 site C. Will map and control as deemed appropriate.
	<i>Glycine wightii</i>	Locally common, downlist to level 2.
	<i>Schefflera actinophylla</i>	Locations unknown. Work with TNC to determine level of control
Pahole	<i>Acacia mearnsii</i>	Currently targeted. See Incipient Weed Report.
	<i>Angiopteris evecta</i>	Location known by State. NRS will control.
	<i>Axonopus compressus</i>	Same site as Kahanahāiki location
	<i>Ehrharta stipoides</i>	Targeted at known sites. See Incipient Weed Report.
	<i>Glycine wightii</i>	Locations unknown. Work with State to determine level of control
	<i>Passiflora suberosa</i>	Will target in course of regular management, esp in Gulch 4.
	<i>Rubus argutus</i>	Locations unknown. Work with State to determine level of control
	<i>Setaria palmifolia</i>	Same as Upper Kapuna site.
	<i>Sphaeropteris cooperi</i>	Targeted by Kay Lynch of O'ahu Trail and Mountain Club
<i>Toona ciliata</i>	Some locations known. Will target in coming year.	

NRS continue to participate in the Oahu Invasive Species Committee (OISC), attending strategy and prioritization meetings, sharing data, and coordinating effort on joint incipient control projects.

Management Unit Level Weed Control

For weed control projects on the MU level, priority setting criteria include the size of intact native habitats, the overlap of these with MIP PU locations or reintroduction sites, and the feasibility of the control project. The first attempt at this prioritization was made by the MIT when MU boundaries were outlined. During the MIP process, the most appropriate habitat was selected. In addition, the MIT screened habitat by landowner, only selecting MUs where land managers were supportive of MIP related management. Subsequently, the MIP Addendum

streamlined the final MIP MU boundaries to remove very heavily degraded habitat and focus initial management on the three best populations per MIP taxon.

In addition to these broad-scale prioritization processes detailed above, NRS have broken up the MIP MUs into smaller units, or WCAs, where weed control has been conducted in the past or in areas that are a high priority for weed control in the future. These areas, in general, focus on ecosystem level weed control in addition to weed control conducted around MIP taxa. In most cases WCAs contain managed PUs and the native habitat surrounding those PUs. Weed control is easier to track over time within WCAs, as weed control issues are generally similar across a particular WCA. All WCA results are discussed in the MU WCA Report; weed control is organized by MU, and then by WCA. Most WCA boundaries are defined for ecosystem-level habitat improvement, but some are defined around fencelines and trails, and others are very small areas defined as a five meter radius around MIP taxa. The purpose of trail WCAs is to prevent weed spread to ecologically significant areas. Weed control in the five-meter WCAs is not likely to be expanded because often the areas are too degraded, and the goal for the MIP taxa is fruit production, rather than 'Manage for Stability'. The Weed Control Summary Tables in the MU WCA Report use six letter abbreviations for most weed and rare plant species. These abbreviations use the first three letters of a plant's genus and species. A list of these codes in their unabbreviated form can be found in Appendix V.

Table 2.1.2 summarizes the MIP MU weed control efforts in Year Two. Due to limitations on personnel, NRS has not been able to conduct weed control in all MUs and fully implement MIP weed control as planned. NRS chose to begin intense MU level weed control where there are exclosures or where ungulates are not considered a threat. Less weed control has been initiated outside exclosures. Also, it is essential that NRS acquire formal permission to conduct MIP management actions. Formal permission has not been granted for a number of sites which therefore are not weeded regularly.

Table 2.1.2. Makua IP Management Units: Weed Effort in Year Two

	WCA Total acres	Total Acres Covered	# of Visits	Effort (Person Hrs)
IP MU: Ekahanui	17.5	8.83	17	111.00
IP MU: Haili to Kealia	4.02	0.53	3	78.00
IP MU: Kaena	6.02	5.96	4	62.00
IP MU: Kahanahaiki	42.7	22.3	27	345.50
IP MU: Kaluaa and Waieli	32.8	12.4	21	224.50
IP MU: Kaluakauila	26.8	15.6	11	96.50
IP MU: Lower Ohikilolo	14.3	14.3	22	204.40
IP MU: Makaha	25.6	6.36	12	313.90
IP MU: Ohikilolo	167	34.5	30	299.25
IP MU: Pahole	23.5	2.69	10	83.50
IP MU: Palikea	9.99	4.16	15	46.75
IP MU: Puu Kumakalii	2.96	0.32	1	3.00
IP MU: Upper Kapuna	9.66	4.35	10	245.50
IP MU: Waianae Kai	2.40	1	2	21.50
IP MU: West Makaleha	6.61	2.44	5	25.00
Totals	392	136	190	2160.30

4. Monitoring of MIP related weed control

Monitoring is a priority in all documents related to the Mākua consultation and has special emphasis in the MIP. This currently is the area most in need of expansion and development by NRS. A Monitoring Program Manager (MPM) has been hired to oversee all monitoring related to the MIP. Thus far, weed monitoring has mainly been focused on weed control efficacy but not long-term impacts of our weed control on native habitat and rare species restoration. Photopoints have been used in the past as an informal means of monitoring trends. The monitoring program (NRS Monitoring) will incorporate tracking of weed control within the 50 meter buffer around PUs, along with weed control conducted across the rest of the MU outside of this area. The following is a list of high-priority weed monitoring issues:

- Review road survey protocol to determine if sufficient
- Monitor the long-term effects in different habitat types of understory and canopy weed control. Investigate overall impacts of weed control on native species and ecosystems. Use data to guide management frequency and approach.
- Determine the ‘best’ treatment for weed monocultures in varying habitat types.

Monitoring activities this past year have been focused on addressing long term efficacy of weeding and other management on increasing native species cover and limiting the establishment and spread of non-native species. The MPM began work in October 2005 and has since focused on familiarizing herself with the areas managed by NRS. During this year, NRS Monitoring has been revisiting Land Condition Trend Analysis (LCTA) plots that were established by the Army as early as 1996 to collect current data and evaluate the efficacy of this design to detect changes in the vegetation community caused by management actions. The plots were designed for Army Integrated Training Areas Management (ITAM) by the Center for Environmental Management of Military Lands (CEMML) at Colorado State University to reveal information relevant to training activities, such as tactical concealment and soil erosion. However, these plots represent the only dataset containing vegetation community structure information from areas managed by NRS and extending back in time to before significant management activities were undertaken. This makes the data potentially valuable as a baseline. Additionally, the plots have been revisited with some frequency (1-3 times) since their installation and that data has been gathered by the MPM to be used in a time series analysis to detect changes over time.

The records and data from these plots were not kept in any central location and were spotty at times. This led to some confusion about the methodology and resulted in data collection practices that did not exactly match those that were used in the past. The plot consists of a line transect of varied length from 25-100 m, and a belt extending perpendicular to that line of varied width from 1-3 m on each side. Along the line, point intercepts are recorded every 0.5 or 1 m using a range pole extended to 8.5 m in height. The plots were designed to be adaptable to different environments and several had been adapted from the standard plot design, further complicating the methodology. The point intercept data were recorded as hits per species within segments of the 8.5 m pole. The segments were every decimeter from 0-2 m height, and every 0.5 m beyond 2 m height. Initially, NRS thought that the decimeter segments were up to 1 m, and that each species intercepted in the segment was to be recorded. Upon conversing with the investigator who installed the plots in 1996, the MPM learned that they had only recorded the top most species interception in each segment. Since some plots had already been read with the incorrect method, NRS decided to continue collecting information on all species' interceptions within each of the segments and to evaluate the difference in the methods at a later time, presumably this coming winter, when several methods will be evaluated for design of the monitoring network plot.

These differences in the way the data were collected limit what conclusions can be drawn from these data at this time. In the future, NRS will revisit the plots and collect data exactly following the method which was used previously and do another comparison of all plots. Results presented in this document do not attempt to account for any bias introduced by the differing methodology, nor were any corrections made to the data. The 2006 data should have more interceptions overall due to the way the data was collected this year but this was not always the case. In any case, interpretations of these results must be made cautiously keeping these differences in mind.

Several LCTA plots are located in newly delineated WCA's and the results of each plot will be discussed in the relevant portion of the WCA section of the report. Three plots (702, 713 and 716) have not received significant weed control and were discussed in Chapter 1: Feral Ungulate Management. Figure 2.1.4 depicts the location of all the plots and Figure 2.1.5 shows all plots

total native and non-native species interceptions. This is the sum of all encounters of all native species versus all non-native species for each plot for each date upon which it was read. In addition to considering the weed control actions that have taken place in the vicinity of each plot, there is some discussion of ungulate management that may have contributed to the results observed especially for those discussed above.

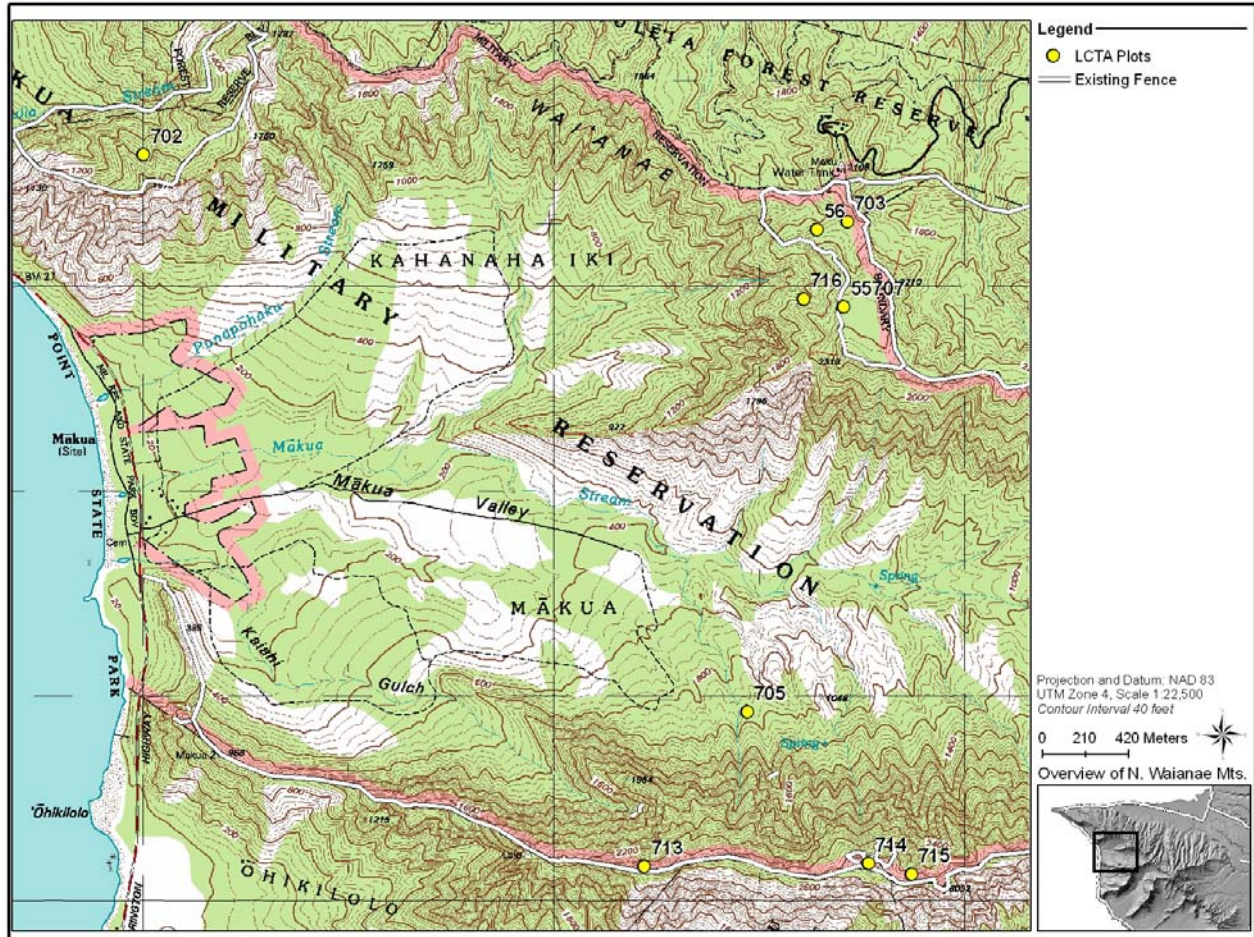


Figure 2.1.4: LCTA Plot Locations

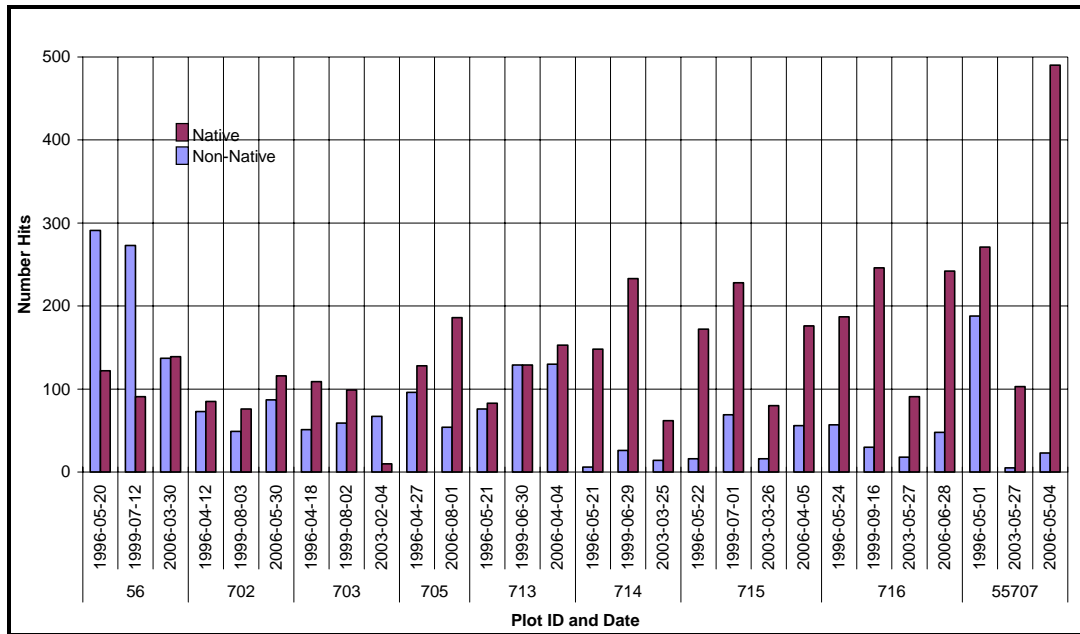


Figure 2.1.5: Sum of native and non-native species interceptions per plot per date

5. Research

There are a few research issues related to weed management. This year a Research Specialist was hired. Along with the Monitoring Program Manager, this person will advise NRS on methodology for testing new weed control techniques, seek out more interest in weed control related topics, and guide NRS in answering research questions. See Chapter 6 for a full account of this year's research activities. At the current time, the Propagule Management Specialist has just begun to look at the longevity of seed banks for incipient species; this will also help to guide management plans. In the future, NRS will identify other such projects and will strive to establish lines of communication with other agencies (especially on neighbor islands) so that findings can be shared between organizations.

Chapter 2.1: MIP Weed Management

Weed management actions are divided into three Reports: Survey, Incipient Weed, and Management Unit Weed Control Area. Only results from the past reporting year, Sept. 1, 2005 to Aug. 31, 2006 are discussed.

Survey Report

Surveys are conducted both on Army land and partner agency land (see Figures 2.1.6 and 2.1.7). Three types of surveys are conducted by NRS: road, landing zone, and transect. Transect survey results are discussed in the relevant discussion in the Management Unit Weed Control Area Report. Road and landing zone survey results are summarized in Tables 2.1.3 and 2.1.4, respectively, and discussed below.

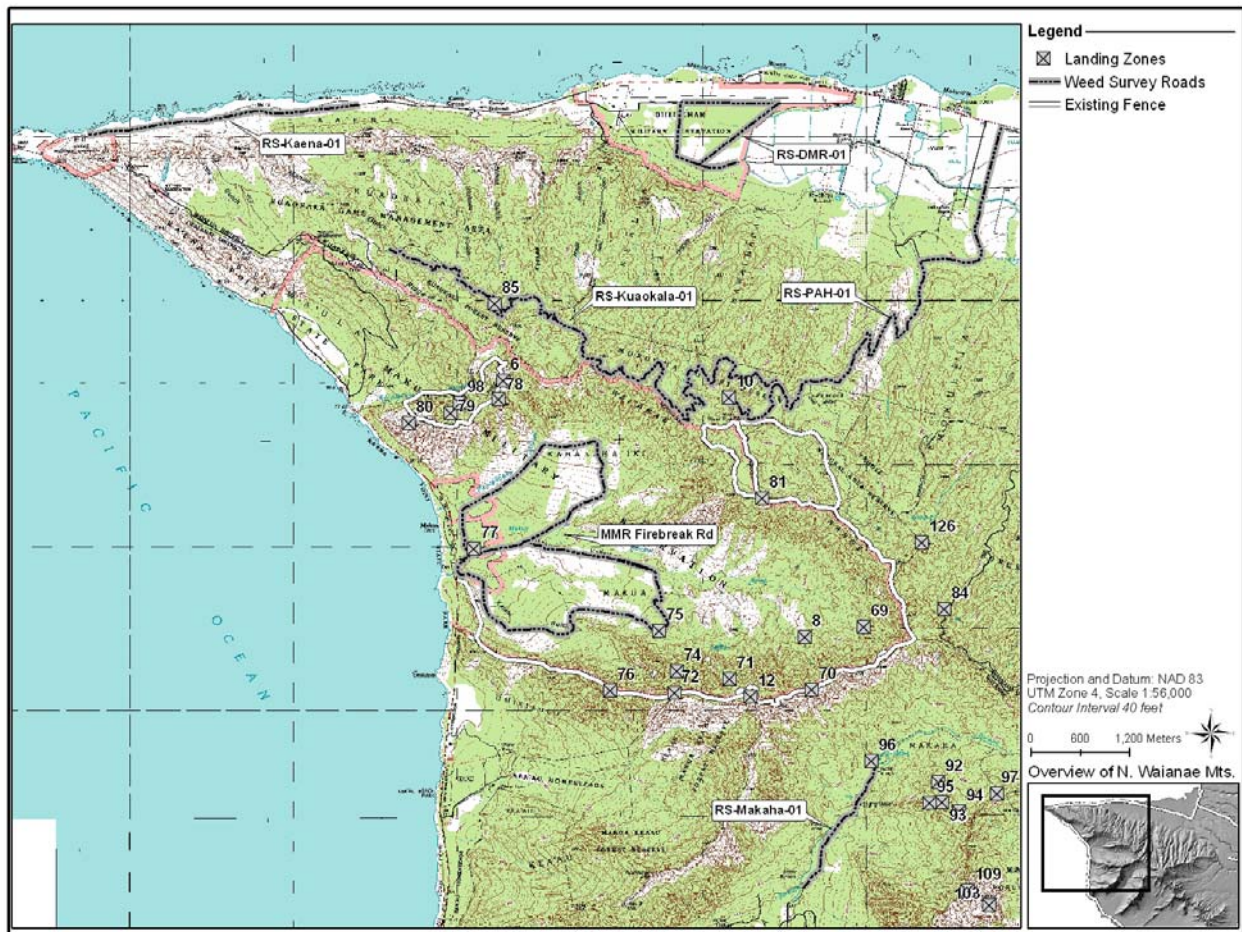


Figure 2.1.6: Northern Wai'anae Surveys

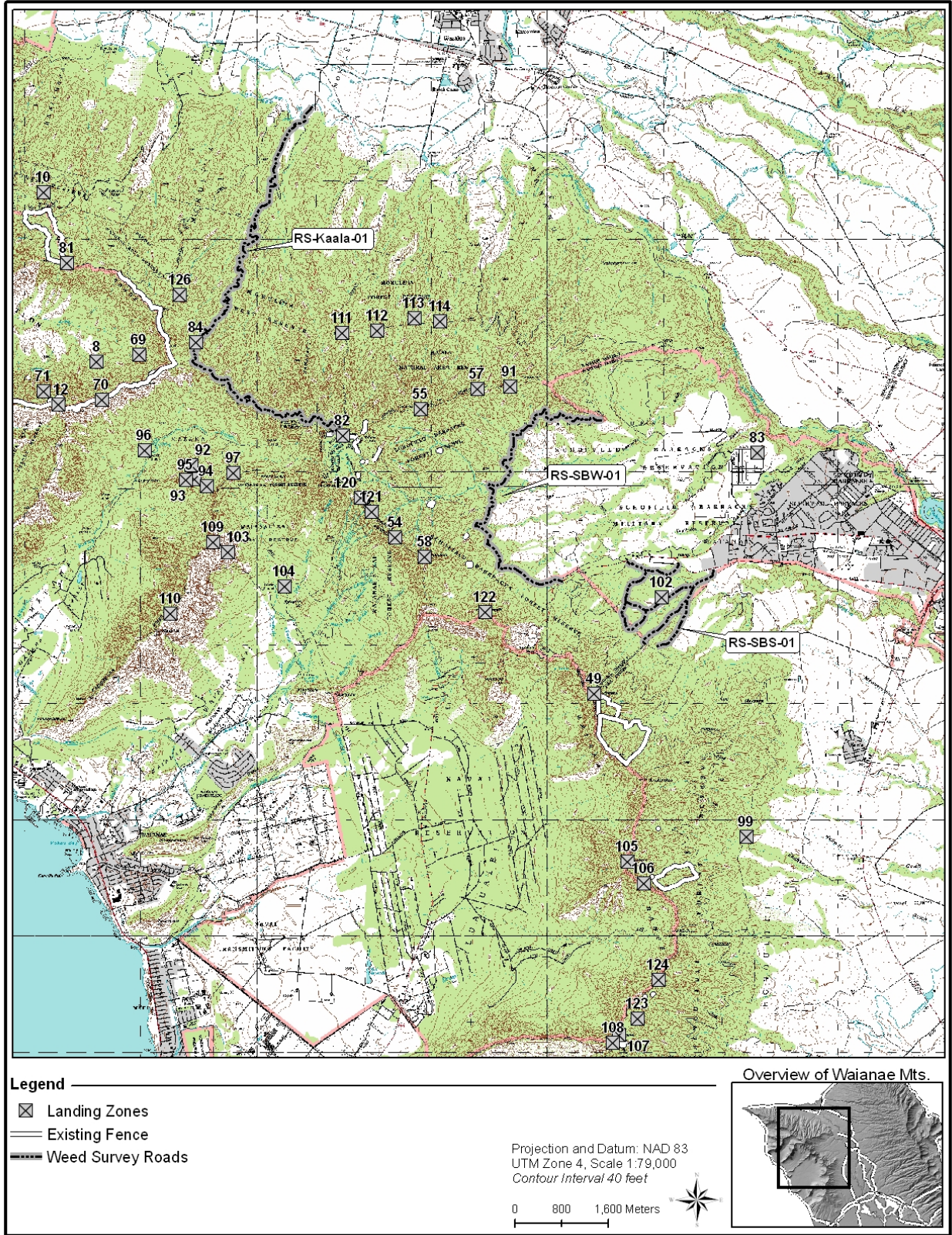


Figure 2.1.7: Southern Wai'anae Surveys

The tables present results of all surveys done this year. The ‘First Survey Date’ column refers to the first date the survey was ever conducted by NRS. The ‘Significant Pest’ column refers only to significant weed pests found in the last year. Species are listed in the table as 6 letter codes; refer to Appendix V for a definition table for these codes. In some cases, the weed is determined not to be a threat, and no action is taken. In other cases, the weed is monitored and control postponed until the potential threat is better understood. In the remaining cases, the weed is determined to be a threat and control is implemented. An ICA is drawn around the infestation, and control efforts are reported in the Incipient Weed Report.

Road Survey Report

Road surveys are conducted once a year, usually in the first quarter of the year. Some of the surveys are conducted along roads used for military training, and some are conducted along roads used often by NRS. Two new surveys were added this year, Ka‘ena Point and Makaha. Several potential pests were found on these two surveys (see Table 2.1.3). At Ka‘ena, *Casuraina equisitifolia* and *Agave sisalana* were found. Neither is threatening enough to trigger control, but NRS will monitor both species and take action if either appears to begin naturalizing aggressively, or begins to threaten Kaena region MUs. At Makaha, two potential pests were found, *Ficus microcarpa* and *Sideroxylon persimile*. *Ficus microcarpa* is possibly well established in the lower portion of Makaha, and is known from very large trees. NRS will monitor the species and assess its spread into the rest of the valley. If active recruitment is seen near priority MUs, NRS will consider control. *Sideroxylon persimile* is uncommon in the Wai‘anaes, but appears to have a small established population in the bottom of Makaha. Since it does not currently threaten priority MUs, NRS will recommend to the BWS Watershed Planner to survey the population to determine its extent and invasive potential. If control is deemed necessary, NRS will assist BWS. No new significant pests were found on any other road surveys.

Table 2.1.3: Road Survey Summary

SurveySiteCode	SurveySiteName	SiteLength (km)	Army/NRS Use	Significant New Pest Species
Property Name: Kaena Natural Area Reserve				
RS-KAENA-01	Kaena Point Road	3.477	NRS	AgaSis, CasEqu
Property Name: Kuaokala Forest Reserve				
RS-KUAOKA-01	Kuaokala Road	9.954	NRS	
Property Name: Makaha Valley				
RS-MAKAHA-01	Makaha Road	1.825	NRS	FicMic, SidPer
Property Name: Makua Military Reservation				
RS-MMR-01	Makua Firebreak Roads	12.118	Army and NRS	
Property Name: Pahole Natural Area Reserve				
RS-PAH-01	Pahole Road	8.081	NRS	

Landing Zone Survey Report

LZ surveys are generally conducted quarterly. Some LZs are used by Army aircraft only, and some are strictly used by NRS. If NRS LZs are not used in a given year, then no surveys are conducted at them. There are over 50 LZs associated with MIP actions, so NRS only survey those with the highest use. In the future, NRS plan to implement a policy of completing a survey every time an LZ is used; this will achieve a more consistent weed spread picture across management areas. One new significant weed, *Erharta stipoides* was discovered at the ‘Ōhikilolo campsite, LZ-MMR-12 (see Table 2.1.4). NRS are not sure how this highly invasive grass reached the remote ‘Ōhikilolo campsite, but it most likely was carried on NRS gear. NRS implemented an aggressive control plan for this infestation; it is discussed in detail in the Incipient Weed Report. NRS will strive to be increasingly vigilant about sanitation in the coming year. No other significant pests were found.

Table 2.1.4: Landing Zone Survey Summary

SurveySiteCode	SurveySiteName	SiteLength (km)	Army/NRS Use	Significant New Pest Species
Property Name: Makua Military Reservation				
LZ-MMR-72	Koiahi LZ		NRS	
LZ-MMR-12	Ohikilolo Camp LZ		NRS	EhrSti
LZ-MMR-70	Red Dirt LZ		NRS	
LZ-MMR-8	Lower Makua LZ		NRS	
LZ-MMR-98	Kaluakauila Lower Patch Camp LZ		NRS	

Incipient Weed Report

All incipient species and their general locations are summarized in Table 2.1.5 below. Figure 2.1.8 shows specific locations of each ICA. Discussion of incipient species control and status is arranged alphabetically by species. Control efforts are summarized in a table, and then discussed by ICA. While eradication may not be an option for every species across all managed lands, it is the goal for each ICA. In order to achieve this, NRS generally strive to visit ICAs quarterly.

Table 2.1.5: Overview of Incipient Taxa and ICA Distribution

Incipient Target	Management Unit (MU)	Number of ICAs
<i>Acacia mearnsii</i>	Kahanahāiki	2
<i>Achyranthes aspera</i>	Kahanahāiki	3
<i>Araucaria columnaris</i>	‘Ōhikilolo	1
<i>Casuarina glauca</i>	Kahanahāiki	1
<i>Cirsium vulgare</i>	‘Ōhikilolo	1
	Kaluakauila	1
<i>Desmodium intortum</i>	MMR no MU	1
<i>Ehrharta stipoides</i>	‘Ōhikilolo	1
	Pahole	2
<i>Pennisetum setaceum</i>	Lower ‘Ōhikilolo	1

<i>Rubus argutus</i>	Kahanahāiki	2
	‘Ōhikilolo	2
	Upper Kapuna	1
	MMR no MU	1
	Mokuleia Forest Reserve	1
<i>Syzigium jambos</i>	Kaluakauila	1
<i>Tecoma capensis</i>	Upper Kapuna	1
<i>Triumfetta semitriloba</i>	Kahanahāiki	5
	MMR no MU	1

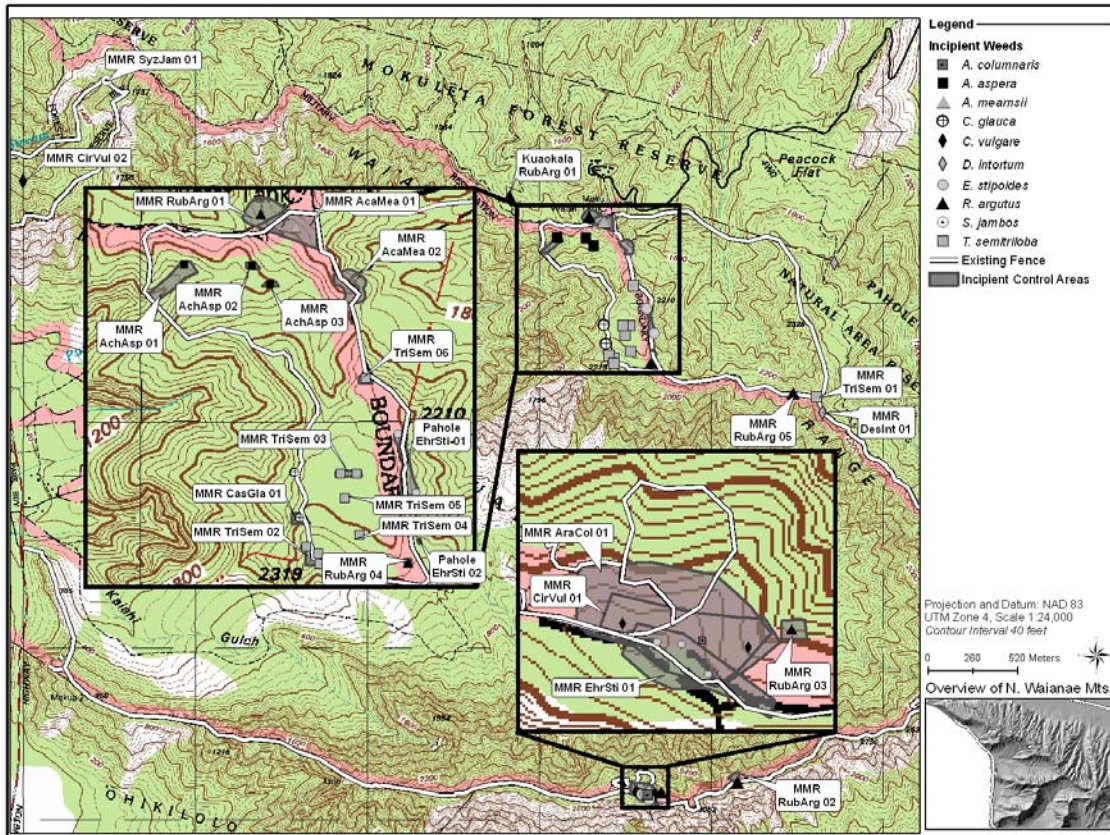


Figure 2.1.8: Locations of Incipient Weed Species in Makua Military Reservation

Incipient Species Control Discussion

Acacia mearnsii

The Pacific Islands Ecosystems at Risk (PIER) web site classifies this species as high risk due to the risk assessment score of 15. This high score was the result of a number of factors including a tendency for this species to form dense thickets, be fire tolerant, have prolific seed production, become naturalized in tropical or subtropical climates, etc. This species is already widespread in some areas of Oahu. However, NRS have targeted this species within MUs for the reasons listed above.

MMR-AcaMea-01; Kahanahaiki AcaMea

Acacia mearnsii is nearly non-existent in Kahanahāiki, and NRS feel that keeping it out of the MU is a high priority. This ICA is the core site for this incipient weed. NRS have been returning to this site for the past five years and pulling new seedlings found. In the coming year NRS will re-visit the site quarterly to survey for and eradicate all new seedlings and new trees found. It is possible that with constant pressure, *A. mearnsii* can be eradicated from the site, although it may be a while before the seedbank is completely exhausted.

MMR-AcaMea-02; Black Wattle by Schwepps trail/Pahole crossover

This ICA is made up of two outlier sites each with large mature trees. One site consisted of two trees and the other had only one tree, all of which were girdled with Garlon 4 at 20% dilution. NRS plan to revisit the sites in the coming year and scope the areas for possible seedlings or other plants not seen on previous trips. It is highly possible that *A. mearnsii* can be completely eradicated from this ICA.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: AcaMea		Acacia mearnsii			
MMR-AcaMea-01	Kahanahaiki	1	1.00	2006-04-27	2005-05-03
MMR-AcaMea-02	Kahanahaiki	2	1.01	2006-04-27	2006-04-25

Achyranthes aspera

This species is of concern to NRS because it is incipient within the Kahanahāiki MU in MMR. It has a short lifecycle and is easily dispersed via a spine tipped bract on the seeds that can stick to clothing. For these reasons, NRS have a zero-tolerance for this species in Kahanahāiki. This taxon is found at several specific sites within the same small gulch. NRS visit the sites quarterly, and can manually pull all plants found within each location in a short time. Regular quarterly visits are important to prevent plants from maturing. It appears that eradication of this species from within the MU is a very attainable goal. With each visit, fewer and fewer immature plants and seedlings are found.

MMR-AchAsp-01; Kahanahāiki AchAsp Lowest

Since October 2005, two adult (the last being in April 2006), five immatures, and four seedlings plants have been found within approximately 1 acre. This is much improved compared to last year, when one adult, four immatures, and 120 seedlings were found. For 2006-2007, NRS will continue to visit the site at least quarterly and extend surveys out from the center of abundance in order to guarantee eradication.

MMR-AchAsp-02; Kahanahāiki AchAsp Middle

Since October 2005, only three seedlings were found. This is similar to the year before, when two immatures were found. This is a small area; approximately 0.1 acre. NRS will continue to monitor this site quarterly.

MMR-AchAsp-03; Kahanahāiki AchAsp Upper

No plants have been observed at this site since October 2005. The original site was only 0.08 acres so NRS are confident that this area has been thoroughly searched. NRS will continue to monitor this site quarterly over the next year. If no plants are seen, NRS may choose to monitor this site once a year or less because mature plants have not been seen at this site since May 2002.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: AchAsp		Achyranthes aspera var. aspera			
MMR-AchAsp-01	Kahanahaiki	4	3.50	2006-04-25	2006-05-23
MMR-AchAsp-02	Kahanahaiki	4	1.50	2002-05-13	2006-04-25
MMR-AchAsp-03	Kahanahaiki	4	1.50	2002-05-13	2003-06-24

Araucaria columnaris

NRS have targeted this species within MMR because it is incipient at ‘Ōhikilolo. *A. columnaris* often forms dense monocultures, and readily naturalizes. While common elsewhere on the island, it is not well-established on the ‘Ōhikilolo ridgeline. NRS are attempting to eradicate this taxon from this ICA and hope to eradicate all seedlings before they reach maturity.

MMR-AraCol-01; Norfolk Control at ‘Ōhikilolo Campsite

The only mature individual was killed several years ago. No weeding has been done in this ICA over the past year. However, in the course of sweeping overlapping WCAs, small numbers of *A. columnaris* have been killed. NRS plan to specifically sweep the area for *A. columnaris* once in the coming year. NRS also plan to research seed bed life of *A. columnaris*, to determine how long germination may be expected.

Casuarina glauca

Smith (1985) states: “this species is very similar to *C. equisetifolia*. However, it forms suckers prolifically, producing dense stands. It is the most aggressive ironwood in Hawaii.” This taxon also creates dense layers of duff and roots, which present a ready fuel source for fire. For these reasons this species is targeted by NRS in areas near relatively intact forest, such as the Kahanahāiki MU.

MMR-CasGla-01; Kahanahāiki Ironwood Removal

This ICA is located along the Mākua rim within Kahanahāiki MU and covers approximately ¼ acre. It stretches from the edge of the enclosure, down a ridge into MMR, and poses both an ecosystem and fire threat to populations of *Cenchrus agrimonioides* and *Achatinella mustelia* which abut it. NRS have been working to control this species in this ICA since 2002. This taxon spreads and matures slowly, and NRS have not weeded this ICA in the past year. NRS plan to sweep the area for resprouts and outliers once in the coming year.

Cirsium vulgare

This species received a score of 21 and a recommendation of ‘reject’ by the Hawaii Ecosystems At Risk (HEAR) project (www.hear.org). It is considered highly invasive because it produces copious amounts of seed which are widely dispersed by wind, seeds remain viable over a long period of time, and it grows in a number of climates and habitats.

MMR CirVul-01

The core population of this weed is located on ‘Ōhikilolo Ridge. This weed is not common in any of the MUs, and is a prime candidate for eradication. During the past year, NRS visited this

ICA two times, once in November 2005, when three immature plants were found, and again in January 2006, when no plants were found. Plants found were all hand pulled, no herbicide used. In the coming year NRS plan to re-visit the site, scope for any re-sprouts at least two times, and research seed bed life. It is believed that eradication of this weed is possible with continued vigilance.

MMR CirVul-02

This ICA is located in Kaluakauila Gulch on the far side of Mākua Valley. NRS found only one immature individual here. This is quite a distance from the ‘Ōhikilolo population and it is not clear where this individual dispersed from. The individual plant was pulled out and the area around was searched. None were found. NRS plans to re-survey the area on the quarterly scheduled trips to Kaluakauila MU. It is highly probable that NRS will be able to eradicate *C. vulgare* from this ICA.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: CirVul		Cirsium vulgare			
MMR-CirVul-01	Ohikilolo	2	2.50	2005-06-15	2005-11-08
MMR-CirVul-02	Kaluakauila	1	0.10		2006-05-10

Desmodium intortum

This invasive species is widespread throughout the Pacific. It spreads via numerous hooked hairs on seed pods. Thus, it is easily carried and dispersed by hikers and hunters. In the past, NRS have targeted this species only in areas where it is not widespread or along trails where NRS, hikers, or hunters may disperse this species into native areas where it is not found. In the coming year, NRS will work with the State to define control goals for this taxon in the Upper Kapuna MU, which is directly adjacent to the current ICA.

MMR-DesInt-01; Makua East Rim DesInt

Due to decreased NRS presence in the East Rim portion of Mākua, NRS monitored this site only once this year. This site is relatively small and covers approximately 0.05 acres. NRS plan to visit this area quarterly in the coming year and renew control efforts.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: DesInt		Desmodium intortum			
MMR-DesInt-01	MMR No MU	1	2.00	2005-10-11	2005-10-11

Ehrharta stipoides

This species has the potential to drastically alter environments by creating a thick mat of vegetation in which it is difficult for native species to regenerate. *E. stipoides* seeds are also easily dispersed by awns that attach to clothing. NRS have chosen to target this species as an incipient in all MUs where it occurs except Palikea. The infestation along the Wai‘anae summit at Pu‘u Palikea is too widespread for control, stretching approximately 3,000 meters along the summit and smaller ridges in the southern Wai‘anaes. This area is only treated along a small ridge that leads to the *Hesperomannia arbuscula* fence (see Chapter 3.1.14), and is discussed in the MU WCA Report.

Pahole-EhrSti-01; Pahole EhrSti along Kahanahāiki Fenceline

This ICA occurs along the Kahanahāiki/Pahole fenceline, and was likely introduced via hikers coming from the nearby State snail enclosure. There are three sites within this ICA, however all seem to have been eradicated. NRS will continue to monitor these sites quarterly. The area is relatively unaffected by *E. stipoides* compared to areas in the southern and central Waianae range. NRS feels that it can be controlled with continued monitoring.

Pahole-EhrSti-02; Pahole EhrSti in State Snail Enclosure

This ICA occurs in and around the State *Achatinella* enclosure along the Pahole rim. It is thought that *E. stipoides* was introduced during construction or monitoring for the snail site. While the infestation here is sparse, it has been persistent, and difficult to eliminate. NRS will monitor *E. stipoides* quarterly. At last treatment, plants were seeding within the snail enclosure and there was one large patch on the south end outside the enclosure. NRS feel this ICA can be controlled, but regular visits are vital to prevent recruiting individuals from maturing.

MMR-EhrSti-01; Ōhikilolo EhrSti Areas

This is the first year *E. stipoides* has been found at Ōhikilolo. This ICA covers 1.1 acres of the primary Ōhikilolo campground, and areas along the fence both above and below camp. While it is unclear how *E. stipoides* reached Ōhikilolo, it seems most likely that it hitchhiked via NRS gear. Unfortunately, this grass probably went undetected for a little while, since it can look very similar to another, less invasive species, *Vulpia bromoides*. Once identified, NRS aggressively treated the entire infestation with foliar spray. This appears to be very effective; on the most current visit, no plants were seen. NRS feel this infestation can be controlled and will continue to treat this site quarterly.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: EhrSti		Ehrharta stipoides			
MMR-EhrSti-01	Ohikilolo	4	4.25	2006-04-06	
Pahole-EhrSti-01	Pahole	1	1.00		
Pahole-EhrSti-02	Pahole	2	2.00	2006-08-02	2006-08-02

Fraxinus uhdei

This species is widely distributed in lower elevation mesic sites throughout the Waianae Mountains. However, NRS plan to target this species in select native areas where it is not yet established.

MMR-FraUhd-01; Ōhikilolo Campsite FraUhd

This ICA contains one large mature and several small individuals within the Ōhikilolo fence. NRS will begin removal of this species from this MU within the next year.

Rubus argutus

Rubus argutus (Blackberry) is a shrub that belongs to the Rosaceae family. It is native to the central and eastern United States and is a naturalized, highly invasive weed in Hawai'i. This brambly shrub produces edible fruit that is black when ripe, and it dispersed by birds. While *R.*

argutus is very well established at Mount Ka‘ala, and has spread down many of the side ridges of Ka‘ala, it is not well established past West Makaleha. NRS would like to keep it out of the northernmost Waianaes. *R. argutus* poses some interesting control problems; clip and drip treatment with Garlon 4 at 20% in FCO is not always effective. This taxon grows via runners underground, and readily re-sprouts from untreated runners. Stronger concentrations of Garlon 4 have been somewhat more effective, but NRS are considering using hand tools to dig runners out of the ground to achieve better control success.

Kuaokala-RubArg-01; RubArg Kuaokala Road

This ICA was visited twice last year. NRS killed nine *R. argutus* on the first trip and 13 on the second. All plants killed on the last trip were immature. This area will be visited quarterly in the next year.

MMR-RubArg-01; Kahanahāiki RubArg at Black Wattle

This ICA is located just outside of the Kahanahāiki exclosure. *R. argutus* was discovered during surveys at the *A. mearnsii* ICA in Kahanahāiki, and was first controlled in May 2003; NRS staff treated *R. argutus* basally with Garlon 4. Most of the plants were in steep areas, accessible by using webbing. NRS visited this ICA three times last year. 115 immature individuals were killed on a single weeding trip last year. This site will be visited quarterly in the coming year.

MMR-RubArg-02; ‘Ōhikilolo RubArg at Red Dirt Puu

This ICA is located just above the *Hedyotis parvula* MMR-C population. Weeding began in December 2001. NRS visited this ICA twice last year. On the first trip two immature plants were found. On the second trip, NRS didn’t find any plants. The absence of mature plants from this area for the past three years provides important information about *R. argutus* seed viability (refer to MMR-RubArg-04 section) NRS will visit this area two times next year.

MMR-RubArg-03; ‘Ōhikilolo RubArg in Lancam Gulch

Three trips were taken to this ICA last year. No plants were spotted on the last weeding trip to this area. No mature plants have ever been found in this area. This population was controlled before it could reproduce, which increases the chance of eradication from this area. This area will be visited two times next year to check for any regrowth.

MMR-RubArg-04; Kahanahāiki RubArg at SE Quad

NRS visited this ICA once last year and did not find any *R. argutus*. The last time a mature plant was found here was in 1999 and the last time any immature plants were found was in 2003. These results suggest it may take at least four years to exhaust the seed bank. Effective control was achieved by combining pesticide control with digging roots out. This ICA is fenced, making the re-establishment of this weed impossible via pigs. NRS will continue to monitor this area yearly for any re-growth.

MMR-RubArg-05; Makua East Rim RubArg

Three immature *R. argutus* were found and treated here in 2004. The same site was checked in 2005 and no plants were found. No surveying of the area was done over the past year to look for more plants, but this site will be visited during each half of the upcoming year to check for resprouts.

UpperKapuna-RubArg-01; Kapuna RubArg Above PhyKaa Fences

NRS weeded in this ICA on two trips last year for a total of 2.5 hours last year. The first trip targeted a patch of 70 plants and the second trip was done to treat scattered *R. argutus* by sweeping through the area. This area will continue to be visited twice a year.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: RubArg		Rubus argutus			
Kuaokala-RubArg-01	Mokuleia FR No MU	2	0.99	2005-06-01	2005-10-05
MMR-RubArg-01	MMR No MU	3	5.25	2006-02-22	2006-08-01
MMR-RubArg-02	Ohikilolo	2	3.50	2002-06-03	2005-11-09
MMR-RubArg-03	Ohikilolo	3	2.00		2005-11-08
MMR-RubArg-04	Kahanahaiki	1	0.10	1999-06-06	2003-08-19
UpperKapuna-RubArg-01	Upper Kapuna	2	2.50		2006-06-15

Syzygium jambos

Native to continental Southeast Asia, *S. jambos* is now a naturalized weed on many islands across the Pacific Ocean. Its fruit are dispersed readily by birds as well by humans and possibly feral pigs. This tree is detrimental to native ecosystems because it does not need disturbance to become established, and can germinate and thrive in shade, eventually overtopping and replacing most native canopy trees. Also, it is a carrier for the devastating *Puccinia*, or ohia rust, which affects all *Myrtaceae*, including *Metrosideros sp.* and *Eugenia sp.* While widespread in the Ko'olaus and southern parts of the Wai'anae Mountains, *S. jambos* is not well known from the Kaluakauila region, and thus is considered a priority weed in this area.

MMR-SyzJam-01; Kaluakauila Upper Transect SyzJam

This ICA was created when one immature *S. jambos* was found along a weed transect in 2005. It is likely that pig traffic is responsible for the spread of this incipient to the region. NRS controlled it, and will monitor the site in the future. Only one individual was found and it is hoped that NRS will be able to keep this weed out of Kaluakauila MU.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: SyzJam		Syzygium jambos			
MMR-SyzJam-01	Kaluakauila	1	0.08		2006-04-03

Triumfetta semitriloba

T. semitriloba is a perennial herb native to North America. It is common in dry disturbed sites on Oahu, however NRS would like to eradicate this species from sites where it is still sparse and keep it out of MUs. This plant produces copious amounts of seed burrs, which are easily transported by pigs and hikers. It reaches maturity quickly, and as a result, small populations can explode exponentially in a short time if not controlled. Frequent visits, often twice a quarter, are necessary to achieve eradication.

MMR-TriSem-01; Makua East Rim TriSem

This site was found just inside the Pahole fence, on the east rim of Makua. It is possible that pigs spread this plant to this area before it was fenced. Ungulate control has reduced this influx. This site was not visited this year. NRS will monitor this site periodically but have not placed a high priority status for this site because *T. semitriloba* is found in many other areas along the east rim of MMR.

MMR-TriSem-02; C-Ridge corner

Including this site, there are a total of five sites of *T. semitriloba* in Kahanahāiki (all sites listed below) that NRS check with regularity. No new sites in Kahanahāiki were found this year. NRS aim to treat all sites at the same time so that the frequency of visitation can be monitored more easily. NRS take care when walking through the sites so as to not disperse *T. semitriloba* further. At the C-Ridge site, eleven mature plants were found in the beginning of the year and none have been seen since. NRS will continue treatment at all Kahanahāiki sites twice per quarter.

MMR-TriSem-03; Pisonia patch

Three immature plants were removed this year.

MMR-TriSem-04; SE Quad

Several mature plants and a handful of seedlings were removed this year.

MMR-TriSem-05; Orange Trail

No plants were found this year. The last mature plant seen was in January of 2005.

MMR-TriSem-06; Top of Switchback

Ten immature plants were found and eradicated at this site at the beginning of the year and none were seen since. No mature plants have ever been seen at this site.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: TriSem		Triumfetta semitriloba			
MMR-TriSem-02	Kahanahaiki	6	5.10	2006-04-25	2006-08-01
MMR-TriSem-03	Kahanahaiki	4	2.75	2006-08-01	2006-04-25
MMR-TriSem-04	Kahanahaiki	3	2.25	2006-04-25	2006-08-01
MMR-TriSem-05	Kahanahaiki	2	0.30	2005-01-09	2005-01-09
MMR-TriSem-06	Kahanahaiki	1	0.25		2005-09-06

Management Unit Weed Control Area Report

Ecosystem scale weed control effort is reported by IP MU. The MUs are arranged geographically, from the northern Wai‘anae Mountains, to the southern Wai‘anae Mountains, and across to the Ko‘olau Mountains. Each MU discussion begins with a brief introduction which covers MU-wide issues such as partner agencies, fire threat, large-scale fencing, and logistical considerations. Then, if relevant, transect survey results are discussed. Finally, there is a WCA discussion, in which strategy, this year’s control efforts, and future plans are described for each WCA. For reference, a map is included for all WCAs in the MU, and a table summarizes weed control efforts at all WCAs.

IP MU: Haili to Keālia

Weed control in this MU takes place on Army land at Dillingham Military Reservation (DMR). Much of DMR is made up of highly degraded habitat, but the rocky talus slopes on the south end of the reservation host patches of native dry forest. The long-term objective of weed management in DMR is to focus on these talus slopes and expand native forest cover. There is also a reintroduction of *Hibiscus brakenridgei* on the far west end of the MU. The weedy lower flats of DMR are dominated by *L. leucocephala* and *P. maximum* and are not a management concern but are a concern from a wildfire perspective. Two WCAs are defined for this MU, see Figure 2.1.9.

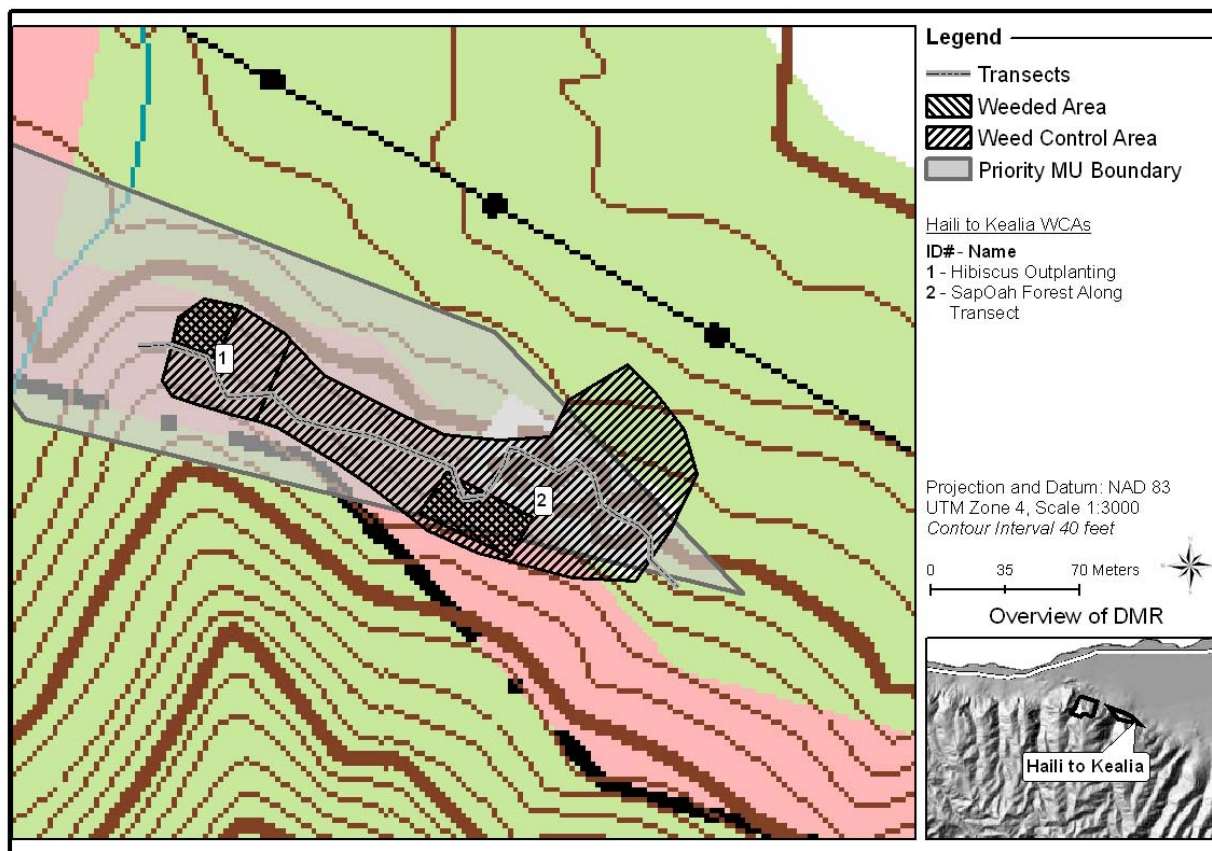


Figure 2.1.9 Weed Control Areas in Haili to Keālia, Dillingham Military Reservation

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present																
IP MU: Haili to Kealia																					
HailitoKealia-01	Habitat	2351.9	553.3	23.53%	HibBraMok																
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;">Treatment Type</th> <th style="width: 10%;"># of Visits</th> <th style="width: 15%;">Effort (Person Hrs)</th> <th style="width: 35%;">Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>1</td> <td>4.00</td> <td></td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>2.00</td> <td>LeuLeu, PanMax</td> </tr> <tr> <td style="text-align: right;">Total</td> <td>2</td> <td>6.00</td> <td></td> </tr> </tbody> </table>						Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	1	4.00		Ecosystem Weed Control	1	2.00	LeuLeu, PanMax	Total	2	6.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	1	4.00																			
Ecosystem Weed Control	1	2.00	LeuLeu, PanMax																		
Total	2	6.00																			
HailitoKealia-02	Habitat	11573	1039.3	8.98%	HibKokKok																
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;">Treatment Type</th> <th style="width: 10%;"># of Visits</th> <th style="width: 15%;">Effort (Person Hrs)</th> <th style="width: 35%;">Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>72.00</td> <td>Fic.Sp., PsiGua, SyzCum</td> </tr> <tr> <td style="text-align: right;">Total</td> <td>1</td> <td>72.00</td> <td></td> </tr> </tbody> </table>						Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	72.00	Fic.Sp., PsiGua, SyzCum	Total	1	72.00					
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Ecosystem Weed Control	1	72.00	Fic.Sp., PsiGua, SyzCum																		
Total	1	72.00																			

WCA Discussion

Haili to Keālia-01; Hibiscus Outplanting

The area has an abundance of *P. maximum* and *L. leucocephala*. Weeding was conducted to prepare for more outplantings of *H. brackenridgei*. Given the preferred high light levels of this taxon, it is difficult to control the competitive sun-loving weeds which thrive in the area. If this continues to be a problem, NRS may consider some levels of habitat restoration via common outplantings to re-establish an appropriate native component that can help keep weed levels down.

Haili to Keālia-02; Sapoah forest along transect

This past year a group of Youth Conservation Corps (YCC) members worked with NRS in a 1000m² area removing alien species throughout a *Sapindus oahuensis* dominated forest. More area can be weeded to the east, west, and downslope of this site. NRS hopes that with continued weeding this area will eventually become mostly native and will only need occasional weeding.

IP MU: Ka‘ena

NRS coordinate with state NARS staff on management of the KAE-B *Chamaesyce celastroides* var. *kaenana* population located within the MU. This population is designated as MFS. Weed control efforts are centered around the *Chamaesyce* population, and there is one WCA defined in this MU, Ka‘ena-01. The population is surrounded by grassy slopes. In 2004, arson fires burned through parts of the region, and while they didn’t affect the population, the potential fire threat to the site was made clear. In the past year, some NRS became certified as Wildland Firefighters. If fire threatens the site in the future, NRS will be able to assist State firefighting efforts. Between January and May 2006, NRS did not visit the NAR, while permits were under discussion with the State; this limited weed control for the year.

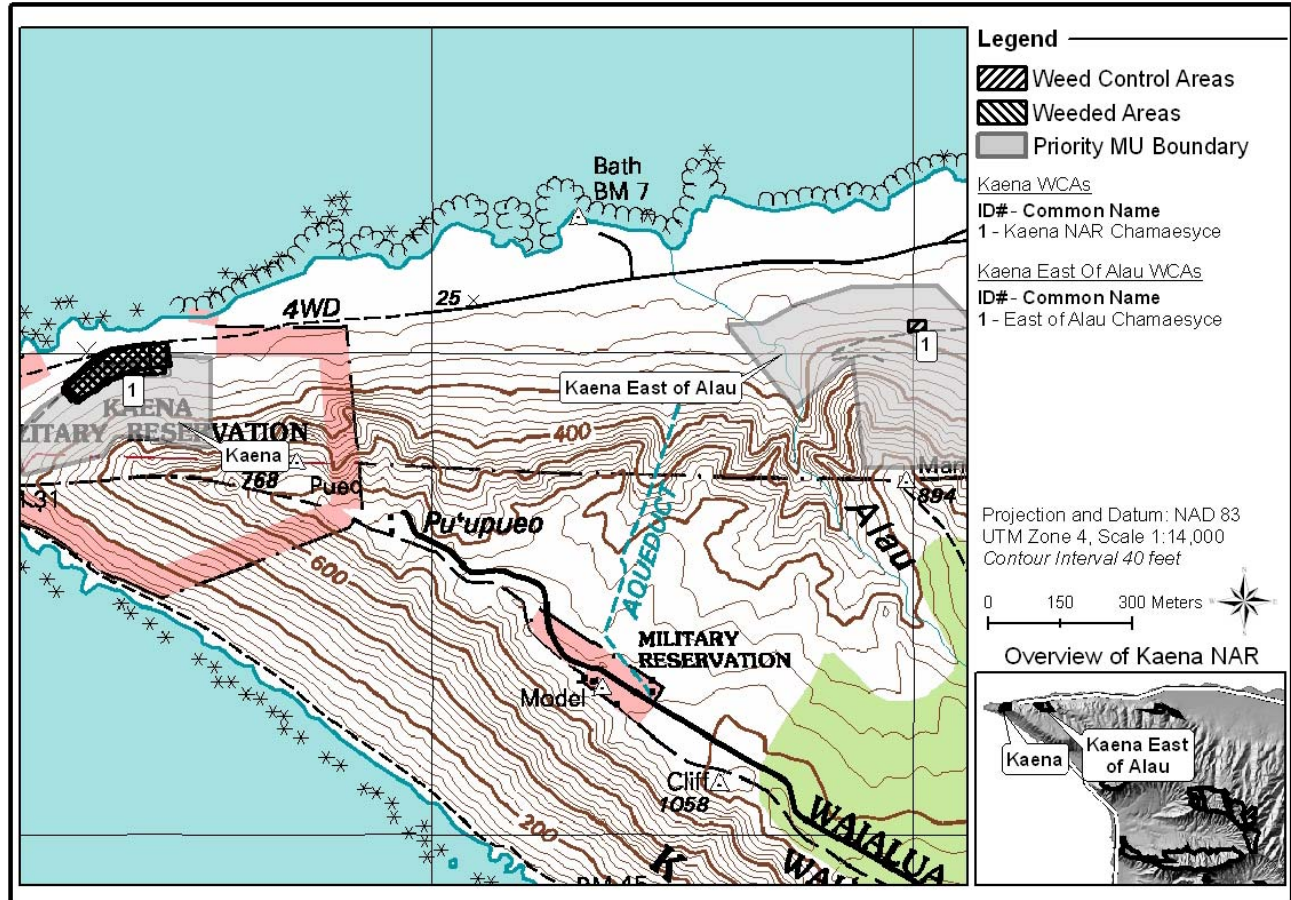


Figure 2.1.10 Weed Control Areas in Ka’ena and Ka’ena East of Alau

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present
IP MU: Kaena					
Kaena-01	Habitat	12189.85	12063.83	98.97%	ChaCelKae
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled		
Grass Control	2	24.00	CenCil, ChlBar, PanMax		
Ecosystem Weed Control	2	38.00	AcaFar, AchAsp, AtrSem, LanCam, LeuLeu, SchTer		
Total	4	62.00			

WCA Discussion

Kaena-01- Ka’ena NAR Chamaesyce

NRS has made great weed control progress in this WCA over the years. Past efforts have resulted in large decreases in quantities of the woody shrubs *L. leucocephala* and *Acacia farnesiana* and the herbaceous *Atriplex semibaccata*. *L. leucocephala* requires hand-sawing and application of Garlon 4 at a concentration of 40%, *A. farnesiana* needs only 20% Garlon 4 after cutting, while *A. semibaccata* only requires hand pulling. NRS continue to sweep across the WCA to control these species, but the time needed to conduct these sweeps has decreased over

time. This year, 18 hours were spent conducting sweeps, and much of this time was spent working on the newly expanded edges of the WCA. One new weed target is *Achyranthes aspera*. This species has just begun colonizing the open weeded areas of the WCA; due to its fecundity, sprawling nature, and fast growth, it's a significant threat. Control technique for this weed consists of handpulling and bagging of all plants found. Grass control continues to pose problems in this WCA. Twenty-two hours were spent on grass control this year. NRS try to time spraying so weedy grasses are beginning to flush, while native grasses have not yet emerged, but struggle with getting effective results. Certain species of grasses appear to be more susceptible to the grass-specific herbicide Fusilade; *Digitaria insularis* and *Panicum maximum* were observed to dieback more than *Chloris barbata*. NRS will experiment with handpulling, which may be more effective, take less total time, and have the greatest positive effect on native vegetation. More studies need to be done to determine optimal techniques in the coming year.

NRS believe that both the number of *Chamaesyce* plants, and the area in which the population occurs, has increased. NRS also think that native vegetation, such as *Sida fallax*, *Eragrostis variabilis*, *Panicum fauriei*, and *Myoporum sandwicense* have also increased due to weed control efforts over the years. Overall, it seems that enough weeding is being done to maintain a healthy population of *Chamaesyce*, but more weeding can be done to further promote the increase of common native vegetation. Hopefully, as native vegetation increases, weed control time should decrease. Therefore, to maximize efficiency, future outplantings will be done in previously weeded areas. NRS worked with DLNR staff this past year to outplant approximately 100 *Sesbania tomentosa* around this WCA. Other common native plants, which include *Eragrostis variabilis* and *Chenopodium oahuensis*, are currently being propagated for future outplantings with DLNR. NRS hope to use these outplantings in the weedy grass portion of the WCA, to help reduce regrowth. NRS will continue to balance grass spraying and other weed removal efforts this coming year and expect to see more native vegetation colonization of these weed free areas. This WCA will be visited quarterly, and each trip will involve targeting multiple weeds by applying different techniques.

IP MU: Lower 'Ōhikilolo

Maintenance weed control at Lower 'Ōhikilolo continued this year as in previous years. There are three WCAs in the MU, see Figure 2.1.11. Effort levels are directly tied to rainfall, as NRS must respond with spot spraying after rains. Grasses have evolved to resprout with rain after being stressed. It is notable that in the areas where the *C. celestroidies* WCAs were expanded to the road last year, grass cover was much more prevalent than in areas that have been maintained for multiple years. This indicates that the seed bank is being depleted in the retreated areas and enforces the goal of treating grass before it becomes reproductive. The additional use of a power sprayer from the road has helped speed control of grass in the lower part of the WCAs. The benefits of this technique are that no re-mixing is required as the spray reservoir is 200 gal, and spray force is greatly increase, increasing coverage. The limitation is that a hose must be pulled from the tank in the trunk into and around the WCA. As a result, NRS found this technique effective to retreat areas with extensive grass cover. However, in areas with sparse grass, a backpack sprayer is more efficient. Across all WCAs NRS prefers to use Fusilade directly around endangered species, and Round-up in less sensitive areas. *L. leucocephala* removal continues in the MU, however the effort is greatly diminished. Most of the WCAs have been

completely swept at least one time and only require occasional re-treatment to remove individuals that have been missed or are new recruits.

An arson fire near Kaneana Cave threatened all three WCAs (see Appendix II). As a result of this and additional consultations with USFWS, the Army plans to expand the fire break areas around the endangered plants and expand buffers around the firebreak road. NRS strongly support this initiative.

In the next year NRS will look at developing a monitoring program to help direct control efforts. It would be ideal to maximize effect by analyzing effort expended compared to change over time. For example, it is less effective to go when grass is just starting to respond to the first rains of winter as most have not started to germinate and are not yet actively growing. However, effort required increases steeply if too much time lapses before treatment, as grass grows explosively, resulting in much more biomass to spray. Somewhere between these extremes there is an ideal where effort is minimized and effect maximized. Perhaps this question can be answered through monitoring.

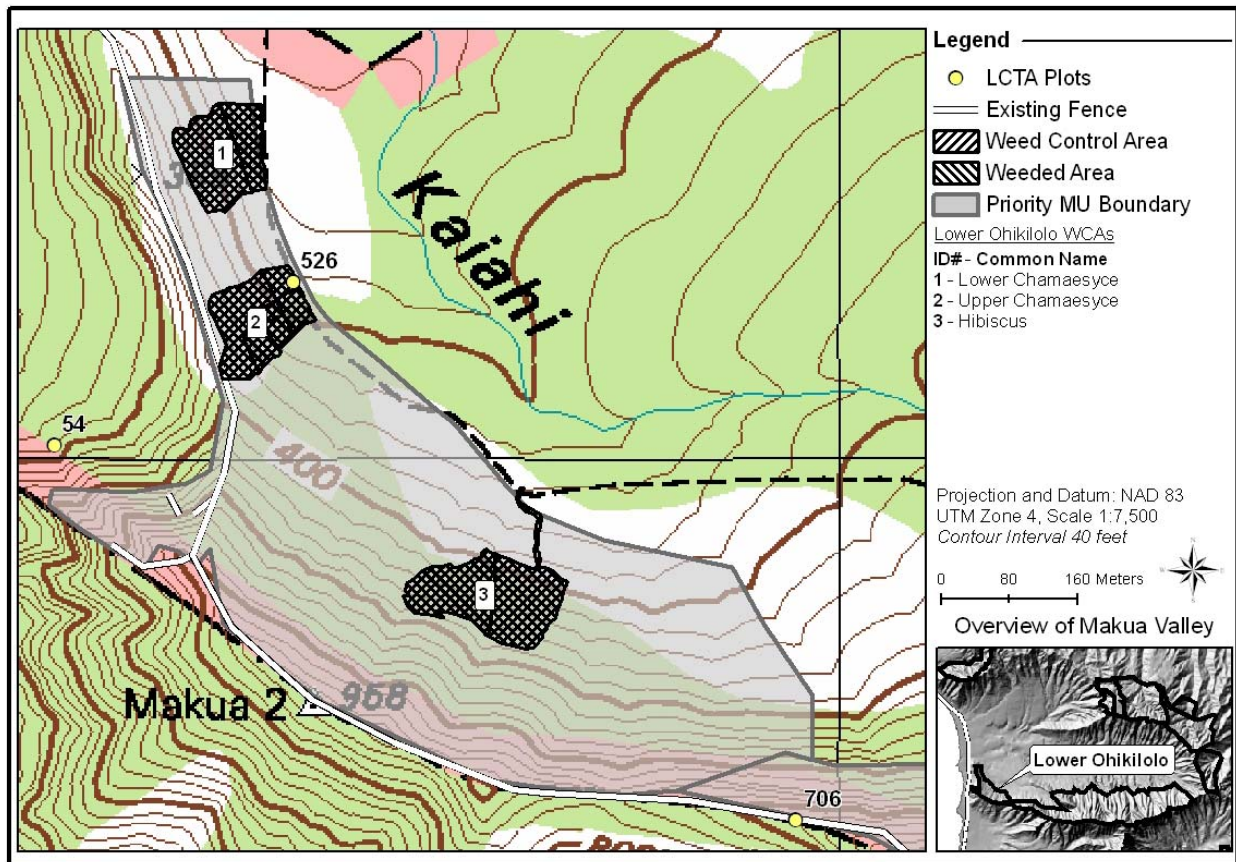


Figure 2.1.11 Weed Control Areas in Lower ‘Ōhikilolo

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present																
IP MU: Lower Ohikilolo																					
LowerOhikilolo-01	Habitat	10052.77	10051.84	99.99%	ChaCelKae																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>7</td> <td>53.20</td> <td>ChlBar, ChlSp., PanMax, RhyRep</td> </tr> <tr> <td>Total</td> <td>7</td> <td>53.20</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	7	53.20	ChlBar, ChlSp., PanMax, RhyRep	Total	7	53.20					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	7	53.20	ChlBar, ChlSp., PanMax, RhyRep																		
Total	7	53.20																			
LowerOhikilolo-02	Habitat	10199.9	10199.9	100.00%	ChaCelKae																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>5</td> <td>6.70</td> <td>ChlBar, PanMax, RhyRep</td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>12.00</td> <td>AcaFar, LeuLeu</td> </tr> <tr> <td>Total</td> <td>6</td> <td>18.70</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	5	6.70	ChlBar, PanMax, RhyRep	Ecosystem Weed Control	1	12.00	AcaFar, LeuLeu	Total	6	18.70	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	5	6.70	ChlBar, PanMax, RhyRep																		
Ecosystem Weed Control	1	12.00	AcaFar, LeuLeu																		
Total	6	18.70																			
LowerOhikilolo-03	Habitat	13708.48	13708.48	100.00%	HibBraMok																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>8</td> <td>99.50</td> <td>AndVir, ChlBar, DesInt, MelMin, PanMax, PasFim, RhyRep</td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>33.00</td> <td>Leuleu</td> </tr> <tr> <td>Total</td> <td>9</td> <td>132.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	8	99.50	AndVir, ChlBar, DesInt, MelMin, PanMax, PasFim, RhyRep	Ecosystem Weed Control	1	33.00	Leuleu	Total	9	132.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	8	99.50	AndVir, ChlBar, DesInt, MelMin, PanMax, PasFim, RhyRep																		
Ecosystem Weed Control	1	33.00	Leuleu																		
Total	9	132.50																			

WCA Discussion

LowerOhikilolo-01 Lower *C. celestroides* patch

Grass was controlled throughout the WCA on six trips this year. NRS plan to weedwhack *Leonotis nepetifolia* in the fall to facilitate finding the higher fuel content grass species seedlings when they are sprayed in the winter. NRS did not conduct *L. leucocephala* and *A. farnesiana* weed control in this past year, but rather prioritized work on untreated areas in the other WCAs in this MU first.

LowerOhikilolo-02 Upper *C. celestroides* patch

Grass was controlled throughout the WCA on five trips this year. The majority of the effort was between November and June. *L. leucocephala* and *A. farnesiana* control was conducted this year. Still more control of these species needs to be done in the next year in the upper-west corner of the WCA. NRS installed an informal plot to investigate the effectiveness of a basal Garlon 4 treatment of grass during the summer. NRS was motivated to perform this trial as the typical 1% Round-up treatment is ineffective on grass when it is dried and not actively growing in the early summer. Results are still pending. An effective control technique would be useful as these grass clumps are the first to respond to rains and because of their size they rapidly become mature. If they could be removed in the summer, then come the winter all new plants would have to grow from seedling size before becoming reproductive.

LowerOhikilolo-03 *H. brackenridgii*

NRS made eight trips to the WCA to control invasive grass. The majority of the trips were between October and March. *L. leucocephala* was controlled with the help of the Wildland Fire Crew and hula halau volunteers in the lower section of this WCA. More *L. leucocephala* needs to be controlled on the lower east side of the patch. *Dodonea viscosa* seeds were spread in a pilot project to determine the feasibility of using this technique to establish this species. Results show that few survived and are detailed in Appendix VI. Perhaps they need to be spread in large rocky areas where grass will not out-compete them. *Myoporum sandwicense* and *Santalum ellipticum* are now growing in this WCA despite the fact that no adult plants were seen at the start of weed control. This may mean that the seed bank still has viable seeds and continued weed control will allow more natives to reestablish. The alien *Bidens pilosa* population has increased in the WCA. NRS plan to weedwhack this population in the fall to facilitate finding the higher fuel content grass species seedlings when they are sprayed in the winter.

IP MU: Kaluakauila

Kaluakauila MU is one of the most highly fire-threatened units in all of Mākua, surpassed only by Lower ‘Ōhikilolo. The area is vulnerable to fires from nearly all directions, with steep fuel-laden slopes which make fire suppression a difficult task.

A fire burned into the bottom of Kaluakauila MU earlier this year, affecting an outplanting site of *Hibiscus brackenridgei* subsp. *mokuleianus*, as well as a wild population of *Chamaesyce celastroides* var. *kaenana* (Appendix IV).

The newly created Wildland Fire Crew outlined in their recent report a plan for fire prevention and management to protect Kaluakauila MU from future burns. The plan consists mainly of three components, including the creation and maintenance of new fire/fuelbreaks in strategic locations around the MU, the reduction of arson along Farrington Highway, and fuel reduction directly around protected species within the MU. In addition, NRS members have been trained to assist Wildfire Team members and are available to help on-site for future fires.

There are three WCAs drawn in Kaluakauila (Figure 2.1.12). Two are centered around concentrations of rare taxa and native dry forest remnants. The third, Kaluakauila-03, encompasses a grassy ridgeline separating Kaluakauila from the greater part of MMR. This WCA is a fuel reduction area; no work has been done here for the past year. The Army Wildfire Crew will assist with work in this WCA over the next year. Kaluakauila-03 is not discussed below.

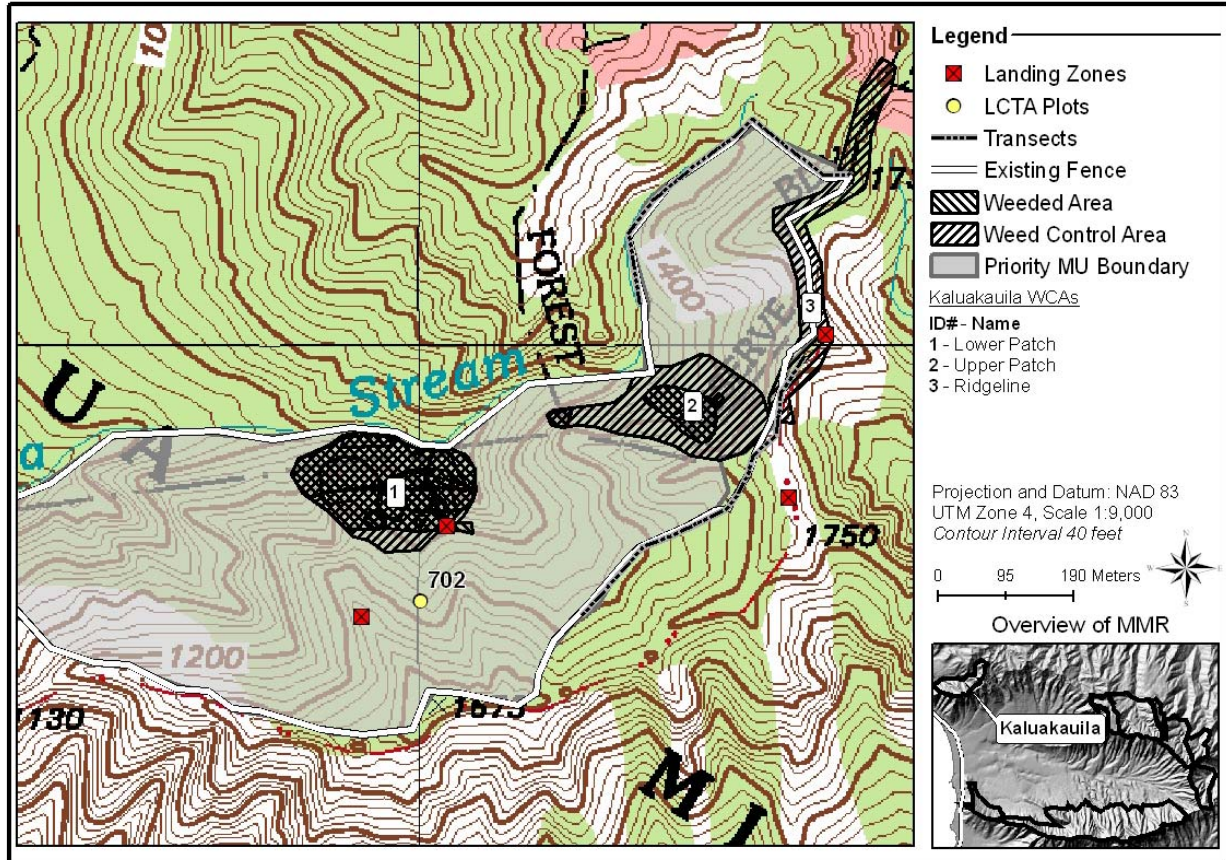


Figure 2.1.12: Kaluakauila Weed Control Areas

Transect discussion

There are two transects in this MU. One significant weed was found this year, *Syzigium jambos*. This species, while common elsewhere, is not known from Kaluakauila. As a carrier for the destructive ohia rust (identified as *Puccinia psidii*), it is doubly significant. The rust would potentially be detrimental to *Eugenia reinwardtiana* and *M. polymorpha*—native trees in the same family as *S. jambos*. Only one tree was seen and it was killed.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present																
IP MU: Kaluakauila																					
Kaluakauila-01	Habitat	29441.38	26075.43	88.57%	AbuSan, BobSan, BonMen, EupHae, HibBraMok, NerAng, NotHum																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>3</td> <td>38.50</td> <td>DiglIn, GreRob, LanCam, LeuLeu, MelMin, PanMax, RhyRep, SetGra</td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>5</td> <td>47.50</td> <td>GreRob, LanCam, LeuLeu, PsiCat, PsiGua, SchTer, SyzCum</td> </tr> <tr> <td>Total</td> <td>8</td> <td>86.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	3	38.50	DiglIn, GreRob, LanCam, LeuLeu, MelMin, PanMax, RhyRep, SetGra	Ecosystem Weed Control	5	47.50	GreRob, LanCam, LeuLeu, PsiCat, PsiGua, SchTer, SyzCum	Total	8	86.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	3	38.50	DiglIn, GreRob, LanCam, LeuLeu, MelMin, PanMax, RhyRep, SetGra																		
Ecosystem Weed Control	5	47.50	GreRob, LanCam, LeuLeu, PsiCat, PsiGua, SchTer, SyzCum																		
Total	8	86.00																			
Kaluakauila-02	Habitat	24712.62	5514.767	22.32%	AbuSan, BobSan, ChaCelKae, EupHae, HibBraMok, MelTen, NerAng, NotHum																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>1</td> <td>5.50</td> <td>AgeRip, MelMin, OplHir, PanMax</td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>2</td> <td>5.00</td> <td>AgeRip, CorFru, LanCam, LeuLeu, PasSub, PsiCat</td> </tr> <tr> <td>Total</td> <td>3</td> <td>10.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	1	5.50	AgeRip, MelMin, OplHir, PanMax	Ecosystem Weed Control	2	5.00	AgeRip, CorFru, LanCam, LeuLeu, PasSub, PsiCat	Total	3	10.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	1	5.50	AgeRip, MelMin, OplHir, PanMax																		
Ecosystem Weed Control	2	5.00	AgeRip, CorFru, LanCam, LeuLeu, PasSub, PsiCat																		
Total	3	10.50																			

WCA Discussion

Kaluakauila-01 (Lower Patch)

For a number of years NRS have been working in the lower patch to restore native habitat for protected species by focusing mainly on *P. maximum* and *L. leucocephala* removal. The Lower Patch WCA contains seven populations of rare plants, four wild and three reintroductions. To encourage the survival and enhancement of these rare and protected species, it is imperative to keep *P. maximum* and *L. leucocephala* under control.

2006 saw a marked reduction of *P. maximum* throughout the lower patch. Spraying was highly successful and effort from the previous year has resulted in the opening up of much of the understory within the patch. Spraying efforts this year were focused on treating resprouting grass, which has become sparse and patchy throughout the area. Native seedlings of *Diospyros sandwichensis*, *D. hillebrandii*, and *Rauvolfia sandwicensis* have been seen emerging in dense aggregations, which may be a result of the removal of grasses. It is interesting to note that spraying effort actually decreased from last year from 53 to 38.5 total hours spraying in the Lower Patch.

This year an informal trial using different concentrations of Roundup herbicide was performed on *P. maximum*. It was found that a concentration of 0.5% is enough to sufficiently kill the grass. In the coming year NRS plan to switch spraying operations to using 0.5% instead of 1% to further reduce the risk of negatively affecting non-target plants.

Other weeding efforts within the Lower Patch WCA have focused on *L. leucocephala*, involving large sweeps through areas to allow native canopy trees to thrive and dominate (Figure 2.1.12).

L. leucocephala is also detrimental to native species because it is thought to use a high amount of water compared to other plants, which puts stress on competing native species in this water-limited WCA. Garlon 4 at a 40% dilution rate was applied to the cut stems of *L. leucocephala* in weeded areas. Areas within the WCA have been prioritized based on their percentage of native plant cover. High priority areas have approximately 75% or more native cover, and are treated first. Other areas are visited after high priority areas have been weeded. It is hoped that the intensive effort required to remove *L. leucocephala* will pay off by not having to treat the area again in the same way. Successive sweeps through treated areas will be necessary to remove emergent seedlings, but will require much less effort than the initial sweep.

To ensure that *P. maximum* is sufficiently suppressed to allow native plant regeneration, NRS will continue monitoring and grass spraying if necessary throughout the Lower Patch WCA every quarter for the 2006-2007 year. If done at this frequency, grass levels should be kept low enough so that sweeps do not require much time or herbicide on any given trip.

During the coming year NRS will continue *L. leucocephala* removal throughout the patch, once a quarter as well. Monitoring of formerly weeded areas will show if re-weeding will be necessary. NRS will also begin to evaluate the possibility of removing other canopy weeds, including *P. cattleianum*, *S. terebinthifolius*, and *G. robusta* in higher priority areas.

Reduction of grass in the Lower Patch WCA is seen as a positive effect of weeding effort in Kaluakauila. However, the area is surrounded by dense *P. maximum*, and therefore is still threatened by wildfire as mentioned above. It may be feasible to expand the native forest boundary by coordinating grass removal and common native canopy species outplanting at the WCA boundaries. This would increase potential habitat for protected species as well as decrease the effects of wildfires on core protected species populations such as *Euphorbia haeleeleana* and outplanted populations. Also, by filling in gaps created by weeding, NRS could potentially reduce the amount of future grass control effort by reducing the amount of habitat favorable for grass growth.

The positive response of the native tree seedlings to the grass removal observed in the Lower Patch WCA provides us with a unique opportunity to experiment with restoration strategies to expand native habitat cover. This year NRS will experiment with translocation of seedlings from overcrowded areas to places recently cleared of weeds. It is important to combine weeding with native outplanting to discourage alien plant regrowth into the weeded area. Also, by transplanting seedlings from dense patches to open areas, we may be utilizing many plants that may have died as a result of competition with cohorts. Using wild germinated seedlings is also much more cost-effective than using greenhouse grown plants, and may increase survival rates by using plants adapted to that specific microclimate.

Monitoring

Plot 702

Please see the discussion and data analysis in Chapter 1: Feral Ungulate Management.

Kaluakauila-02 (Upper Patch)

The Upper Patch is more uniform than the Lower Patch, and has a larger area of 75% or more native canopy. Weeding effort in the Upper Patch has focused mainly on grass and broadleaf canopy control around the three reintroduced and four wild populations of rare plant species in the Upper Patch WCA (Figure 2.6). Grass control throughout the area concentrated on new re-growth, with the observation that previously sprayed grass had actually died, and treatment was effective. NRS did expand the area controlled for grass this year, to encompass new reintroductions and better protect the forest patch. NRS will continue to control grass in the WCA and remove weeds from outplanting sites therein, and will visit the site at least three times in the following year to ensure the improvement of the outplantings and the native forest. Habitat restoration techniques discussed above will be implemented in the Upper Patch if found to be successful and feasible in the Lower Patch.

An informal trial was performed on *Ageratina riparia*, a widespread herbaceous weed. NRS found that it is possible to treat the weed with a 1% roundup foliar spray, a finding that may be helpful for future attempts at controlling this aggressive weed.

IP MU: Kahanahāiki

Numerous WCAs were established in this MU over the past year because there are multiple MFS taxa and many areas of 75% native forest. WCAs were also mapped out to include existing weeding areas. All WCAs fall within the fence, minimizing the disturbances caused by ungulates—primary agents of weed dispersal. Weed control is not conducted throughout the entire fenced area as much of the south-facing fenceline is very weedy both in the understory and overstory and not worth weeding. Over the years, NRS spent much time documenting vegetation types and prioritizing MU level weed areas based on high levels of native components and proximity to endangered species.

Four LCTA plots occur within the MU, plot 56 located in WCA Kahanahāiki-03, plot 55707 located in WCA Kahanahāiki-09, plot 703 located in WCA Kahanahāiki-04 and plot 716 located outside any WCA but in the MU (Figure 2.1.13). Only plot 703 was not read by NRS Monitoring this year; it could not be relocated. NRS continue to look for this plot and it will be read as soon as it is located. The discussion of plot 716 appears in the Kahanahāiki MU section of Chapter 1: Feral Ungulate Management. Detailed discussions of each plot and the data analysis appear in the WCA sections below.

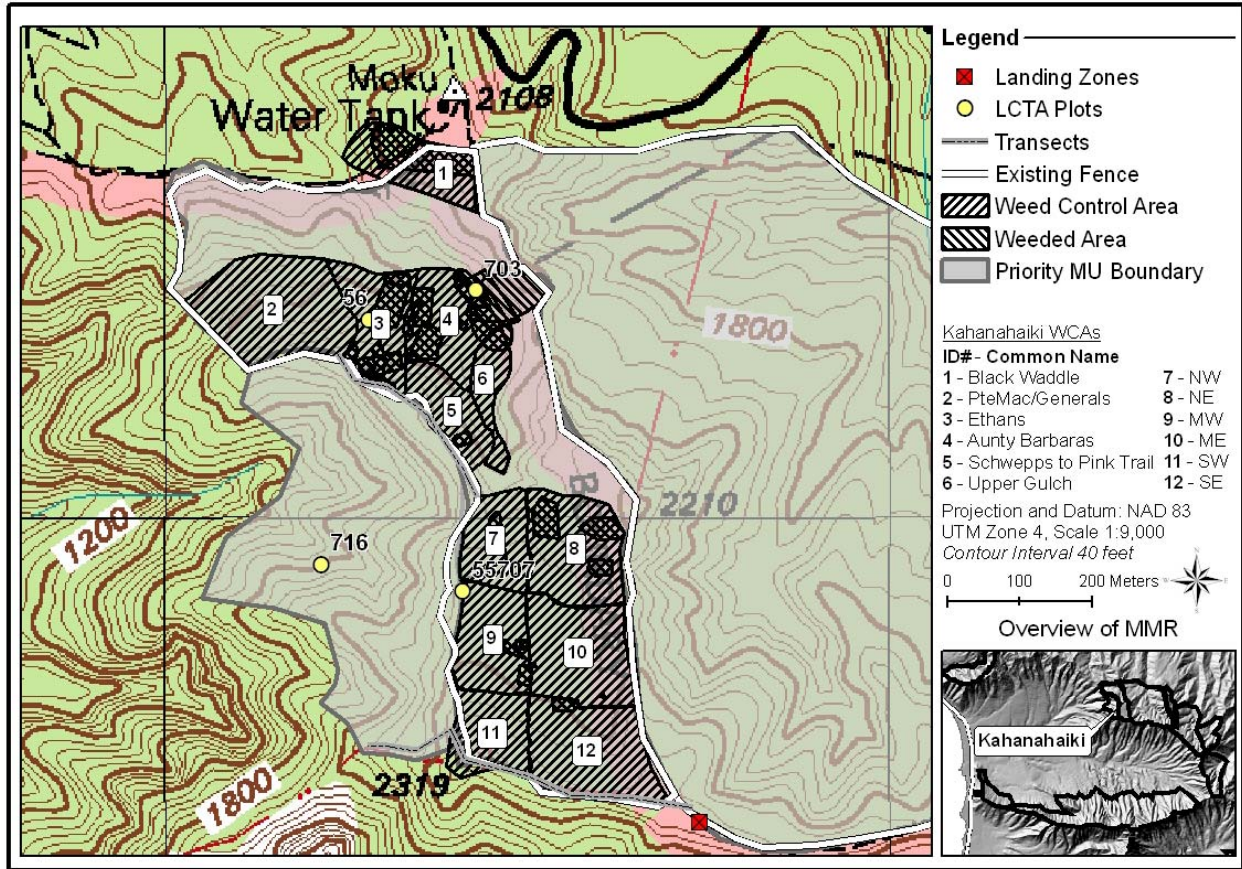


Figure 2.1.13 Weed Control Areas in Kahanahaiki, Makua Military Reservation

Transect Discussion

There are two weed transects read in Kahanahaiki. Both run alongside the fence. No new significant weeds were found along either this year.

Monitoring

Plot 716

Please see the discussion and data analysis in Chapter 1: Feral Ungulate Management.

WCA Code	WCA Type	WCA Total Area	Total Area Covered	% Area Covered	IP Taxa Present																
IP MU: Kahanahaiki																					
Kahanahaiki-01	Habitat	6807.84	2785.349	40.91%																	
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>1</td> <td>2.00</td> <td>MelMin</td> </tr> <tr> <td>Total</td> <td>1</td> <td>2.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	1	2.00	MelMin	Total	1	2.00					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	1	2.00	MelMin																		
Total	1	2.00																			
Kahanahaiki-03	Habitat	13980.01	5071.018	36.27%	AlpPon, CyaSupSup, DelSub, FluNeo, SchObo																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>4</td> <td>49.50</td> <td>AleMol, CliHir, CraCre, GreRob, LanCam, PsiCat, PsiGua, RubRos, SchTer</td> </tr> <tr> <td>Total</td> <td>4</td> <td>49.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	4	49.50	AleMol, CliHir, CraCre, GreRob, LanCam, PsiCat, PsiGua, RubRos, SchTer	Total	4	49.50					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Ecosystem Weed Control	4	49.50	AleMol, CliHir, CraCre, GreRob, LanCam, PsiCat, PsiGua, RubRos, SchTer																		
Total	4	49.50																			
Kahanahaiki-04	Habitat	13998.24	5749.253	41.07%	CenAgrAgr, CyrDen, DieFal, FluNeo, SchNut																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>2</td> <td>7.00</td> <td>MelMin, PasCon</td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>6</td> <td>58.00</td> <td>AleMol, BudAsi, ChrPar, CliHir, GreRob, PasEdu, PsiCat, PsiGua, RubRos, SchTer, SyzCum</td> </tr> <tr> <td>Total</td> <td>8</td> <td>65.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	2	7.00	MelMin, PasCon	Ecosystem Weed Control	6	58.00	AleMol, BudAsi, ChrPar, CliHir, GreRob, PasEdu, PsiCat, PsiGua, RubRos, SchTer, SyzCum	Total	8	65.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	2	7.00	MelMin, PasCon																		
Ecosystem Weed Control	6	58.00	AleMol, BudAsi, ChrPar, CliHir, GreRob, PasEdu, PsiCat, PsiGua, RubRos, SchTer, SyzCum																		
Total	8	65.00																			
Kahanahaiki-05	Habitat	9122.041	364.3728	3.99%	CenAgrAgr, CyaSupSup, DelSub, SchNut, SchObo																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>1</td> <td>0.50</td> <td>MelMin</td> </tr> <tr> <td>Total</td> <td>1</td> <td>0.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	1	0.50	MelMin	Total	1	0.50					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	1	0.50	MelMin																		
Total	1	0.50																			
Kahanahaiki-07	Habitat	11241.32	1639.618	14.59%	CenAgrAgr, CyaSupSup																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>7.50</td> <td>GreRob, LanCam, PsiCat, SchTer</td> </tr> <tr> <td>Total</td> <td>1</td> <td>7.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	7.50	GreRob, LanCam, PsiCat, SchTer	Total	1	7.50					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Ecosystem Weed Control	1	7.50	GreRob, LanCam, PsiCat, SchTer																		
Total	1	7.50																			
Kahanahaiki-08	Habitat	18384.99	6527.801	35.51%	CenAgrAgr, SchNut, SchObo																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>3.00</td> <td>GreRob, PsiCat, SchTer, SpaCam</td> </tr> <tr> <td>Total</td> <td>1</td> <td>3.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	3.00	GreRob, PsiCat, SchTer, SpaCam	Total	1	3.00					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Ecosystem Weed Control	1	3.00	GreRob, PsiCat, SchTer, SpaCam																		
Total	1	3.00																			

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present				
Kahanahaiki-09	Habitat	14073.09	10278.96	73.04%	CenAgrAgr				
						Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
						Grass Control	1	18.00	PsiCat
						Ecosystem Weed Control	2	76.00	PsiCat
						Total	3	94.00	
Kahanahaiki-10	Habitat	18889.65	11665.27	61.75%					
						Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
						Ecosystem Weed Control	3	10.00	MonHib, PsiCat
						Total	3	10.00	
Kahanahaiki-11	Habitat	11441.89	8825.093	77.13%	CenAgrAgr				
						Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
						Unknown	1	0.00	
						Total	1	0.00	
Kahanahaiki-12	Habitat	21145.24	18264.63	86.38%	CenAgrAgr				
						Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
						Ecosystem Weed Control	3	114.00	CliHir, PsiCat
						Total	3	114.00	
MMRNoMU-01	Habitat	5719.412	3197.025	55.90%					
						Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
						Ecosystem Weed Control	1	0.00	MelMin
						Total	1	0.00	

WCA Discussion

Kahanahāiki-01; Black Wattle area weed control

This WCA is easily accessible to NRS because it is near the trail head. Weeding tasks that have taken place here include backpack spraying *Melinis minutiflora*. NRS will visit this area twice a year to spray grasses. *Microlepis strigosa* (palapalai) has been used for outplantings in this area and is doing well. This area is good for volunteer groups to work on because it is easily accessible and includes both weeding and outplanting tasks.

Kahanahāiki-02; Ptemac/Generals

No weeding was done in this WCA this past year, however both grass control and ecosystem level weed control are planned for the coming year. *Blechnum appendiculatum* trials done in July 2005 were analyzed twice this report year and show promising results. Only a few plots had any resprouts and some plots had native plant revival. NRS is encouraged by these results and will continue to experiment with a lower pesticide percentage. In 2002 trials at 'Ōhikilolo using

a hand-saw and 2% and 3% Round-up proved ineffective. The 2005 trial used a pick and 10% Round-up. NRS will experiment with a pick and 5% Round-up for Report Year 2007.

Kahanahāiki-03; Ethans Gulch

Three weeding trips were conducted in the upper regions of this WCA (south side). Weeding was done at one site for outplanting *Schiedea obovata* and another nearby where an outplanting of common natives also occurred. In the previous reporting year, NRS had aggressively removed *P. cattleianum* from this area and this year NRS continued that project. At another site, closer to the gulch bottom, NRS again weeded in effort to remove *P. cattleianum* and replace it with common native gulch species to be outplanted this winter. In all sites where *P. cattleianum* has been removed in this WCA, NRS have been surprised to find very little recruitment of this or other habitat altering weeds. To prevent future colonization, NRS are establishing common outplantings to increase native cover

Monitoring

Plot 56

This plot shows significant changes in the mean number of interceptions (χ) of non-native species over time (p=0.059). Interceptions of non-native species declined from their initial value in 1996 $\chi=2.88\pm 2.03$ to a lower $\chi=2.14\pm 2.08$ in 2006. Interceptions of native vegetation were unchanged in this time (p=0.9067). There is no need to adjust these data for values that seem to be erroneous, as all data conform nicely to the patterns described above and have similar standard deviations. This area was fenced in 1996 and no ungulates are known to have been in the vicinity since 1998. Only non-native species show a significant response corresponding to ungulate removal; however this plot has been the site of intense weed control efforts focused on non-native canopy species and the decline in non-native species χ may be due to those efforts. In fact, non-native tree species χ appears to be declining though not significantly (p=0.137).

Several understory species were first detected at this plot this year including the non-natives *B. appendiculatum* and *Crassocephalum crepidoides* however; at least one non-native tree has been eliminated from this plot, *G. robusta*. The only species that showed significant change over time was *S. terebinthifolius* which decreased (p=0.0902, 1996 $\chi=2.4\pm 1.14$ 2006 $\chi=1.0\pm 0.0$, n=5 for all years). *P. cattleianum* showed no change in mean interception in this plot despite a significant effort to remove the species from this area which was undertaken in 2004. Most individuals killed at that time were fairly tall and may have escaped detection by this method in early visits due to their height or new individuals growing into the light gaps created by the weeding have replaced those removed. It is important to note that when conducting this type of weed control NRS purposefully leave several individuals at a site to maintain some sort of canopy while the native forest recovers. Data collected in the future may help resolve some of these questions as the community continues to respond to the recent alterations.

Kahanahāiki-04; Aunty Barbs

This is a very large WCA. Work is focused on the region directly around several rare species outplantings. This site was visited eight times last year for girdling trees and grass spraying. Chainsaws were useful in weeding this area to girdle the bigger trees and to clear monotypic stands of *P. cattleianum*. The canopy in this area mainly consists of non-native trees such as *G. robusta*, *A. moluccana* and *P. guajava*. Weeding in this area is focused on clearing weedy

grasses and shrubs to allow native understory to expand. Larger canopy weeds have been killed to allow more sunlight to reach these established native plants. Although most of the canopy is weedy, areas directly around the reintroductions are mostly native. This area will continue to be visited once each quarter to weed outplanted areas. Future monitoring efforts will continue to focus on hot spots of weedy grasses and shrubs such as *Oplismenus hirtellus* and *R. rosifolius*.

Monitoring

Plot 703

This plot shows a significant change in the mean number of native species interceptions over time for the years it was read, 1996, 1999 and 2003 (p=0.005). The mean number of interceptions (χ) has steadily decreased throughout this time period beginning with $\chi=2.37\pm 1.22$ in 1996, $\chi=1.87\pm 0.88$ in 1999 and $\chi=1.25\pm 0.46$ in 2003. The plot could not be located this year by NRS staff but attempts continue. This area was fenced in 1996 and has been ungulate free since 1998. Subsequent to ungulate removal from the area there was a period of significant mortality for *Pisonia umbellifera*. In fact when individual species mean interception is analyzed the reduction in *Pisonia* species' χ is evident though not significant (*P. brunoniana* p= 0.1504 and *P. umbellifera* p=0.1130). The mean interception of the two species of *Pisonia* present declined from 2.26 ± 1.19 to 1.83 ± 0.72 for *P. brunoniana* and from 3.00 ± 1.36 to 2.29 ± 1.05 for *P. umbellifera*. NRS noted that *P. umbellifera* suffered greater population declines during this unexplained dieback than did *P. brunoniana*.

The mean number of non-native species interception showed no significant changes within the lifetime of the plot (p=0.827), however individual non-native species did show significant changes in response to ungulate removal. *Clidemia hirta* increased following ungulate removal (p=0.0845; prior to fence $\chi=1.25\pm 0.5$, post fence $\chi=2.43\pm 1.3$) while *Deparia petersenii* decreased (p=0.0769; prior to fence $\chi=1.6\pm 0.52$, post fence $\chi=1.0\pm 0.0$). The only native species to show a significant change was *Morinda trimera* which also decreased (p=0.0312, prior to fence $\chi=2.25\pm 0.71$ post fence $\chi=1.25\pm 0.5$).

This plot had not been weeded prior to 2003, the most recent data collection visit, but has been the site of fairly intense weed control efforts since that time. NRS expects more current data will show a decrease in the mean non-native species interception as a result of these efforts. Weed control in the vicinity has been focused on canopy species such as *Aleurites moluccana*.

Kahanahāiki-05; Schwepps/Pink Trail

NRS staff went to this site once last year to spray *M. minutiflora*. A handsprayer was sufficient to treat grass near the native plants *S. nuttallii* and *C. agrimonioides*. NRS will visit this site each quarter next year to monitor and control the weedy grasses and expand weeding to some of the steeper native forest patches.

Kahanahāiki-06; Upper Gulch

This area was not weeded last year but NRS worked with volunteers to increase the native vegetation found here by outplanting *M. strigosa*, a native fern. NRS plant to visit this WCA twice next year.

Kahanahāiki-07; North Western Quadrant

Last year one weeding trip was made in a small gulch containing large amounts of *Melicope lanaiensis*. This trip targeted *G. robusta*, *Lantana camara*, *P. cattleianum*, and *S. terebinthifolius*. The weeding in the main gulch looked effective, and not many weeds have come back, so more work will be done to target surrounding areas. This WCA has very patchy forest distribution and weeding efforts were focused on the most native part of it, the gulch. Other parts of it were weeded in previous years, and are scheduled to be re-swept next year. Future trips will be made two times in the next year to continue to expand weeded areas and target hot spots in previously weeded areas.

Kahanahāiki-08; North Eastern Quadrant

This WCA has sections with high levels of weed cover and therefore weed control is focused in small areas with higher levels of native cover or around rare plant populations. This year NRS weeded carefully through a wild population of *C. agrimonioides* as well as targeted *G. robusta* over a portion of the WCA. No large-scale sweeps were conducted this year, but are planned for in the coming year.

Kahanahāiki-09; Middle Western Quadrant

This WCA had a high level of *P. cattleianum* seedling recruitment. Seedlings grew in thick 1-2m high stands in areas where incomplete control of larger trees was conducted in previous years. NRS has developed a technique where weedwhackers with blades are used to clear these stands, and then the remaining small stumps are sprayed with Garlon 4 in water. This technique has been particularly good project for volunteers who can clear and pile slash after NRS weedwack an area. *M. strigosa* was later outplanted in these areas to aid in the reestablishment of native groundcover. To date, all of the ferns outplanted are still alive and slowly beginning to spread. NRS will visit this site quarterly next year to continue to clear thick areas of *P. cattleianum* and retreat any resprouts from previously weedwhacked areas. *Melinis minutiflora* and *R. rosifolius* will be monitored and efforts will be made to keep these weeds out of native patches.

Monitoring

Plot 55707

When comparing the number native species intercepted in the plot over time for all the years the plot was read (1996, 2003, 2006) there was a significant change over time ($p < 0.0001$). **The mean number of native species interceptions (χ) increased over time (1996 $\chi = 1.89 \pm 1.39$, 2003 $\chi = 2.58 \pm 1.66$ and 2006 $\chi = 3.71 \pm 2.33$).**

The mean non-native species interception in this plot has decreased from 1996 ($\chi = 2.15 \pm 1.5$) to present ($\chi = 1.75 \pm 1.02$) but not significantly. The data from 2003 and 2006 are fairly similar and despite not being significant the trend in the change among all years is clear ($p = 0.27$).

This area has been pig free since the fence was completed in 1996; however some pigs still remained in the area through 1998. When the data are examined looking for effects of ungulate removal there was a significant increase in native species' χ after fencing from 1.89 ± 1.39 to 3.35 ± 2.23 ($p < 0.0001$). Native sedges, ferns, shrubs, trees and vines all showed a significant positive response to ungulate removal ($p < 0.043$ in all cases). There was a non-significant trend

for non-native grasses to increase slightly but they were generally rare in the plot both before and after ungulate removal ($p=0.1114$). Several species increased in this plot including *Acacia koa* which increased over 2 fold ($p=0.0011$), *A. oliviformis* also increased over 2 fold ($p=0.002$), *Metrosideros polymorpha* ($p=0.0003$), and *Sphenomeris chinensis* ($p=0.09$). This plot has received frequent weed control and augmentation with *A. koa* which help to explain some of the changes in species' interception. Despite this, non-native species showed no significant change either as a group or individually. Several species were observed only in 1996 such as *P. cattleianum* ($n=51$) and *R. rosifolius* which was rare even in 1996 ($n=1$). Weed control efforts here should focus on non-native tree species like *S. terebinthifolius* and grass species like *Paspalum conjugatum*.

Kahanahāiki-10; Middle Eastern Quadrant

This area was weeded on three different trips last year. Most of the effort in this area was to reduce the thick stands of *P. cattleianum* saplings described above. *Montanoa hibiscifolia* was also targeted in this WCA as it is not yet well established in Kahanahāiki MU. This WCA has not been thoroughly swept for other common weed species for several years, however it will likely be targeted for this type of treatment as well as continued *P. cattleianum* removal this year.

Kahanahāiki-11; South Western Quadrant

This area was not weeded last year but it is still the most native WCA in the Maile Flats region. It was swept for weeds in 2004 and next year NRS will visit this site two times.

Kahanahāiki-12; South Eastern Quadrant

While this WCA has some very nice forest patches as well as surprisingly high levels of hapu'u ferns (*Cibotium chamissoi*), there are weedy patches throughout. Many of these weedy areas are monotypic *P. cattleianum* stands; however there are also several light gaps in the WCA, such as one resulting from the dieback of *Pisonia umbellifera*, that foster the invasion of sun-loving weeds. This WCA was weeded three times last year, again mainly focusing on weedwhack clearing of large areas of *P. cattleianum* as described in the Kahanahāiki-09 WCA discussion. Next year, work will continue to focus on *P. cattleianum* control as well as focus on other isolated weed patches, and fence and trail corridors to facilitate ease of large-scale sweep weeding in the future. The entire WCA was swept for all weeds in March 2005, and is scheduled for retreatment again in the coming reporting year.

IP MU: Pahole Gulch

This is the second year that NRS has conducted weed control in Pahole Gulch within NAR. Unfortunately the permit application process delayed the continuation of work in the gulch until May 2006. Since May, NRS has been making trips to the gulch to conduct weed control and evaluate strategies. NRS is still in the process of developing the over-all weed control strategy approach for the gulch. Weed actions conducted in the gulch are based on objectives established through discussion between NRS and the NARS Specialist. Within the next year NRS plan to completely refine the WCA boundaries and outline others in the MU. Within the Pahole gulch WCAs and subunits have been established based on populations of existing and reintroduced rare plant taxa and areas with intact native habitat.

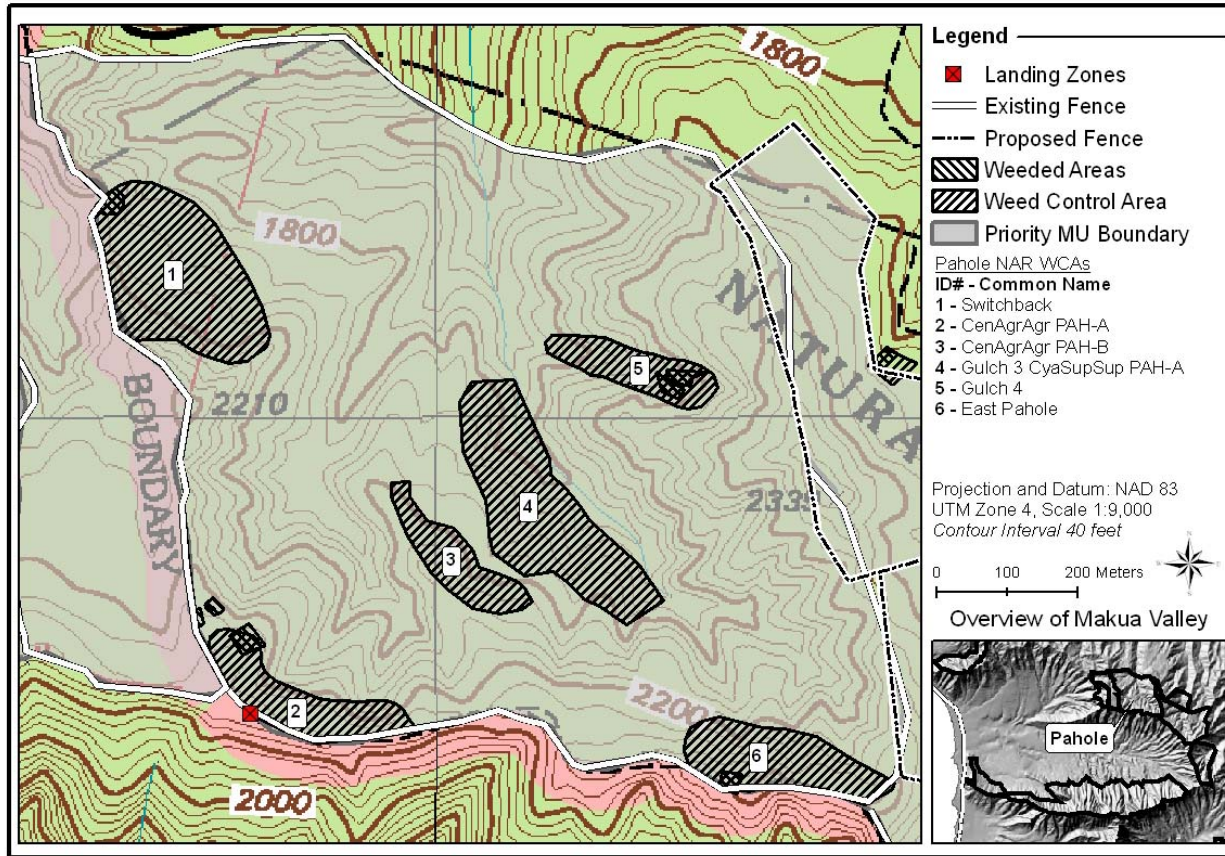


Figure 2.1.14 Weed Control Areas in Pahole NAR

WCA Discussion

Pahole-01; Switchbacks, SchNut Reintro

Pahole -01 is located on the North East facing slopes of Pahole about a third of the way out to the overlook. It includes the reintroduction site for *S. nutallii* at the switchback site and reintroduction sites that were established this year for *C. agrimonoides* and *S. obovatum*. Weeding was conducted prior to outplanting *S. obovata* and *C. agrimonioides*. Weeds are not re-establishing and the reintroductions are doing well. Many of the reintroduced plants are producing seeds and NRS hope that intermittent weeding will be sufficient. The WCA contains a mix of native dominated and alien dominated areas. There is much more area to cover within this WCA and NRS look forward to expanding weed control. The eastern side of the WCA (down slope away from the ridge crest) is an area of high quality native forest. NRS feel that this area is especially important to target. The NARS specialist indicated that there was plot reading to be completed in the area before weed control operations should proceed. Perhaps the plots can be read by the Monitoring Program Manager and weeding can resume. Grass control also needs to be conducted in this WCA during winter months when *M. minutiflora* begins to invade.

Pahole-02; Cenagr PAH-A

WCA Pahole -02 spans the flat area above the Pahole snail enclosure between the Pahole and Makua rim. There are nice patches of native forest separated by dense stands of *P. cattleianum*. *Dicranopteris linearis* dominates the area near the Pahole rim. NRS made three weeding trips to

the area this year. On one trip, NRS used volunteers to work near the trail in the flat, *P. cattleianum* dominated, accessible areas. NRS has also focused on areas where there is native understory such as *M. strigosa* and *N. exaltata* that is fringing the boundaries of native and alien canopies. This way, when the *P. cattleianum* is removed, these species can fill in the gaps between native canopies. NRS has seen this strategy work in this and adjacent areas.

Pahole-03; Cenagr PAH-B

WCA Pahole-03 is centered around a wild *C. agrimonioides* population. NRS did not conduct weed control in the WCA this year; however, plan to resume operations in the area soon. The highest priority action is to control *M. minutiflora* that grows in along the open ridge crest and in the past directly smothered *C. agrimonioides*. These patches must be manually cleared away from the *C. agrimonioides*. Then once at a safe distance of at least more than three meters they can be sprayed. Down slope from the *C. agrimonioides* the native forest is being invaded by *P. cattleianum*. NRS will begin to slowly work in this area in the next year.

Pahole-04; Gulch 3 Cyasup Reintro/Chaher

WCA Pahole-04 is centered around reintroductions of *C. superba* and *C. herbsti*. NRS did not conduct weed control in the WCA this year; however, plan to begin weed operations in conjunction with site preparations for *C. herbsti* reintroduction in the coming winter. The area that surrounds the *C. superba* reintroduction is more problematic. This species was reintroduced along the gulch bottom in a site that is excellent for *C. superba* but unfortunately dominated by introduced species including *R. rosifolius*, *Christella parasitica*, *Paspalum conjugatum*. The presence of these species in the under story does not seem to impact the *C. superba* as these plants are robust, however, the dense cover possibly inhibits any possible germination. Unfortunately, even in a native dominated habitat, germination is unlikely because of slug predation on newly germinated seedlings. NRS will not prioritize larger scale under story weed control in this area until slug control techniques are developed.

Pahole-05; Gulch 4

WCA Pahole-05 encompasses an area where *Pritchardia kaalaensis* was outplanted by NRS. Unfortunately, the outplantings are not doing well. NRS has done extensive weed control in the area in the past and went to the area twice this year to do maintenance and prepare new areas for reintroduction in the coming year. The weed control has changed the regime of weeds in the area. *Buddleia asiatica* has replaced *Ageratum adenophora* that was removed. *B. asiatica* has since been removed. NRS will continue to maintain and expand efforts in this area as is needed to support continued reintroduction efforts.

Pahole-06; East Pahole Rim Schnut/Cyalon

WCA Pahole-06 is in the South eastern corner of the fence. This area is one of the most intact areas remaining in Pahole. This WCA contains wild populations of *C. longiflora* and *S. nutallii*. NARS staff has suggested that NRS pair weeding trips with collection trips to minimize impacts. NRS strongly agree with this strategy. One trip was made this year. NRS has attacked *P. cattleianum* to prevent fruits from rolling downhill into native dominated areas. NRS focused on removing stands that did not have too many seedlings growing underneath. In past years NRS has swept through native areas removing sparse canopy weeds. This site will be visited, at most, two times year and care will always be taken to minimize impacts.

Pahole-07

WCA Pahole-07 is located outside the Pahole fence near the Nike site. Weeding was conducted prior to outplanting *S. obovata*. The area is relatively native and NRS feel that that not much weeding will need to be done in this area. NRS will monitor the results of the weed control and conduct more control if necessary.

Pahole-No MU; Pahole Road

WCA Pahole-No MU covers roadside weed spray along the access road from the Dillingham Ranch gate to the Pahole Mid-elevation Nursery. This effort is shared with NARS staff. NRS sprayed the road four times this year and will monitor vegetation over the next year and respond accordingly.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present		
IP MU: Pahole							
Pahole-01	Habitat	42891.98	2264.998	5.28%	CenAgrAgr, CyaSupSup, SchNut, SchObo		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	1	12.00	CliHir, LanCam, PsiCat, SchTer
				Total	1	12.00	
Pahole-02	Habitat	18225.8	2058.337	11.29%	CenAgrAgr, CyaLon, HedDegDeg, PlaPriPri		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	3	18.50	CliHir, LanCam, PsiCat, SchTer, StaDic
				Total	3	18.50	
Pahole-05	Habitat	12584.59	3088.569	24.54%	CyrDen, PhyKaa		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	2	14.00	AgeRip, BudAsi, RubRos
				Total	2	14.00	
Pahole-06	Habitat	21361.96	3460.317	16.20%	CyaLon, CyrDen, SchNut, SchObo		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	1	12.00	BudMad, CliHir, LanCam, PsiCat
				Total	1	12.00	
PaholeNoMU-01	Trail	0	0				
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	3	27.00	MelMin, PanMax
				Total	3	27.00	

IP MU: Upper Kapuna

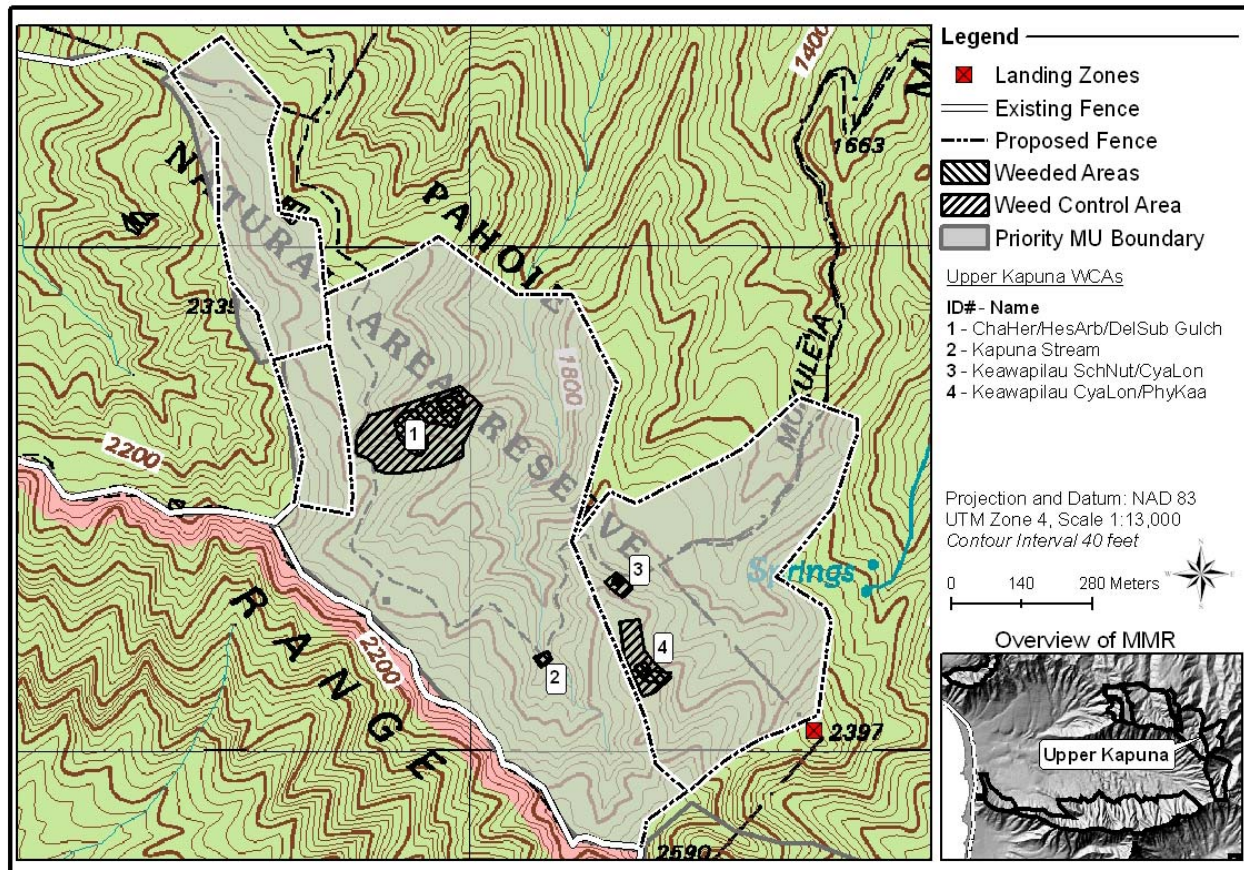


Figure 2.1.15: Weed Control Areas in Upper Kapuna, Pahole NAR

Upper Kapuna MU includes five WCAs. A sixth WCA lies just outside the MU boundary. One is a fenceline, the rest are situated around populations of protected plant species, wild and reintroduced. All WCAs were established with the assistance of NARS staff. Two of the WCAs are currently within small fences, while the remaining three are not protected at this time. However, a system of four staggered fences is proposed for the area, the third of which will include Upper Kapuna-03 and 04, and the fourth of which will include Upper Kapuna-01. NRS have committed to helping the state complete the units, and construction is pending initiation by the state's fencing contractor.

At the present time weeding is concentrated in the direct vicinities of the rare plant populations. Once the areas are fenced, NRS will intensify efforts in the MU, weed priorities will be re-evaluated and perhaps more effort will be spent improving the habitat between rare plant populations and in areas with high native composition. It is possible that future weeding could expand current WCA boundaries, leading to the merging of nearby WCA's.

NRS did not access this MU between January and May 2006, as permitting issues with the State were settled. Upon the commencement of weeding activities in the MU, NRS noted regrowth of weeds during the interim. It is hoped that NRS will continue to be allowed to weed in the

WCA’s with regularity in the future so as to insure that progress made by previous weeding effort is not lost to re-infestation by non-native species.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present												
IP MU: Upper Kapuna																	
UpperKapuna-01	Habitat	28340.27	10101.75	35.64%	ChaHer, DelSub, HesArbu												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>2</td> <td>52.50</td> <td>BleApp, ChrPar, CllHir, LanCam, PsiCat, RubRos, SchTer</td> </tr> <tr> <td>Total</td> <td>2</td> <td>52.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	2	52.50	BleApp, ChrPar, CllHir, LanCam, PsiCat, RubRos, SchTer	Total	2	52.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	2	52.50	BleApp, ChrPar, CllHir, LanCam, PsiCat, RubRos, SchTer														
Total	2	52.50															
UpperKapuna-02	Habitat	566.2155	523.0246	92.37%	ChaHer, CyaSupSup												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>4.00</td> <td>CllHir, PsiCat, RubRos</td> </tr> <tr> <td>Total</td> <td>1</td> <td>4.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	4.00	CllHir, PsiCat, RubRos	Total	1	4.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	1	4.00	CllHir, PsiCat, RubRos														
Total	1	4.00															
UpperKapuna-03	Habitat	1345.736	426.3477	31.68%	CyaLon, SchNut												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>2</td> <td>19.50</td> <td>BudAsi, CllHir, PsiCat, RubRos</td> </tr> <tr> <td>Total</td> <td>2</td> <td>19.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	2	19.50	BudAsi, CllHir, PsiCat, RubRos	Total	2	19.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	2	19.50	BudAsi, CllHir, PsiCat, RubRos														
Total	2	19.50															
UpperKapuna-04	Habitat	6995.6	4892.227	69.93%	CyaLon, PhyKaa												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>2</td> <td>42.50</td> <td>BudAsi, CllHir, GreRob, PsiCat, RubRos, SchTer</td> </tr> <tr> <td>Total</td> <td>2</td> <td>42.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	2	42.50	BudAsi, CllHir, GreRob, PsiCat, RubRos, SchTer	Total	2	42.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	2	42.50	BudAsi, CllHir, GreRob, PsiCat, RubRos, SchTer														
Total	2	42.50															
UpperKapuna-05	Fenceline Clearing	0	0														
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>2</td> <td>121.00</td> <td>CllHir, EucRob, GreRob, PsiCat, SchTer</td> </tr> <tr> <td>Total</td> <td>2</td> <td>121.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	2	121.00	CllHir, EucRob, GreRob, PsiCat, SchTer	Total	2	121.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	2	121.00	CllHir, EucRob, GreRob, PsiCat, SchTer														
Total	2	121.00															
UpperKapunaNoMU-01	Habitat	1843.315	1648.023	89.41%	CyaSupSup												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>6.00</td> <td>ChrPar, FraUhd, RubRos, SchTer</td> </tr> <tr> <td>Total</td> <td>1</td> <td>6.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	6.00	ChrPar, FraUhd, RubRos, SchTer	Total	1	6.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	1	6.00	ChrPar, FraUhd, RubRos, SchTer														
Total	1	6.00															

WCA Discussion

Upper Kapuna-01; ChaHer/Hesarb/Delsub Gulch

There are a number of rare plant species present in this WCA, several of which are designated MFS. There is also some very nice native habitat in the WCA, the maintenance and expansion

of which being critical to the survival of the rare plant taxa found therein. Weeding effort over the past year has been focused on areas around the rare plants, and in areas of healthier native forest. The weeding effort in this WCA is focused mainly on understory weeds, as the state managers feel it necessary to keep overstory control to a minimum (6% per trip) to reduce light gaps which stimulate rapid growth of lower weeds.

It will be necessary to continue weeding effort in this WCA on a regular basis, as there are aggressive weeds which do not take much time to return to the weeded areas like *R. rosifolius* and *B. asiatica*. NRS plan to return to this site at least four times in the next year to improve the habitat for the rare plants present. Priority areas for weeding will continue to be around rare plants, as well as increasing the buffer of native dominated habitat around them.

Upper Kapuna-02; Kapuna Stream

This WCA is contained by a small fence, in which are planted *C. superba* and *C. herbstii*. Weeding is focused on maintaining the health of the microclimate around the outplantings. The area is small and so not much effort is needed to keep up with weed regeneration. The main weed in the area is *R. rosifolius*, an understory plant which can quickly colonize an area. In the coming year, NRS will visit the site at least once to monitor the re-growth of *R. rosifolius* and other weeds and treat them if necessary. This site is managed for fruit production, and so not much effort is invested in weeding the surrounding habitat. The understory is primarily native, with the exception of a thick carpet of *B. appendiculatum*; the overstory is mixed native and non-native. Weeding is focused only on understory species at this time so as not to alter the light regime for the outplanted species.

Upper Kapuna-03; Keawapilau SchNut/CyaLon.

There are two protected species in this WCA, *Cyanea longiflora* and *Schideia nuttallii*, both of which are designated 'Manage for Stability'. The area contains a fair amount of overstory weeds separating some small diverse native patches. In the past year the weeding conducted at this spot has focused on understory weeds. Weeding is concentrated mainly in the immediate vicinity of the rare taxa. It was noted that the areas look good and that weeding from the previous year was effective but that *Clidemia hirta*, a common understory weed in the area, had re-colonized the weeded areas. This year much of the *C. hirta* around the lower *C. longiflora* was weeded. In the following year NRS will visit the site quarterly to assess the re-growth of weeds, and continue to keep the areas around the protected plants free of weeds to eliminate competition and to encourage recruitment.

On September 25th of this year NRS visited this WCA with Patti Welton to assist in a reading of a "releve" plot which was first installed and read in 1933 by Mrs. Welton for her PhD thesis at the University of Hawai'i. The plots give a measure of community structure based on height and cover of all species present. There are relevés scattered throughout Upper Kapuna and Pahole MUs, and in the future it will be important to read the plots before weeding occurs. It is important to read them prior to weeding to get baseline data for the area, so that the effects of future weeding can be measured.

Upper Kapuna-04; Keawapilau CyaLon/PhyKaa

Upper Kapuna-03 and 04 are close enough together that weeding at the two sites is often tasked as one action. The areas immediately around the rare plants are particularly sensitive due to the presence of the rare taxa and the steep terrain of the site. NRS only weed directly around the taxa to maintain their existing microclimates. In the rest of the WCA, there are patches of mostly native forest where more intense, understory weed control is conducted. NRS believe that species such as *C. longiflora* would benefit from creating more continual habitat through the population. The only canopy weeding that occurs in this WCA is the removal of *G. robusta*, which occurs sparsely and does not affect the shade/light dynamics very much due to its height and foliar structure. NRS plan to revisit this site quarterly in the coming year.

Upper Kapuna-05; Kapuna fenceline

This year a new fenceline was cleared in the Kapuna area in preparation for fence construction. The cut vegetation was treated with Garlon 4 herbicide at 20% dilution rate. In the coming year NRS will monitor the fenceline for re-growth and treat as necessary, but will not maintain this WCA into the future.

Upper Kapuna No MU-01; 1-Acre Site

This WCA is defined by an old outplanting site within a fence, containing a number of protected species which are doing very well and are some of the largest outplanted specimens of their species anywhere. The area is known as the “1-Acre Site”, and is on state land. Weeding is focused within the fenced area on understory weeds as there remains a high number of understory weeds, the fern *C. parasitica* in particular, and the overstory is largely native-dominant. One trip was spent weeding in this WCA, and it was observed that the site is looking good, with healthy outplantings and large native canopy trees. In the coming year NRS plan to re-visit the site at least once to treat understory weeds around the outplantings. The WCA is managed mainly for fruit production, so ecosystem scale weeding here is limited.

IP MU: West Makaleha

The West Makaleha MU is within Mokulē‘ia Forest Reserve and borders MMR and Pahole NAR. At this time, there are two WCAs within the West Makaleha MU, West Makaleha-01 and West Makaleha-02 (Figure 2.1.16). The management actions for West Makaleha-01 revolve around maintaining the habitat for a population of *S. obovata*. The management actions for West Makaleha-02 are focused first around a population of *C. grimesiana* subsp. *obatae*. Secondly, the site will be utilized to continue habitat restoration efforts and expand outplanting sites of, *C. longiflora*, *S. obovata*, and *Pritchardia kaalae*.

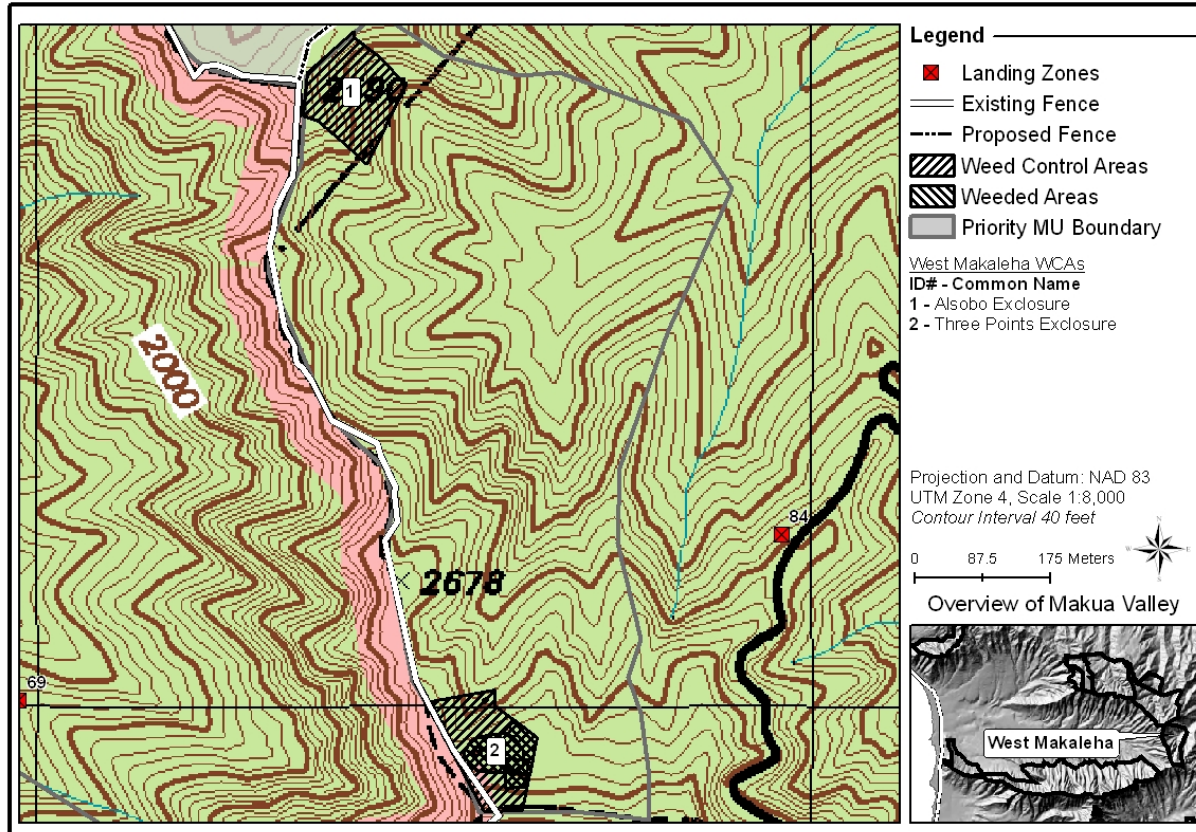


Figure 2.1.16 Weed Control Areas in West Makaleha

WCA Discussion

West Makaleha-01; Alsobo Exclusion

NRS have intentionally minimized their presence and impact in the area. Management actions are scheduled with routine monitoring and collection visits because the plants grow on a steep slope, and the immediate habitat is not highly threatened by weeds. No weeding was done in 2005-2006. Follow-up weeding for past canopy removal above the slope is scheduled for next year.

West Makaleha-02; Three Points Exclusion

NRS try to initiate control efforts quarterly in order to keep weed populations manageable. The long term objective for this WCA is to restore the area to a predominantly native forest. Complete eradication of all alien invasive species in the near future is unrealistic but attainable goals have been established for;

- 100% native canopy cover
- 95% native understory

These restoration goals will take many years to accomplish for a large percentage of the WCA but short term objectives directed at guiding management efforts will help to attain the desired end product.

- Prevent incipient invasive aliens from becoming established.
- Create a Zero Tolerance weed list to guide effort.

- Develop/locate protocols to treat species which NRS don't currently have a means of controlling.
- Use volunteer labor for select projects.

The highest priority weed control in this area is concentrated around a population of *C. grimesiana* subsp. *obatae*. The forest within this area is relatively intact and does not require a large amount of management to keep it so. As it stands now, *R. argutus* and a few other understory species are the biggest challenges for this area. All of the canopy *P. cattleianum* within this area have been eradicated. NRS was able to visit the area two times this year and focused all efforts on the understory weeds. NRS will continue this as it appears that the strategy has been working. Quarterly trips are planned and shall include overnight camping stays in order to maximize time spent.

Work in the upper open portion of West Makaleha-02 has been focused on habit restoration efforts and expanding outplanting sites of *D. subcordata*, *C. longiflora*, *S. obovata*, and *P. kaalae*). NRS has successfully controlled grass species dominating the upper portion of the enclosure in the past with undesirable consequences (NRS Report, 2005). NRS has moved away from the total elimination of grass from this area for the time being and focusing more energy on spot treatment associated with outplanting of common native species. NRS will also continue quarterly management actions of *R. argutus* and other understory invasive species through spraying and clip and drip methods.

NRS have taken an aggressive approach to killing the monotypic *P. cattleianum* stands with impressive results (NRS Report 2005). This aggressive approach in combination with hand weeding has facilitated the recruitment of more natives. NRS will continue with this management action and combine common native outplanting with it.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present
IP MU: West Makaleha					
WestMakaleha-02	Habitat	13375.15	4940.791	36.94%	CyaGriOba, DelSub, PriKaa, SchObo
	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	
	Grass Control	1	1.50	MelMin, PasCon	
	Ecosystem Weed Control	4	23.50	BudAsi, CiiHir, PasCon, PasEdu, PsiCat, RubArg, RubRos	
	Total	5	25.00		

IP MU: ‘Ōhikilolo

The ‘Ōhikilolo MU lies between Mākua and Mākaha valleys. There are a total of 19 WCAs within this MU, most of which are established around wild and outplanted populations of *Pritchardia kaalae*, wild populations of a number of other rare and protected plant species, and also a large number of *A. mustelina*. There is much variation among WCA's in the level of weeding effort they receive. Some WCA's, like Ohikilolo-10, are largely native and require only occasional understory weeding, while others are alien dominated, and will require long-term plans if native-dominance is to be achieved. The MU is threatened by fire originating from

MMR as well as from roadside fires started on Farrington Highway. As of 2005 the entire MU has been cleared of feral goats, the effects of which are quantified by data from four LCTA plots three of which are reported below and the other appears in Chapter 1: Feral Ungulate Management.

Within the MU, LCTA plot 713 is located in WCA Ohikilolo-03 (see Chapter 1 for discussion and data analysis), plot 705 is located in WCA Ohikilolo-05, plot 714 is located in WCA Ohikilolo-10 and plot 715 is located in WCA Ohikilolo-13 (Figure 2.1.19). Only plot 714 was not read by NRS Monitoring this year because it is mostly native with a thick fern understory, had been read in 2003 and we did not wish to damage the forest in order to collect the data this year. This plot will be read next year. Detailed discussions and the data analysis appear in the WCA sections below.

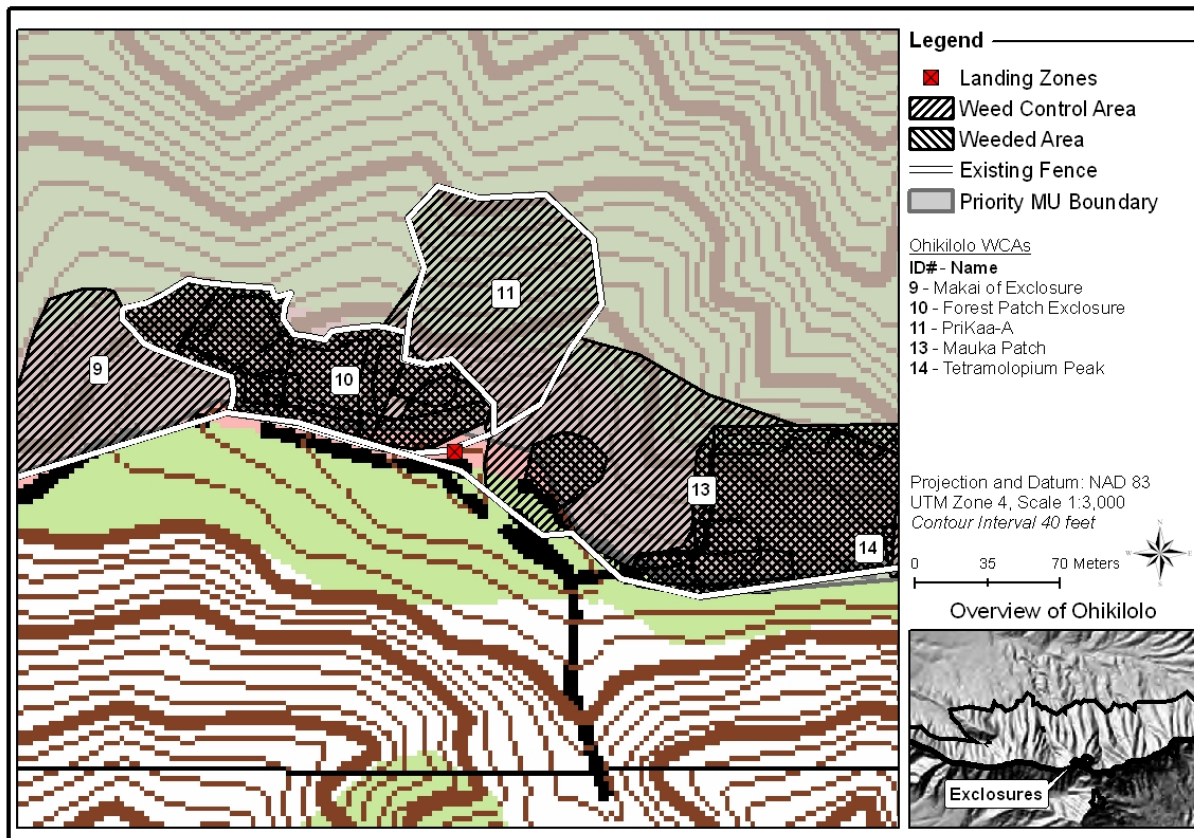


Figure 2.1.17 Weed Control Areas in ‘Ohikilolo – Fence Exclosures Section, Makua Military Reservation

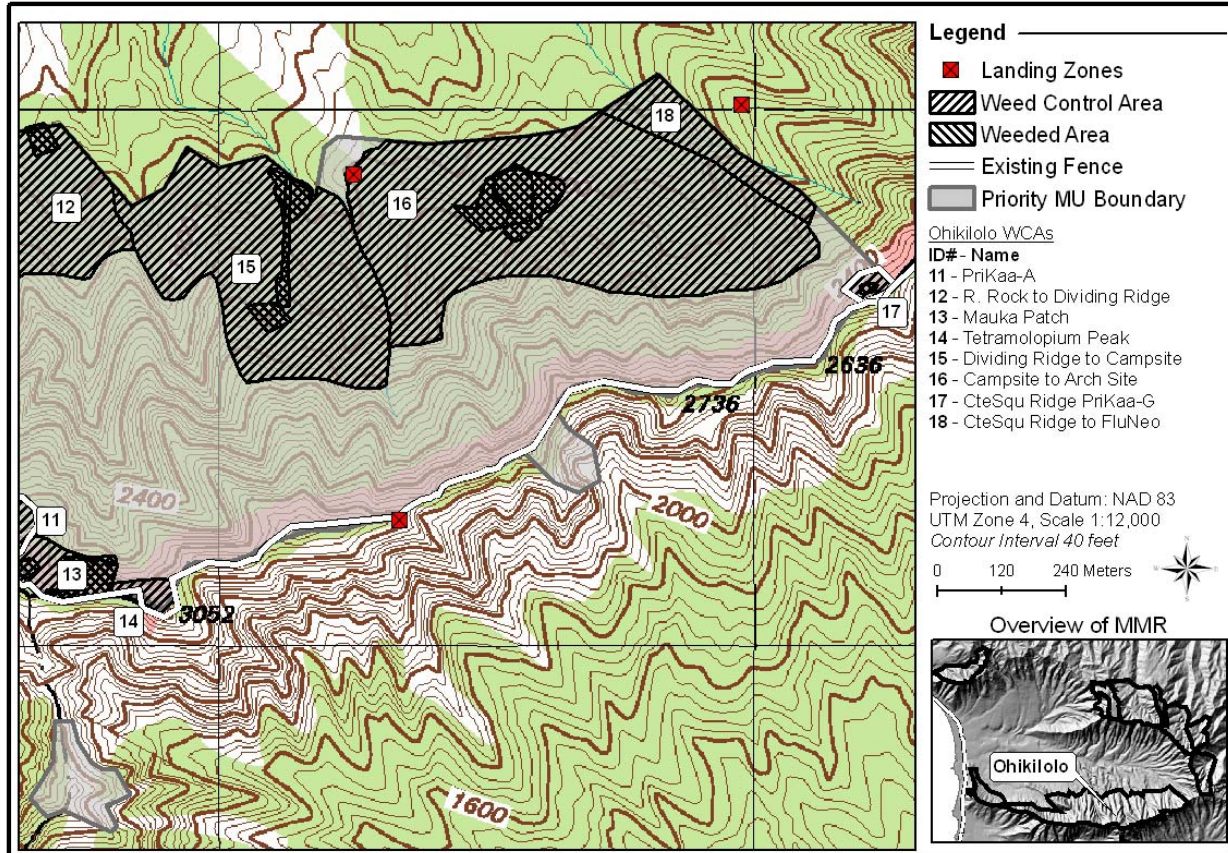


Figure 2.1.18 Weed Control Areas in Ohikilolo – Mauka Section, Makua Military Reservation

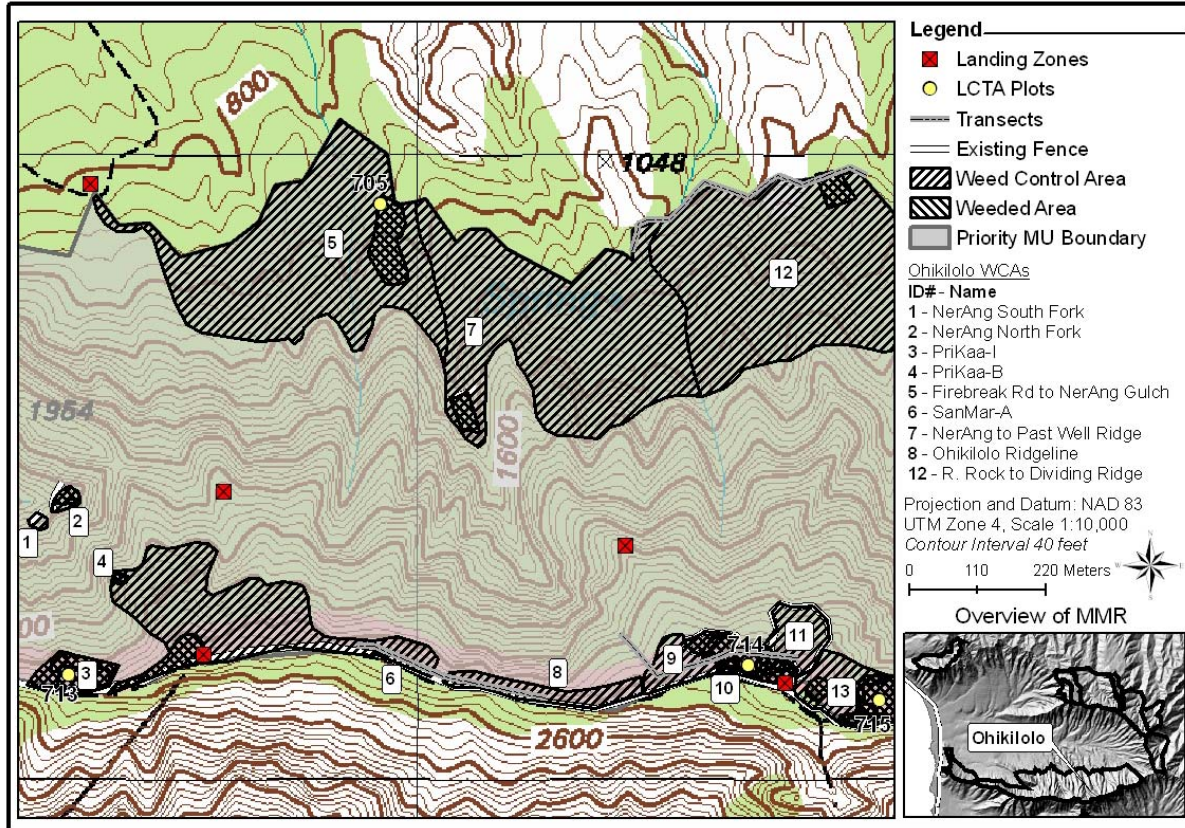


Figure 2.1.19 Weed Control Areas in Ohikilolo – Makai Section, Makua Military Reservation

Transect Discussion

There are two transects in this MU. No new significant weeds were identified.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present		
IP MU: Ohikilolo							
Ohikilolo-02	Habitat	1244.415	871.1389	70.00%	NerAng, NotHum		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Grass Control	1	4.00	AgeAde, BleApp, MelMin
				Ecosystem Weed Control	1	1.00	AgeAde
				Total	2	5.00	
Ohikilolo-03	Habitat	6570.25	6470.33	98.48%	MelTen, PriKaa, PteMac, VioChaCha		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	3	8.50	AgeAde, AgeRip, EriKar, GreRob, LanCam, SchTer, StaDic
				Total	3	8.50	
Ohikilolo-04	3M	372.912	210.5436	56.46%	PriKaa		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Grass Control	2	0.75	AndVir, MelMin, RhyRep, SetGra
				Total	2	0.75	
Ohikilolo-05	Habitat	92851.78	18087.61	19.48%	BobSan		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	2	15.50	AgeAde, AgeRip, AleMol, CorFru, GreRob, MelAze, PasEdu, PluCar, PsiCat, PsiGua, RivHum, RubRos, SchTer, SenSur, SpaCam, SyzJam
				Total	2	15.50	
Ohikilolo-06	Habitat	3862.677	100.9095	2.61%	DubHer, SanMar		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Grass Control	1	1.00	MelMin, RhyRep
				Total	1	1.00	
Ohikilolo-10	Habitat	7514.252	7241.446	96.37%	PriKaa, SanMar		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Grass Control	2	6.50	MelMin, RhyRep, SetGra

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present
					Ecosystem Weed Control
					3 31.50
					AgeAde, AgeRip, EriKar, LanCam, RubRos, SchTer, SetGra, StaDic, TriSem
					Total 5 38.00
Ohikilolo-12	Habitat	107927.7	8652.23	8.02%	BobSan, LobNii, Nespol
					Treatment Type # of Visits Effort (Person Hrs) Species Controlled
					Ecosystem Weed Control 1 4.00 PsiCat, SchTer, SyzCum
					Total 1 4.00
Ohikilolo-13	Habitat	16507.03	9035.384	54.74%	MelMak, NotLon, PriKaa, PteMac
					Treatment Type # of Visits Effort (Person Hrs) Species Controlled
					Grass Control 2 3.50 MelMin, SetGra
					Ecosystem Weed Control 4 126.00 AgeAde, AgeCon, AgeRip, BleApp, BudAsi, ChrDen, ChrPar, CupCar, EriKar, KalPin, LanCam, PsiCat, PsiGua, RubRos, SchTer, SetGra, StaDic, SyzCum, TooCil, TriSem
					Total 6 129.50
Ohikilolo-15	Habitat	141076.5	28410.85	20.14%	AleMacMac, BobSan, DieFal, FluNeo, PteMac
					Treatment Type # of Visits Effort (Person Hrs) Species Controlled
					Ecosystem Weed Control 3 32.00 BudAsi, GreRob, KalPin, LanCam, PsiCat, PsiGua, RubRos, SchTer, SyzCum
					Total 3 32.00
Ohikilolo-16	Habitat	226524.3	38880.4	17.16%	AleMacMac, BobSan, MelTen, PteMac
					Treatment Type # of Visits Effort (Person Hrs) Species Controlled
					Ecosystem Weed Control 3 57.50 CliHir, GreRob, PsiCat, SchTer, SpaCam, TooCil
					Total 3 57.50
Ohikilolo-17	Habitat	3599.952	512.3422	14.23%	PriKaa
					Treatment Type # of Visits Effort (Person Hrs) Species Controlled
					Ecosystem Weed Control 1 4.50 AgeAde, GreRob, PsiCat, SchTer, StaDic
					Total 1 4.50

P. cattleianum had established since last weeded, and were not yet mature. NRS believe that this two year revisitation frequency may be appropriate for similar types of habitats throughout Lower Mākua. NRS would also like to follow up this weed control with grass control where it is encroaching from the edges of the forest patch.

Monitoring

Plot 705

This plot shows significant changes in the mean number of native and non-native species interceptions over time (native $p=0.02$, non-native $p=0.04$). Both native and non-native mean number of interceptions (χ) increased over time from 1996 (native $\chi=2.56\pm1.54$ and non-native $\chi=1.68\pm1.02$) to 2006 (native $\chi=3.38\pm2.02$ and non-native $\chi=2.25\pm1.29$) though the total number of hits of invasive species decreased, χ , the mean, increased (Figure 2.1.5). This plot has been weeded for overstory invaders such as *P. cattleianum*, *G. robusta* and *A. moluccana* in 2002, 2003 and 2004. Additionally goat removal has been carried out by NRS at this location; therefore these changes represent those that could be expected following intensive management activity and upon removal of goats (pigs may still be impacting this area) but without reintroductions.

Specifically, in response to management native trees (1996 $\chi=2.56\pm1.54$ 2006 $\chi=3.38\pm2.02$) and non-native grasses (1996 $\chi=1.12\pm0.33$ 2006 $\chi=2.5\pm2.12$) have significantly increased in mean number of interceptions in the plot ($p=0.0221$ and 0.0073 respectively). However, non-native grass was only encountered twice in 2006, which is a dramatic decrease in the total number of points at which it was encountered from 1996 ($n=17$). Therefore the increase in mean interceptions of non-native grass may be an artifact of sampling and not represent a real increase in cover. Non-native herbs and vines were detected only in 2006 and this could be due to relief from browse pressure. Understory weed control activity has been low in this area and these data suggest that in the absence of browsers, grass and herbaceous species' control may have to be intensified in order to reduce non-native plant cover. No ferns were detected in this plot at either date sampled. This could be due to significant and continued disturbance by feral pigs which continue to be present in the area.

Ohikilolo-06; Ohikilolo Sanmar-A

This WCA surrounds a population of *Sanicula mariversa*. The primary threats to this site are weedy grasses. Weeding effort this year has been minimal, and it was observed that past years weeding efforts succeeded in killing many of the grasses in the area. In the coming year NRS will re-visit the site to monitor the *S. mariversa* and assess if more grass control is necessary. NRS will also monitor the possible influx of *Stachytarpheta dichotoma* to the site, and treat it and other common fenceline weeds as necessary.

Ohikilolo-07; Nerang to Past Well Ridge

This year NRS focused weeding in this WCA around a site of wild and reintroduced populations of *N. angulata* and *Nototrichium humile*. The weed control conducted around the rare plants is difficult because the gulch has steep walls and therefore weeds are mostly controlled in the gulch bottom and up as high as staff can get on the gulch walls. NRS have anecdotally noticed an increase in native fern cover in the gulch bottom likely due to the continual removal of feral ungulates and weeds such as *Ageratina riperia*, *A. adenophora* and *R. rosifolius*.

Ohikilolo-08; Ohikilolo Transect 9 Ridgeline

NRS expended no weeding effort in this WCA during the 2005-06 reporting year. In the future, NRS will seek to expand on efforts from 2004-05 and sweep any previously untouched areas in this WCA for *G. robusta* and *S. terebinthifolius*.

Ohikilolo-09; Ohikilolo Makai of Exclosure

The effort spent weeding in this WCA was spent on grass control. Five hours of grass control were spent in this WCA this year. This area has some nice native habitat, and since not much weeding has ever been done in this WCA, it would be a good opportunity to set up a monitoring plot inside to document and measure the effects of weeding on habitat structure and composition.

Ohikilolo-10; Ohikilolo Forest Patch Exclosure

This year NRS went to this WCA to weed once. The forest within this WCA is native dominant, and is home to a high number of *A. mustelina*. Weeding was split between ecosystem and grass weeding. The most prosperous weed in the area is *Rubus rosifolius*, which quickly occupies open areas if left un-weeded for long periods. Weeding effort in this patch has decreased over time, as natives fill in weeded areas. NRS have noted that native ferns seem to be responding well, and are filling in understory areas. On the last trip to weed in this WCA, NRS commented on the health of the habitat, finding it hard to move because of the thickness of the native vegetation. In the coming year, NRS plans to re-visit the WCA twice to ensure that grass and other weeds are suppressed. *A. mustelina* will most likely benefit from the weeding effort done in this WCA as the native canopy species regenerate and become more common.

Monitoring

Plot 714

This plot shows almost no change in the mean number of interceptions of native and non-native species over time for all years it was read (1996, 1999, 2003). Again, the data from 1999 don't match the patterns seen in the data collect in both other years. The means from 1999 are higher for both native and non-native species than those for both 1996 and 2003, and have higher standard deviations. A small 10 acre fence was erected around this area in 1999 and these data could be a response to removal of browsing pressure from goats. Additionally, these data were collected slightly later in the year (June compared to May in 1996 and March in 2003) and this could have contributed to the differences in the values. From these data NRS concludes that there have been no marked changes in the vegetation in this plot (native $p=0.186$, non-native $p=0.7196$). NRS believe however, that the volume of the understory vegetation has increased and suggest that this method is not adequate to detect such changes.

Upon examination of these data, it becomes clear that the number of non-native plant interceptions has always been very low in this plot (1996=6, 1999=26, 2003=14) while native species interceptions have always been high (1996=148, 1999=233, 2003=62). Native sedges', the only group of species that showed any significant change with goat removal in this plot, ($p=0.0338$) mean interception (χ) dropped from 1.83 ± 0.408 to 1.0 ± 0.0 with goat removal. This group was rare overall (prior to goat removal $n=6$, post goat removal $n=2$), and this decrease may be due to limits of the sampling design which is not ideal for detecting species with low cover. Weeding intensity has been fairly constant at this site but without current data it is difficult to

determine if weeding efforts are significantly altering the vegetation community. These data suggest that weeding activity in this plot could be reduced due to the low occurrence of non-native species found here. The location and weed control history of the area may provide NRS an opportunity to evaluate the importance of weeding frequency on successful removal of species from the ecosystem. The plot will be read in 2007 and these questions will be evaluated.

Ohikilolo-11; Ohikilolo Prikaa-A Fence

NRS expended no weeding effort in this WCA during the 2005-2006 reporting year. NRS plan to weed 0 times in the next year.

Ohikilolo-12; Rons Rock to Dividing Ridge

NRS weeded one forest patch in this area on one trip this year. The area is relatively flat, and has several large *Syzigium jambos* that NRS would like to girdle with chainsaws next time.

‘Ohikilolo 13; ‘Ohikilolo Mauka Patch

Weeding effort was spent in the this WCA on nearly every trip taken to ‘Ohikilolo this year. Currently the weeding strategy for this WCA consists of large sweeps through the area to cover as much ground as possible. Because of intensive weeding efforts here in previous years, and because of continuing weeding trips, the area is made up primarily of native plants, and not as much effort is needed now to keep it in a native-dominant state.

Effort is also invested in grass control within the WCA, with the major target being *M. minutiflora*. This grass forms dense mats which may inhibit seedling germination and growth, and so it is important to spend time to control it.

The area that is primarily swept on weeding trips consists of a large piece of habitat from the ridge fenceline, around the *Melicope makahae* down to the *Pteralyxia macrocarpa*. Within that section *Freycinetia arborea* and a variety of ferns are thriving and make up the majority of the groundcover. An alien fern, *B. appendiculatum*, is covering a lot of ground on the ridge tops where taller ferns have not become established. This weed, however, is very low in stature and does not affect higher vegetation tiers, besides possibly affecting seed germination rates. No control is planned for this weed at the present time.

The *R. rosifolius* epidemic noted in last years report is under control, although *R. rosifolius* does persist in sporadic numbers and has to be continually attacked during weeding sweeps.

This WCA contains a large number of outplanted *P. kaalae* which are scattered all around the area. A large weeding effort was undertaken to clear the area for planting. Weeding in the next year will partly focus around the outplantings to ensure that they are not overrun by aggressive fast-growing weeds filling in the gaps created by clearing.

In the coming year weeding effort will be similar to this year, with large area sweeps through native dominated areas and outplanting sites. Sweeping the site three times a year should be adequate to control weeds as well as allow time for expansion efforts at the boundaries of the native dominated areas.

Monitoring

Plot 715

This plot shows both native species counts and non-native species counts differed significantly among years for all years the plot was read (p=0.0033 and 0.006 respectively). Again, the mean counts (χ) for non-native species intercepted in 1999 were much higher than the counts for all other years. In this plot however the native counts seem more reasonable compared to the other years' values. The standard deviation of the non-native counts from 1999 is also exceptionally high (2.006) compared to other years. It is not known why the mean was higher in 1999, there were different investigators each year, and this could be a function of biases in the way the plot was read, or could represent a real increase in the intercepted vegetation on the line. Goats remained in the area until 2005 despite the fence completion in 2000 however the rate of detection and presumed associated impacts have declined sharply beginning in 2001-2002. Weed control activity in the vicinity of the plot has been fairly intensive beginning in 2001 and has been focused on understory weeds.

Upon goat removal NRS expects that understory species cover will increase and therefore the mean number of species interceptions (χ) will also increase. When comparisons were made between growth form groups' χ before and after goat removal, only native vines showed a significant increase in χ (p=0.0302). This group includes species like *Freycinetia arborea* whose χ rose significantly through time (p=0.0620 1996 χ =1.25±0.5 to 2006 χ =3.9±1.91) confirming that understory species will respond favorably to goat removal. Overall the trend is for both native and non-native species interception to increase over time (native species: 1996 χ = 1.95±1.05, 2006 χ = 2.75±1.6, non-native species: 1996 χ = 1.78±0.44, 2006 χ = 2.43±1.08). This indicates that overall, vegetative cover is increasing in this plot. Interception of the non-native fern *B. appendiculatum* has shown an increasing trend since it was first detected in 2003 in this plot (p=0.1563) and the non-native tree *S. terebinthifolius* may be increasing as well (p=0.0113 but largely due to spike in 1999). This suggests that weed control activity in this area may need to be increased in order to reduce non-native species' cover.

Ohikilolo-14; Ohikilolo Tetramolopium Peak

NRS expended no weeding effort in this WCA during the 2005-2006 reporting year. Grass is the primary threat in this WCA, which consists of a steep ridgeline and peak home to *Tetralopium filiforme*. Last year the grass in this WCA was well sprayed, and after subsequent monitoring this year it was deemed that no retreatment was necessary.

Ohikilolo-15; Dividing Ridge to Campsite

Several days of weed control were spent in this WCA, prioritized around rare plant populations. NRS weeded a large area of habitat around a *Bobea sandwicensis* population, as well as around an area encompassing a *Flueggea neowawraea* and several *Alectryon macrococcus*. Next year NRS plans to weed in this area two times.

Ohikilolo-16; Campsite to Arch Site

This WCA has several areas of large, continuous patches of native forest. Of note, NRS discovered a really large, over 80% native, broad slope that had been overlooked in the past. NRS conducted about 55 people hours' worth of weeding during two trips to this area, created one continuous weeded area, and noted that there remains more appropriate habitat to sweep

through. The most dominant weed in the area are large *P. cattleianum* trees, but individuals are few and far between likely because the native canopy and understory are healthy and little room is left for invasion of weeds. While no MIP taxa are in this area, NRS are considering this forest patch for future outplantings of MIP taxa. NRS need to look at planning additional fencing to protect this intact WCA.

Ohikilolo-17; Ohikilolo Ctesqu Ridge Prikaa-G

This WCA is defined by a small fence erected this year to protect a reintroduction of *P. kaalae*. The overstory in this steeply graded habitat is largely native-dominated with some aliens, predominantly *S. terebinthifolius*. The understory largely open and is dominated by herbaceous alien species such as *B. appendiculatum* and *A. adenophora*. Since the outplanting in the beginning of the year, the WCA has been weeded twice. In February it appeared that *A. adenophora*, a non-native perennial herb, had expanded in number and size amongst the outplantings possibly due to increased light availability. Weeding was focused on basally treating large clumps of this weed. It has been observed that cut pieces of *A. adenophora* have the ability to re-root in suitable conditions, making the “clip and drip” technique less appropriate for this weed. NRS applied G4 at 20% onto the uncut bases of the clumps. However, the day was overcast, and soon after the site was weeded a larger rainshower engulfed the area. On a later sweep, in August of this year, it was observed that nearly all the large clumps of *A. adenophora* had died. Treatment appeared to have been successful. In the coming year, NRS plan to monitor the regrowth of *A. adenophora* and other understory weeds by doing bi-annual sweeps through the outplanting site, and possibly removing some of the non-native canopy trees to ensure optimal habitat for the outplanted *P. kaalae*.

Ohikilolo-18; CteSqu Ridge to FluNeo

NRS expended no weeding effort in this WCA during the 2005-2006 reporting year.

Ohikilolo-19; ‘Ōhikilolo Fence between Prikaa I and Sanmar A

This WCA complements ‘Ōhikilolo-08; both are defined along the fenceline, both include areas of approximately 100% alien vegetation and areas of around 75% native shrub, and the primary targets at both are *G. robusta* and *S. terebinthifolius*. This WCA was created this year, and NRS targeted all *G. robusta* reachable without ropes. In the future, NRS plan to sweep the rest of the WCA. Once an initial sweep is done, retreatment may not be necessary for several years.

IP MU: Mākaha

Just a few of the areas within Mākaha are in exceptional condition. A majority of the MU that is to be fenced is heavily impacted by a variety of weeds. In order to delineate WCAs within the fence, NRS created fairly large sections. Initially, NRS have focused more attention to weeding around rare or endangered plant populations and habitat with high conservation value within the different sections. With more visits, NRS have realized that more effort needs to be focused on other sections of lesser quality as well in order to abate the invasion. NRS are also focusing on eliminating zero tolerance weeds from the fenced area. As Mākaha Valley is surveyed in greater detail and more fences are constructed, more WCAs will likely be established. Only WCAs in which control has been conducted this year are discussed below.

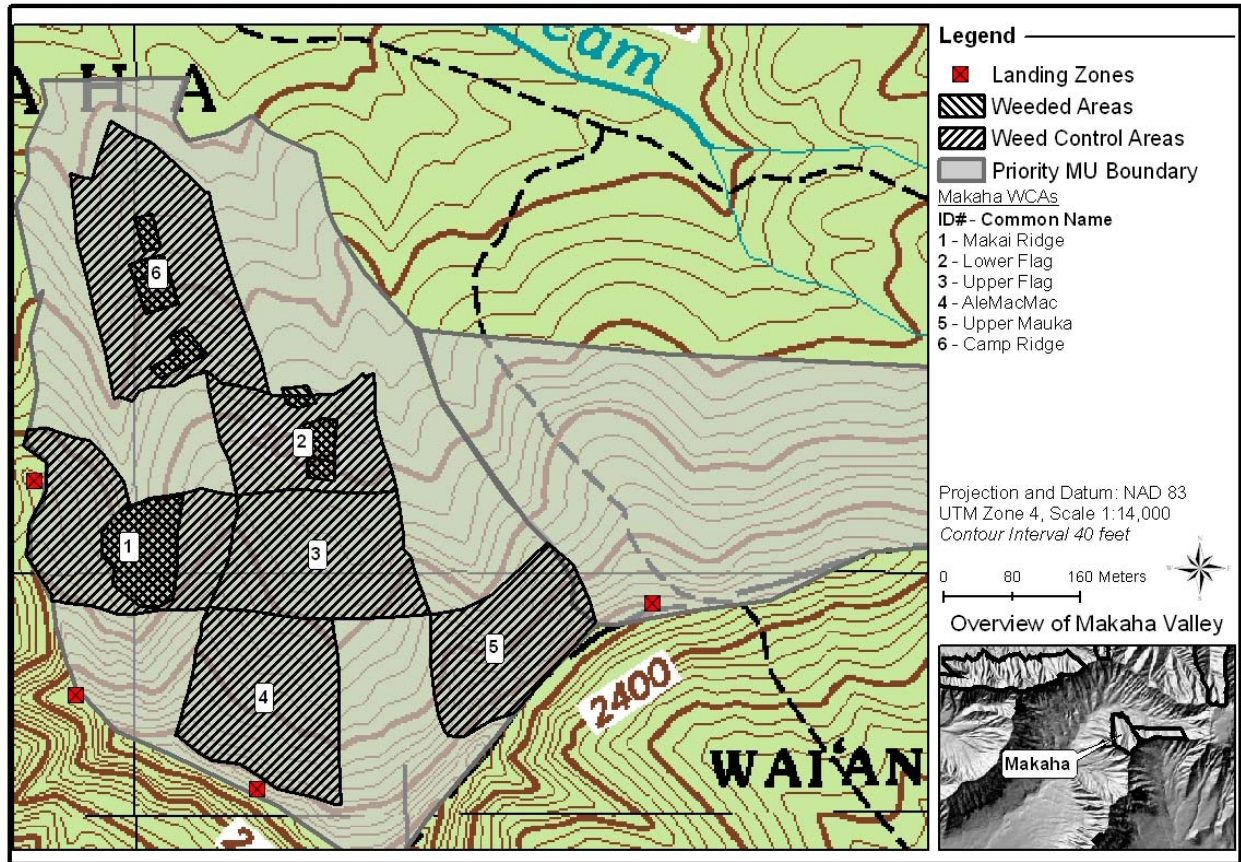


Figure 2.1.20 Mākaha Weed Control Areas

WCA Discussion

Mākaha -01; Makai Ridge

In the past, NRS have focused management efforts in Makaha-01 around an individual of *F. neowawraea*. In order to allow the habitat time to recover from the removal of the canopy NRS decided to focus its efforts on one habitat altering species of tree, *Toona ciliata*. This is the one site within the fence with a sizable population of *T. ciliata* and the most likely source of seed for dispersal within the fence. In 2005-2006, NRS spent 23.5 hours clearing 2.3 acres of all mature trees. This is the first time NRS has attempted a large scale control of this species. The process will probably take at least 3 years to eliminate the seed source.

Mākaha -02; Lower Flag

NRS conducted three work excursions with the Waianae High School Hawaiian Studies group in order to remove *P. cattleianum*, *Coffee arabica* and other weeds. This area was selected due to its proximity to the access trail and the bottom of the fence. There are also irregular patches of native canopy throughout this WCA and NRS hope that this native habitat will eventually spread with the removal of these weeds. NRS spent a total of 35 hours conducting weed control over a 2500 m² area.

Mākaha -06; Camp Ridge

NRS, in association with Associate Professor Tamara Ticktin of the University of Hawai‘i, created test plots in order to measure the response of native habitat with the removal of *P. cattleianum* and other weeds. Twelve 20 x 20 meter plots were set up to evaluate three different methods of weed removal. Three of the plots were Total Cut, whereby all alien species were completely removed. Three more plots were Total Girdle, so all the alien trees were killed by means of girdling and were left standing. Three other plots were Selectively weeded by size so that some large alien trees were left alive and only small alien species were removed. The last three plots were set up as controls. Within each 20 x 20 m plot a 10 x 10 m subplot was arranged so that all the trees that were > 1 cm dbh were measured and tagged within each of the 10 x 10 m plots, ten 1 x 1 m plots were done so that all of the seedlings were measured and tagged.

The 1 x 1 plots are to be remonitored every 1-2 months tagging and recording all of the new native seedlings and removing, drying, and weighing all of the new alien weeds. Light measurements were taken before and after weeding, then every three months there after in each of the 1 x 1 m plots using hemispheric photographs and LICOR light meters. There was also one HOBO set up in a total cut plot and a second in a total girdle plot prior to the weeding documenting any changes in light, soil moisture, humidity, and temperature.

To date, all of the results are incomplete. All trees in the plots will be re-measured one year after the experiment which is October 2006 and results reported in next years report.

Mākaha -07; Fenceline

This WCA consists of weeding along fenceline. A total of 68 people hours were spent clearing all of the vegetation along the fence corridor. Once the fence is complete, any weeding actions that take place within the areas of the WCA that are a part of other WCA's will be reported likewise.

Mākaha-No MU; Trail Trisem

In an effort to stop the progress of *Triumfetta semitriloba* into the fenced MU, NRS has spent nine people hours clearing this weed from along the trail corridor. It appears that this method has been working with less plants being observed each time. NRS shall continue with this action.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present												
IP MU: Makaha																	
Makaha-01	Habitat	35385.17	18248.78	51.57%	FluNeo												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>23.50</td> <td>TooCil</td> </tr> <tr> <td>Total</td> <td>1</td> <td>23.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	23.50	TooCil	Total	1	23.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	1	23.50	TooCil														
Total	1	23.50															
Makaha-02	Habitat	22754.41	2689.832	11.82%													
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>3</td> <td>35.00</td> <td>CofAra, PsiCat, SchTer, TooCil, TriSem</td> </tr> <tr> <td>Total</td> <td>3</td> <td>35.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	3	35.00	CofAra, PsiCat, SchTer, TooCil, TriSem	Total	3	35.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	3	35.00	CofAra, PsiCat, SchTer, TooCil, TriSem														
Total	3	35.00															
Makaha-06	Habitat	45433.15	4818.784	10.61%													
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>5</td> <td>186.90</td> <td>AgeAde, AleMol, BudAsi, CiiHir, CofAra, CorFru, FraUhd, GreRob, KalPin, LanCam, MelAze, PasEdu, PluCar, PsiCat, SchTer, TooCil, TriSem</td> </tr> <tr> <td>Total</td> <td>5</td> <td>186.90</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	5	186.90	AgeAde, AleMol, BudAsi, CiiHir, CofAra, CorFru, FraUhd, GreRob, KalPin, LanCam, MelAze, PasEdu, PluCar, PsiCat, SchTer, TooCil, TriSem	Total	5	186.90	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	5	186.90	AgeAde, AleMol, BudAsi, CiiHir, CofAra, CorFru, FraUhd, GreRob, KalPin, LanCam, MelAze, PasEdu, PluCar, PsiCat, SchTer, TooCil, TriSem														
Total	5	186.90															
Makaha-07	Fenceline Clearing	0	0														
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>3</td> <td>68.50</td> <td>GreRob, LanCam, PsiCat, SchTer</td> </tr> <tr> <td>Total</td> <td>3</td> <td>68.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	3	68.50	GreRob, LanCam, PsiCat, SchTer	Total	3	68.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	3	68.50	GreRob, LanCam, PsiCat, SchTer														
Total	3	68.50															

IP MU: Pu'ukūmakali'i

This is the first year any weed control work has been conducted in the Pu'ukūmakali'i MU. The MU encompasses an important population of *T. filiforme*, which has been designated as MFS. The MU is very steep, encompassing the tops of very sheer cliffs north of Kolekole Pass. Currently, only one WCA has been drawn in the MU, and weed control has been limited to those areas accessible without rappelling gear.

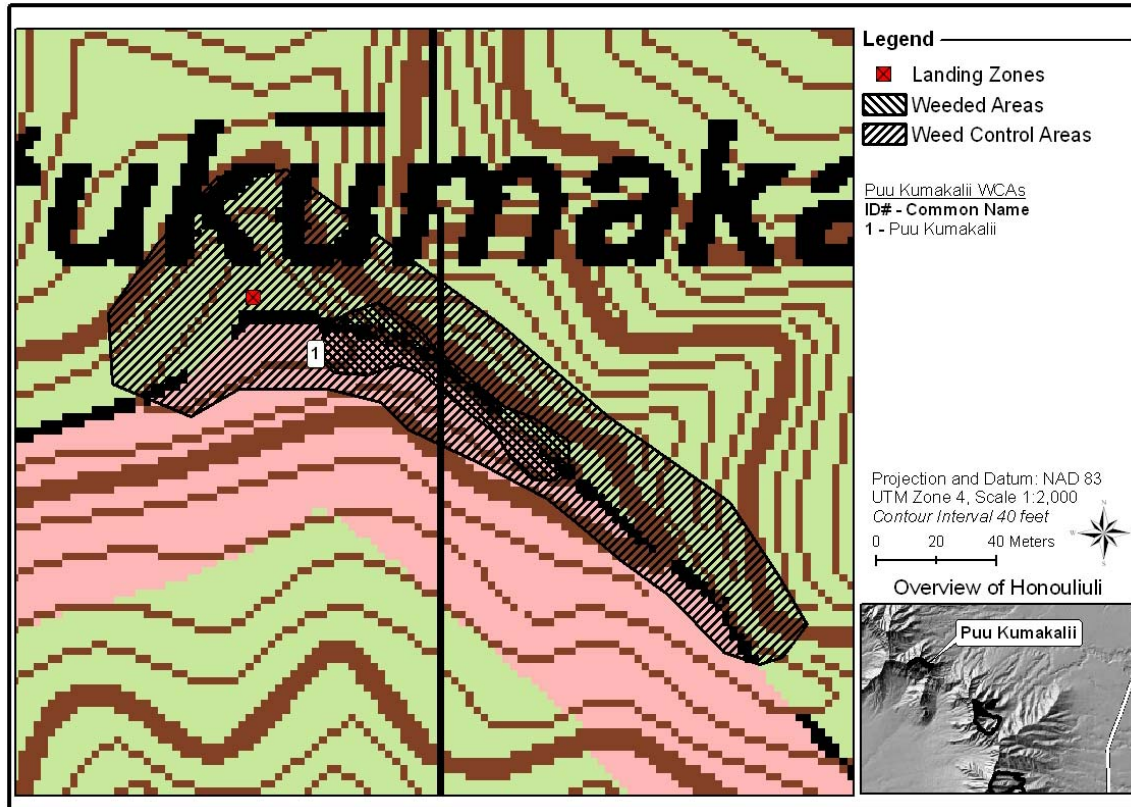


Figure 2.1.22 Weed Control Areas in Pu'u Kūmakalii'i

WCA Discussion

Kumakalii-01

This WCA is drawn around an outplanting of *T. filiforme* and the surrounding area. It was weeded once last year. On that weeding trip, a LZ was cleared at the ridge top. The weeds that were targeted were *S. actinophylla* and *P. cattleianum*, both of which are uncommon in this area. In particular, *S. actinophylla* poses a large threat to this MU, and NRS hope to prevent it from dominating the MU. Both the WCA and the MU need to be surveyed to better prioritize weed control, scope populations of uncommon weedy trees, and identify native vegetation communities. No weed control was done directly around the reintroduction site, as it is a native species dominated cliff. Next year NRS will visit the site at least once to better scope the area and check for any *S. actinophylla* resprouts.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present
IP MU: Puu Kumakalii					
Kumakalii-01	Habitat	12001.64	1306.239	10.88%	TetFil
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled		
Ecosystem Weed Control	1	3.00	PsiCat, SchAct		
Total	1	3.00			

IP MU: Wai‘anae Kai

This is the first year NRS have performed any weed control in the Wai‘anae Kai MU. Both WCAs are centered around rare plant populations. Effort in Wai‘anae Kai will intensify as management goals are defined and logistical considerations resolved. NRS work collaboratively with State Forest Reserve staff and PEP staff in this MU. The lower portion of the MU is predominantly vegetated with *P. maximum* and *L. leucocephala*, and is threatened by fire. The state constructed a fire break to mitigate this fire threat in 2003. In the past year, many NRS became certified as Wildland Firefighters. If future fires threaten the MU, NRS will be able to assist in fire fighting efforts.

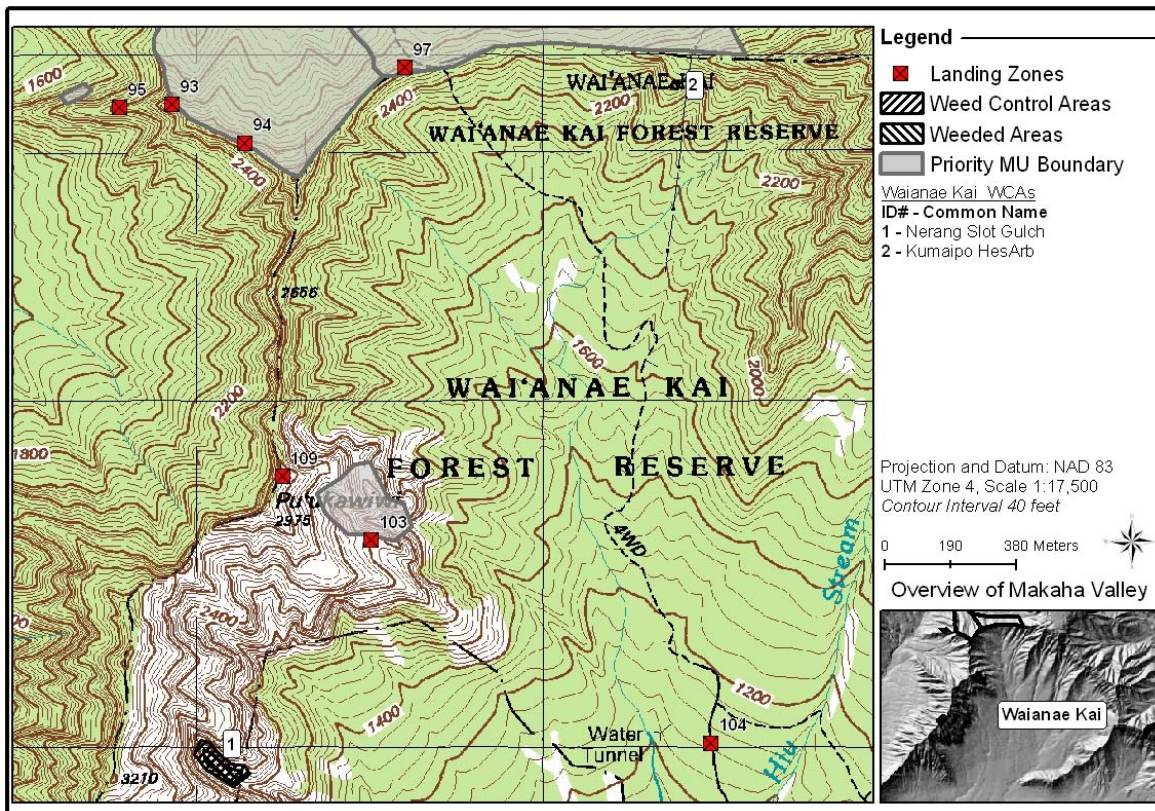


Figure 2.1.23 Weed Control Areas at Wai‘anae Kai

WCA Discussion

Waianaekai-01; Nerang Slot Gulch

This WCA is located in a slot gulch with very high cliff walls. The gulch houses important populations of *N. angulata* and *N. humile*. The vegetation in the gulch is mixed, with some native elements, and large amounts of *L. leucocephala*. While the gulch is surrounded by grass, there is very little *P. maximum* in the WCA itself. Little work has been done in this WCA because it is not yet fenced. Preliminary weeding has focused on large, scattered tree weeds, particularly *Casuarina equisetifolia*, *G. robusta*, and *Melia azedarach*. NRS hope to eradicate such low-density overstory weeds. In the future, NRS will target *L. leucocephala*, continue to treat weedy trees, and kill grass as necessary to reduce fire threat. This topographically isolated

WCA is expected to respond well to weed control; once woody weeds have been removed, the site may only require maintenance once a year.

WaianaeKai-02; Kumaipo HesArb

PEP staff built a fence protecting *Hesperomannia arbuscula* in May 2006, defining this WCA. This *H. arbuscula* site is not designated as MFS, therefore, NRS will focus on assisting on-going efforts rather than beginning large scale weeding. The vegetation at the site is mixed, with a variety of native mesic canopy and understory species. NRS assisted PEP in clearing fenceline and performing weed control. Work centered on clearing understory weeds. To prevent the creation of light gaps favorable for *R. argutus* and *C. hirta*, few canopy species were killed. NRS will maintain a low level of effort at this site, and will continue to assist PEP management efforts at this site.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present		
IP MU: Waianae Kai							
Waianae Kai-01	Fuelbreak	9288.504	3603.674	38.80%	NerAng, NotHum		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	1	7.50	AcaCon, CasGla, GreRob, LeuLeu, MelAze, PsiGua, SchTer
				Total	1	7.50	
Waianae Kai-02	Habitat	441.5404	439.164	99.46%	HesArbu		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	1	14.00	ClhHir, GreRob, LanCam, PsiCat, RubArg
				Total	1	14.00	

IP MU: ‘Ēkahanui

The ‘Ēkahanui MU is comprised of a number of WCAs around wild and reintroduced populations of rare plants. The area is currently managed by TNC, but during the coming year NRS will assume the majority of the management responsibilities for the MU. The area is threatened by fire. A 170 acre fire occurred in 2005, which fortunately burned only five acres of forest within the TNCH preserve boundary. In 2004, another large fire in the adjacent Pu‘u Mai‘alau Gulch to the south, burned with 300 m of the fence.

Most of the WCA’s are protected in a 40 acre fence, completed in 1999. NRS are in the process of constructing a new 170 acre fence to greatly increase the area protected from feral ungulates, and to encompass all the presently managed WCA’s and their corresponding rare plant populations. Completion of this fence is expected in the summer of 2007.

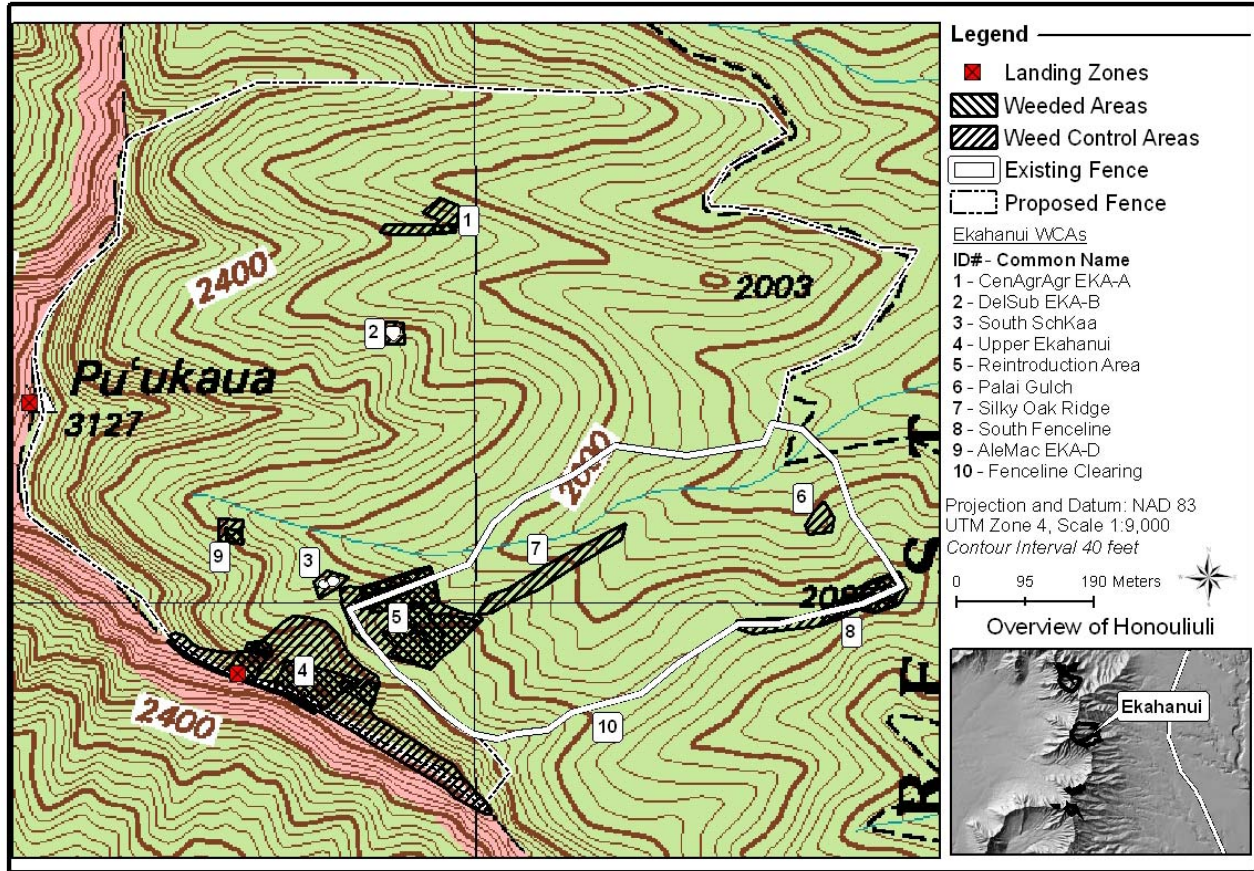


Figure 2.1.24: Weed Control Areas in ‘Ēkahanui

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present																
IP MU: Ekahanui																					
Ekahanui-01	Habitat	2459.3	297.1	12.08%	CenAgrAgr																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>2.00</td> <td>CliHir, GreRob, PsiGua, SchTer</td> </tr> <tr> <td>Total</td> <td>1</td> <td>2.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	2.00	CliHir, GreRob, PsiGua, SchTer	Total	1	2.00					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Ecosystem Weed Control	1	2.00	CliHir, GreRob, PsiGua, SchTer																		
Total	1	2.00																			
Ekahanui-04	Habitat	26366.45	1808	6.86%	PlaPriPri, SchKaa, UreKaa																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>4</td> <td>15.50</td> <td>AndVir, MelMin, PasCon, RhyRep</td> </tr> <tr> <td>Total</td> <td>4</td> <td>15.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	4	15.50	AndVir, MelMin, PasCon, RhyRep	Total	4	15.50					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	4	15.50	AndVir, MelMin, PasCon, RhyRep																		
Total	4	15.50																			
Ekahanui-05	Habitat	15352	12301	80.13%	AleMacMac, CenAgrAgr, CyaGriOba, DelSub, SchKaa																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>1</td> <td>2.50</td> <td>MelMin, PasCon</td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>5</td> <td>71.50</td> <td>AgeRip, BudAsi, ChrPar, CliHir, GreRob, LanCam, PasSub, PsiCat, RubRos, SchTer</td> </tr> <tr> <td>Total</td> <td>6</td> <td>74.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	1	2.50	MelMin, PasCon	Ecosystem Weed Control	5	71.50	AgeRip, BudAsi, ChrPar, CliHir, GreRob, LanCam, PasSub, PsiCat, RubRos, SchTer	Total	6	74.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	1	2.50	MelMin, PasCon																		
Ecosystem Weed Control	5	71.50	AgeRip, BudAsi, ChrPar, CliHir, GreRob, LanCam, PasSub, PsiCat, RubRos, SchTer																		
Total	6	74.00																			
Ekahanui-08	Habitat	4012.297	888.1375	22.14%																	
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>3</td> <td>8.50</td> <td>MelMin, PanMax</td> </tr> <tr> <td>Total</td> <td>3</td> <td>8.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	3	8.50	MelMin, PanMax	Total	3	8.50					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	3	8.50	MelMin, PanMax																		
Total	3	8.50																			
Ekahanui-09	Habitat	1022.6	4034	394.48%	AleMacMac																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>3.00</td> <td>LanCam, PsiCat, SchTer</td> </tr> <tr> <td>Total</td> <td>1</td> <td>3.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	3.00	LanCam, PsiCat, SchTer	Total	1	3.00					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Ecosystem Weed Control	1	3.00	LanCam, PsiCat, SchTer																		
Total	1	3.00																			
Ekahanui-10	Fenceline Clearing	5649	4034	71.41%																	
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>5.00</td> <td>PsiCat</td> </tr> <tr> <td>Total</td> <td>1</td> <td>5.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	5.00	PsiCat	Total	1	5.00					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Ecosystem Weed Control	1	5.00	PsiCat																		
Total	1	5.00																			

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present												
HuliwaiNoMU-01	3M	620.6545	95.27272	15.35%	CenAgrAgr												
<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>3.00</td> <td>AgeRip, CiiHir, LanCam, PasSub, SchTer</td> </tr> <tr> <td>Total</td> <td>1</td> <td>3.00</td> <td></td> </tr> </tbody> </table>						Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	3.00	AgeRip, CiiHir, LanCam, PasSub, SchTer	Total	1	3.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	1	3.00	AgeRip, CiiHir, LanCam, PasSub, SchTer														
Total	1	3.00															

WCA Discussion

Ekahanui-01; CenagrAgr EKA-A

Only one trip was made to weed this WCA during this year. The weed control objective at this WCA is to suppress weeds around the *C. agrimonioides* var. *agrimonioides* plants. This population is a wild site, but the habitat around it is patchy, with a mixture of weeds and natives. Although there are some nice patches, not much is done currently due to the dense weed cover. Once the fence is completed and this WCA is protected, NRS plan to visit the site to weed around the *C. agrimonioides* var. *agrimonioides* and improve the habitat one or two times per year. In the following year NRS will monitor weed re-growth and treat if needed.

Ekahanui-02; Delsub EKA-B

This WCA is very small, surrounded by poor quality habitat. NRS work to keep understory weeds down to facilitate rare taxa fruit production. In the '04-'05 reporting year the area was heavily weeded, and this year it was deemed that no weeding was needed. NRS will continue to monitor the WCA and hand weed two meters around the plant during fruit collection trips.

Ekahanui-03; 'Ēkahanui South Schkaa

No weeding effort was conducted in this WCA for the '05-'06 reporting year. When the entire 'Ēkahanui MU fence is completed, this largely native site will be used for reintroductions. Weed control efforts will begin then. TNC has already begun weed control across a 4 acre area to control Christmas berry and guava.

Ekahanui-04; Upper 'Ēkahanui

This WCA is comprised of some very steep terrain housing a couple populations of rare plants, and some *Achatinella mustelina*. This year a total of 14 hours of weeding effort were spent controlling the grass here. The grass spraying has proven to be hazardous on the steep areas, and NRS needs to develop a safer technique for spraying grass in this WCA.

After three trips to spray grass in this WCA over the past year, NRS observed that much of the grass died, and that only two trips are needed in the next year for follow-up spot spraying. Future trips should require less time and herbicide than previous trips, demonstrating that intensive initial investment in weeding can lead to reduced efforts in later years to maintain healthy native habitat. NRS plan to survey the WCA for the most intact forest patches and begin weeding selectively in them if there is extra time on weeding trips.

Ekahanui-05; Reintroduction Area

This WCA is the most intensely weeded area in the entire MU. It spans a four acre area of mixed native and alien forest, and has been an important reintroduction site for many rare taxa over the years (Figure 2.1.23). Initially, a large amount of effort was spent removing *Passiflora suberosa* to establish the site as a reintroduction area, with little re-treatment of that weed needed since then. However, much effort has been spent at this site improving habitat by reducing potential competition from other weeds. Over the year, a total of 71.5 hours were spent weeding in this WCA (see Table above).

Around the *C. agrimonioides* var. *agrimonioides* outplantings, trips focused on opening up the canopy. Fruiting of the *C. agrimonioides* var. *agrimonioides* has been noted since then and it is thought that the plants are doing well with a little more light. Non-native grass control was also done in this area on one trip this year.

For other outplanting areas within the WCA, weeding focused mostly on understory and vine clearing around outplantings to discourage competition and to allow the outplantings room to grow. All areas should be re-visited at least every other quarter to ensure that understory weeds and vines do not take over in the outplanted areas.

Ekahanui-06; 'Ēkahanui Palai Patch

This site is managed to promote fruit production of the *C. grimesiana* reintroduction. While there are some native canopy and fern components, NRS limit weeding effort at the site. No weed control was conducted at the site this year by NRS. TNC staff conducted limited follow up weeding of understory weeds.

Ekahanui-08; 'Ēkahanui South Fenceline

Two trips were taken to this WCA this year. With the exception of 'Elepaio, there are no rare and few common native taxa in this WCA. It was created to help reduce fuel loads close to the enclosure. This is one of the few places where *P. maximum*, the fuel-loading grass, is found on the fenceline. The time between visits was too long, and NRS will strive to visit the site quarterly in the future.

Ekahanui-09; AleMac EKA-D site north outside fence

This WCA was created this year. This area is an outlier-it is not within a current fenced area, although the second larger sub-unit fence will include this area. The area was found rather by chance, while checking on an *Alectryon macrocarpus* nearby. The area has a very native canopy with a few *A. mustelina*. These resources encouraged NRS to weed in the area, taking out small non-native canopy trees and understory weeds. Hopefully this will allow the native species to increase at this site. NRS will return to the WCA at least two times in the next year to monitor and continue to improve the habitat.

Ekahanui-10; 'Ēkahanui Fenceline Clearing

This WCA is made up of the fenceline cleared in preparation for the construction of the second subunit of the 'Ēkahanui fenceline. Fenceline clearing is not yet complete. A small amount of herbicide was used and NRS will monitor for regrowth of weeds and will assess whether or not additional treatment is necessary.

HuliwaiNoMU-01

This WCA does not lie in any IP MU, but is close to the ‘Ēkahanui MU. Only one trip was made to weed in this MU during the past year for rare plant protection.

IP MU: Kalua‘ā and Wai‘eli

NRS and TNCH collaborate on management for these areas. Several more WCAs were created this year to reflect areas that TNCH has weeded. NRS hope to expand weed control efforts in these areas in the future. NRS are only beginning to understand the scope of, and participate in, these TNCH projects. Weed control this year focused mostly on creating and maintaining reintroduction of both common and rare plant sites, which are some of the most appropriate habitats for weeding. Some of the areas are very weedy and NRS and TNCH have managed to significantly reduce the amount of the aggressive *Passiflora suberosa* that reduces light and strangles established native and reintroduced plants. Weeding is particularly tedious in this MU given the numbers of native snail populations which must be avoided. In some areas NRS have to exclude weeding certain sites where snails are known to occur because of the potential negative impact on these tree and ground snails.

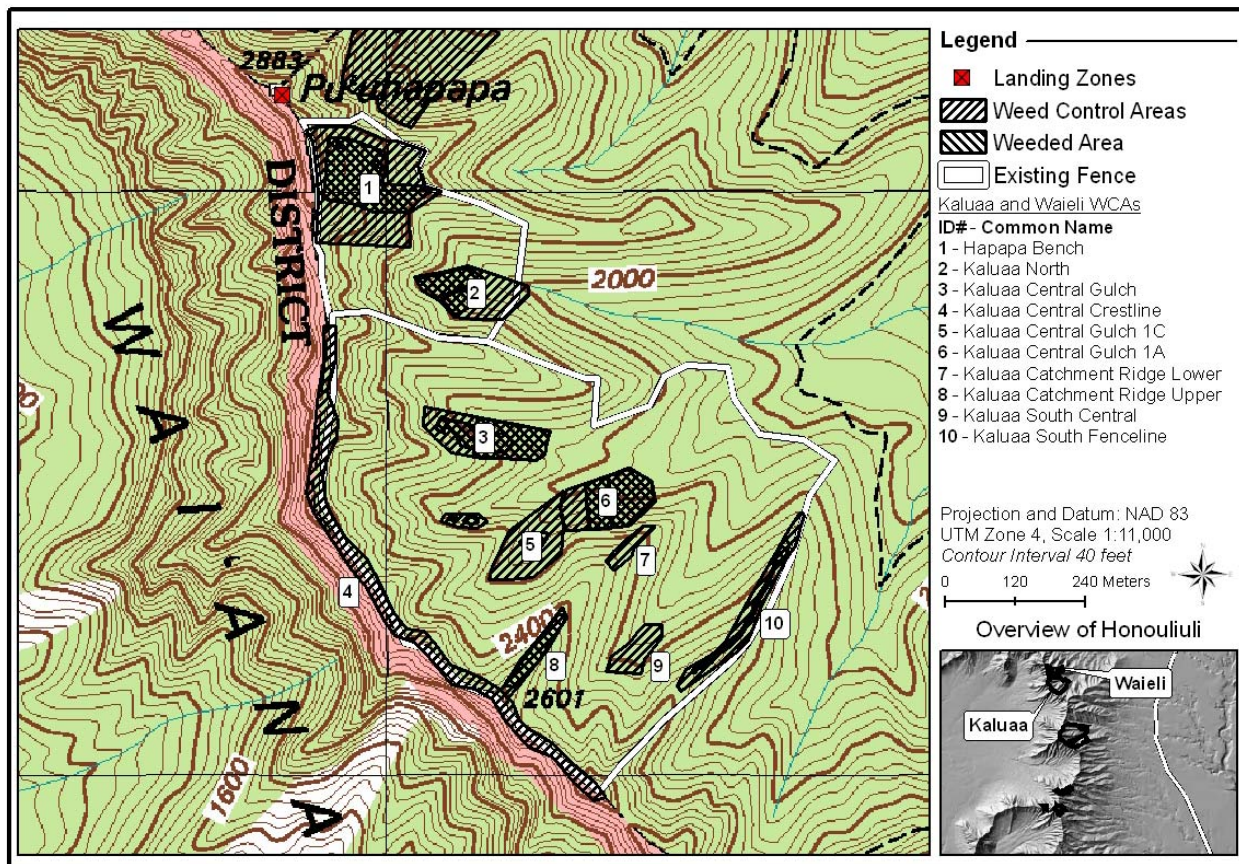


Figure 2.1.24 Weed Control Areas in Kalua‘ā & Wai‘eli

WCA Discussion

Kalua‘ā and Wai‘eli-01; Hapapa bench

This three acre site was weeded by TNCH staff early in the calendar year. The goal is to gradually reduce *Schinus terebinthifolius* canopy cover. Continued understory reduction of *C. hirta*, *P. edulis*, *B. asiatica*, and *E. karvinskianus* is still needed. The area will continue to be weeded two times per year.

Kalua‘ā and Wai‘eli-02; Kalua‘ā North

This two acre site was weeded by TNCH staff as a potential NRS outplanting site. The upper third of this WCA was weeded this year. Canopy control is complete. Understory reduction of *C. hirta* and *P. suberosa* is still needed. The area will continue to be weeded two times per year.

Kalua‘ā and Wai‘eli-03; Kalua‘ā Central Gulch

Weeding is done in this WCA to maintain and expand outplanting sites. Lots of *P. suberosa* was removed, and without this invasive component, the area is left with high levels of native canopy. As mentioned above, NRS are also careful to limit their weeding in areas where known populations of two species of ground snails (*Amastra micans* and *A. spirizona*) occur. NRS also weeded in a new area this year that was proposed as an outplanting site. Although no plants were in fact reintroduced, NRS should continue weed control up-gulch from this site. Two of the three acres of this WCA were weeded this year.

Kalua‘ā and Wai‘eli-04; Kalua‘ā Central Crestline

Grass control was conducted and will continue once every six months by TNC staff. Weed control for woody alien plants is still needed for the fenceline.

Kalua‘ā and Wai‘eli-05; Kalua‘ā Central Gulch 1C

Weeding was conducted around the following rare plants in this area by TNC staff: *S. kaalae*, *D. subcordata*, and *U. kaalae* populations. Understory weeding will continue every six months by TNC staff.

Kalua‘ā and Wai‘eli-06; Kalua‘ā Central Gulch 1A

This 2 acre WCA encompasses many reintroductions, and 76% of the entire WCA is considered a TNC Project Stewardship site, and NRS leave that part alone for that purpose. NRS conducted no other weed control in this WCA this year. Understory weeding will continue every six months by TNC staff.

Kalua‘ā and Wai‘eli-08; Kalua‘ā Catchment Ridge Upper

Weeding was conducted around *C. agrimonioides* and *S. kanehoana* in this area. Understory weeding will continue every six months by TNC staff.

Kalua‘ā and Wai‘eli-09; Kalua‘ā South Central

This one acre site was weeded in preparation for TNC outplantings. Understory weeding will continue every six months by NRS and TNC staff. This site may be used for NRS reintroductions this coming year.

Kalua‘ā and Wai‘eli-10; South Fenceline

This site was weeded for the *S. kanehoana* outplanting. The area is abundant with *D. linearis* and NRS hopes that *S. kanehoana* grows well in this environment. The *D. linearis* will help to keep weed regrowth at bay. NRS will monitor the outplantings and will plant more in the future if the current outplantings continue to thrive.

Kalua‘ā and Wai‘eli-11; Kalua‘ā Central Gulch 2

This site was weeded in preparation for outplanting, however no plants were reintroduced here. The habitat looked similar to other areas of *P. mollis*. There is a decent native plant population here as well. This could still be used as a future outplanting site.

Kalua‘ā and Wai‘eli-12; Waieli Dryfalls Alemacmac

Almost 20% of this two acre WCA was weeded this year. Managed species include *A. macrococcus*. *Toona ciliata* and *S. terebinthifolius* canopy was reduced by TNC staff. Understory weeding will continue every six months by TNC staff and NRS as feasible.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present		
IP MU: Kaluaa and Waieli							
KaluaaandWaieli-01	Habitat	33518.84	13829.55	41.26%	MelChr		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	4	38.00	CliHir, EriKar, LanCam, MelMin, PasSub, RubRos, SchTer, TooCil
				Total	4	38.00	
KaluaaandWaieli-02	Habitat	11797.58	4266.515	36.16%	AleMacMac, DieFal, SchKaa, UreKaa		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	2	21.00	CliHir, PasSub, RubRos, SchTer, TooCil
				Total	2	21.00	
KaluaaandWaieli-03	Habitat	12586.88	9100.383	72.30%	AleMacMac		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	4	52.00	BudAsi, CliHir, IpoCai, LanCam, PasEdu, PasSub, PsiGua, RubRos, SchTer, TooCil
				Total	4	52.00	
KaluaaandWaieli-05	Habitat	10876.72	985.8016	9.06%			
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	1	6.00	CliHir, LanCam, RubRos, SchTer, TooCil
				Total	1	6.00	
KaluaaandWaieli-06	Habitat	12225.94	9111.412	74.53%	AleMacMac, CyaGriOba, DelSub, PhyMol, SchKaa, UreKaa		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	2	46.00	CliHir, PasSub, RubRos
				Total	2	46.00	
KaluaaandWaieli-08	Habitat	3800.976	2978.834	78.37%	CenAgrAgr		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	1	14.00	BudAsi, CliHir, LanCam, MelMin, PanMax, PasSub, SchTer
				Total	1	14.00	

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present												
KaluaaandWaieli-09	Habitat	4327.179	1570.608	36.30%													
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>2</td> <td>10.50</td> <td>CliHir, LanCam, PasSub, PsiCat, PsiGua, RubRos, SchTer</td> </tr> <tr> <td>Total</td> <td>2</td> <td>10.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	2	10.50	CliHir, LanCam, PasSub, PsiCat, PsiGua, RubRos, SchTer	Total	2	10.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	2	10.50	CliHir, LanCam, PasSub, PsiCat, PsiGua, RubRos, SchTer														
Total	2	10.50															
KaluaaandWaieli-10	Habitat	8611.691	1860.842	21.61%	CenAgrAgr, SteKan												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>3</td> <td>21.00</td> <td>CliHir, GreRob, LanCam, PasSub, StaDic</td> </tr> <tr> <td>Total</td> <td>3</td> <td>21.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	3	21.00	CliHir, GreRob, LanCam, PasSub, StaDic	Total	3	21.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	3	21.00	CliHir, GreRob, LanCam, PasSub, StaDic														
Total	3	21.00															
KaluaaandWaieli-11	Habitat	1438.288	301.6661	20.97%													
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>4.00</td> <td>LanCam, PasCon, RubRos, SpaCam, TooCil</td> </tr> <tr> <td>Total</td> <td>1</td> <td>4.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	4.00	LanCam, PasCon, RubRos, SpaCam, TooCil	Total	1	4.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	1	4.00	LanCam, PasCon, RubRos, SpaCam, TooCil														
Total	1	4.00															
kaluaaandWaieli-12	Habitat	33574.3	6109.168	18.20%	AleMacMac, CyaMem, DieFal, PhyMol, SchHoo, UreKaa												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>12.00</td> <td>SchTer, TooCil</td> </tr> <tr> <td>Total</td> <td>1</td> <td>12.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	12.00	SchTer, TooCil	Total	1	12.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	1	12.00	SchTer, TooCil														
Total	1	12.00															

IP MU: Puali'i portion of Palikea MU

The Puali'i portion of the Palikea MU is comprised of three recently designated WCAs around wild and reintroduced populations of rare plants. The area is currently managed by TNCH but during the coming year NRS will assume management responsibilities for the MU. The area is threatened by fire due to large amounts of light and heavy fuel types east of the area, however, no fires in recent years have threatened the MU. TNCH staff is in the process of constructing a fence to encompass all the presently managed WCA's and their corresponding rare plant populations. Completion of this fence is expected by November 2006.

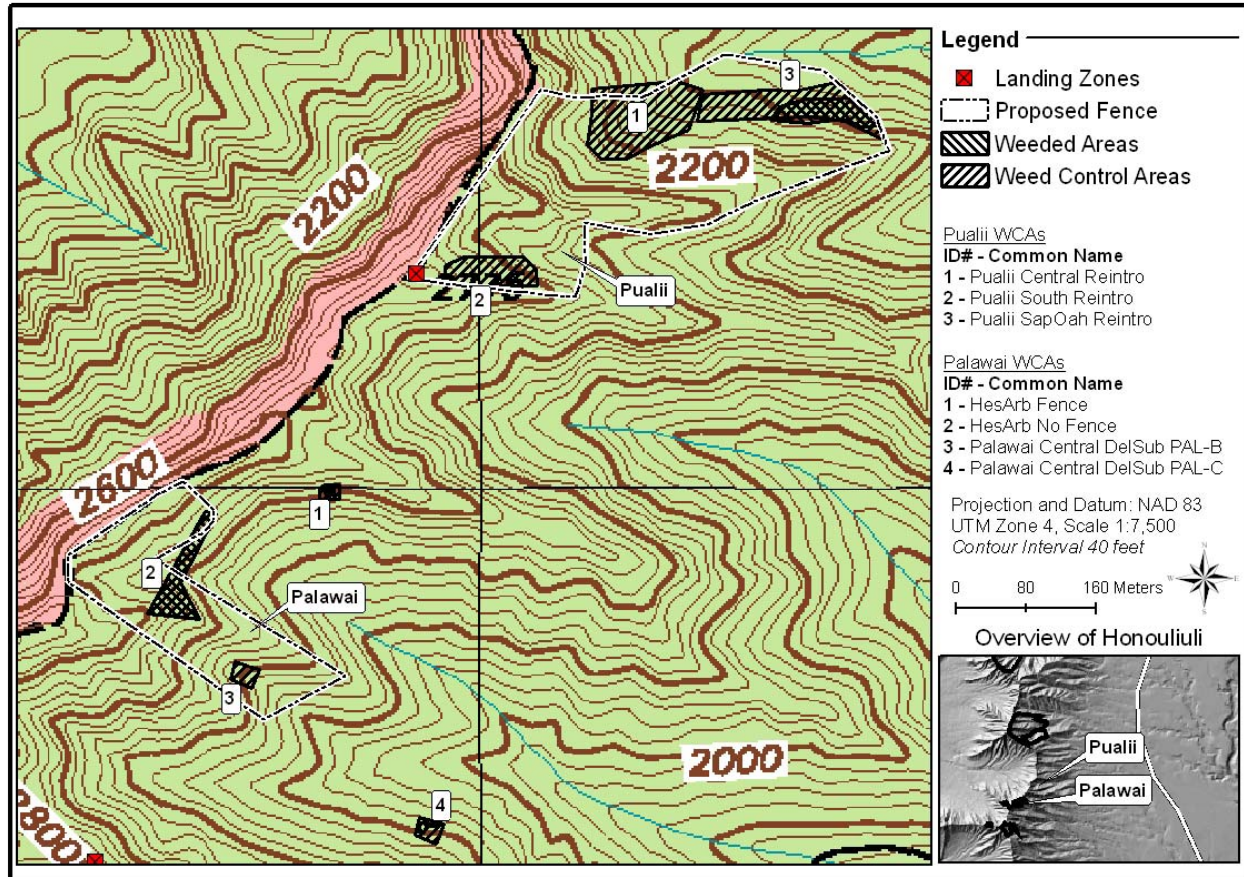


Figure 2.1.25 Weed Control in Pualii & Palawai Gulches

WCA Discussion

Pualii-01 Central Reintroduction Site

Pualii-01 contains a native dominant forest patch consisting of a *Pouteria sandwicensis* stand. The stand is near rare plant populations *Diellia falcata*, *Urera kaalae* and *Sicyos lanceoloidea*, and serves as a new reintroduction site for TNCH staff, where *Delissea subcordata*, *Urera kaalae*, and *S. lanceoloidea* were planted this year. There was no weeding effort in this WCA by the NRS staff for the '05-'06 reporting year, however, TNCH staff had weeded the area in the previous reporting year to prepare the site for plant reintroductions. When the fence is completed, weed control efforts will begin for the '06-'07 reintroductions.

Pualii-02 South Reintroduction Site

Pualii-02 is a native dominant area consisting of a *Metrosideros polymorpha* canopy. This area also serves a reintroduction site by TNCH for *Delissea subcordata*, *Gardenia brighamii*, and *P. mollis*. No weeding by TNCH or NRS staff occurred during the '05-'06 reporting year.

Pualii-03 *Sapindus oahuensis* Reintroduction Site

Pualii-03 contains a native dominant forest of *Sapindus oahuensis*. The forest is also a new reintroduction site for TNCH staff, where *Abutilon sandwicensis* and *Gardenia brighamii* were planted this year. There was one weeding effort this year consisting of 15 hours of work controlling *S. terebinthifolius*. Once the fence is completed weed control efforts will resume.

IP MU: Palikea

The Palikea MU is on the Southern end of the Waianae Mountains. In the last year NRS has collaborated with TNC staff on weed control in this area. The area contains some relatively intact areas as well as others that are completely alien dominated. *S. terebinthifolius* is particularly dominant in the areas below the MU. *Ehrharta stipioides* and *Morella faya* are also prevalent on an access route to this area. As far as NRS knows, this is the only area where these species are widespread on O‘ahu. NRS are careful to prevent spread. A 25 acre fence is planned in the Palikea peak area and will encompass the existing two acre fence. Completion of this larger unit is expected by fall 2007.

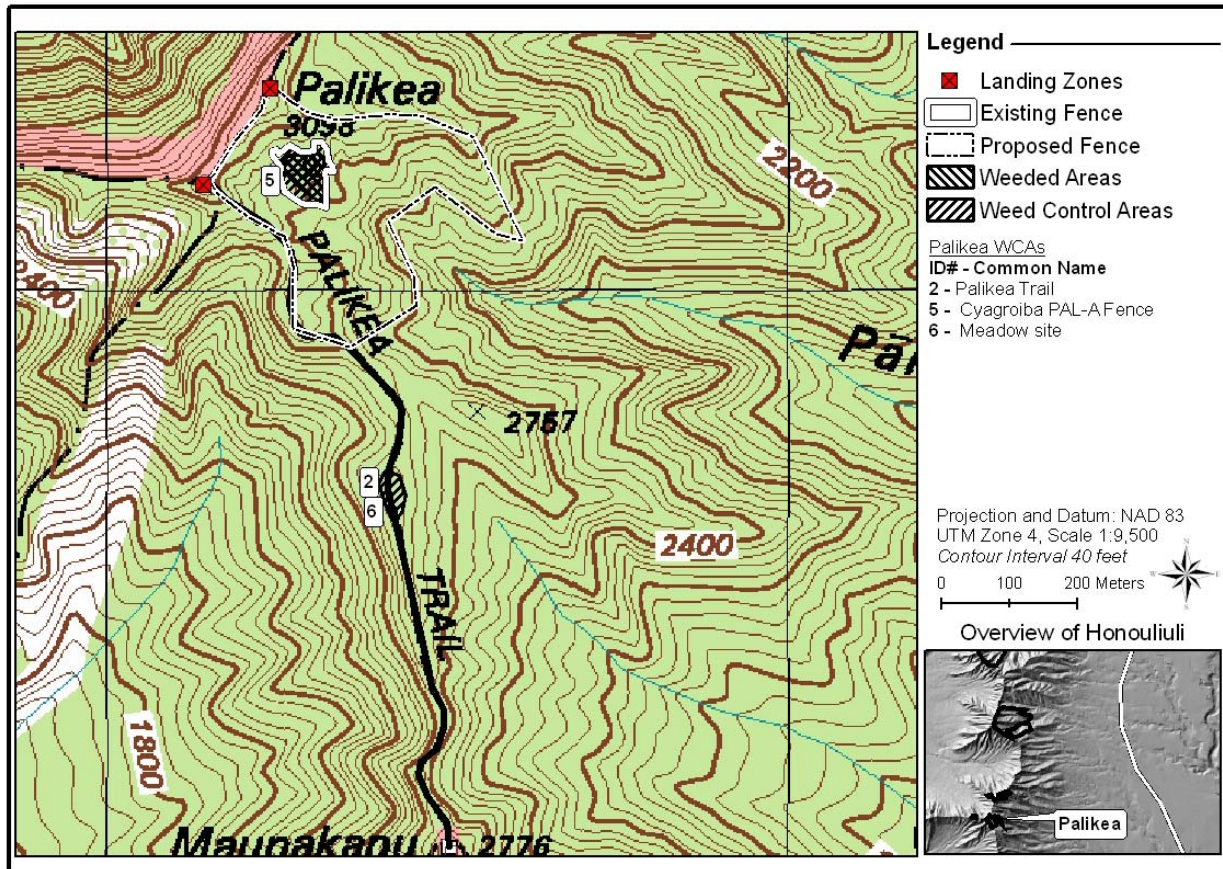


Figure 2.1.26 Weed Control Areas in Palikea

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present																
IP MU: Palikea																					
Palikea-01	Habitat	378.8505	60.64963	16.01%	HesArbu																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>1</td> <td>0.50</td> <td>EhrSti, MelMin, PasCon</td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>4.50</td> <td>PasSub, PsiCat, SchTer</td> </tr> <tr> <td>Total</td> <td>2</td> <td>5.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	1	0.50	EhrSti, MelMin, PasCon	Ecosystem Weed Control	1	4.50	PasSub, PsiCat, SchTer	Total	2	5.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	1	0.50	EhrSti, MelMin, PasCon																		
Ecosystem Weed Control	1	4.50	PasSub, PsiCat, SchTer																		
Total	2	5.00																			
Palikea-02	Trail	2803.129	2803.129	100.00%	HesArbu																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>3</td> <td>3.50</td> <td>EhrSti</td> </tr> <tr> <td>Total</td> <td>3</td> <td>3.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	3	3.50	EhrSti	Total	3	3.50					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	3	3.50	EhrSti																		
Total	3	3.50																			
Palikea-03	Habitat	7507.921	2368.256	31.54%	HedPar																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>1</td> <td>2.00</td> <td>AxoFis, MelMin, PasCon</td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>0.50</td> <td>AgeAde, AgeRip</td> </tr> <tr> <td>Total</td> <td>2</td> <td>2.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	1	2.00	AxoFis, MelMin, PasCon	Ecosystem Weed Control	1	0.50	AgeAde, AgeRip	Total	2	2.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	1	2.00	AxoFis, MelMin, PasCon																		
Ecosystem Weed Control	1	0.50	AgeAde, AgeRip																		
Total	2	2.50																			
Palikea-04	Habitat	8617.785	2514.285	29.18%	HedPar																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>4.00</td> <td>EriKar, GreRob, MelQui, PsiCat, SphCoo</td> </tr> <tr> <td>Total</td> <td>1</td> <td>4.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	4.00	EriKar, GreRob, MelQui, PsiCat, SphCoo	Total	1	4.00					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Ecosystem Weed Control	1	4.00	EriKar, GreRob, MelQui, PsiCat, SphCoo																		
Total	1	4.00																			
Palikea-05	Habitat	5382.713	3100.04	57.59%	CyaGriOba																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>1</td> <td>2.50</td> <td>EhrSti</td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>3</td> <td>21.00</td> <td>CliHir, PasSub, PsiCat, RubRos, SchTer</td> </tr> <tr> <td>Total</td> <td>4</td> <td>23.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	1	2.50	EhrSti	Ecosystem Weed Control	3	21.00	CliHir, PasSub, PsiCat, RubRos, SchTer	Total	4	23.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	1	2.50	EhrSti																		
Ecosystem Weed Control	3	21.00	CliHir, PasSub, PsiCat, RubRos, SchTer																		
Total	4	23.50																			
Palikea-06	Habitat	1854.305	351.9855	18.98%																	
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>2</td> <td>6.00</td> <td>EhrSti</td> </tr> <tr> <td>Total</td> <td>2</td> <td>6.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	2	6.00	EhrSti	Total	2	6.00					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	2	6.00	EhrSti																		
Total	2	6.00																			

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present												
PalikeaNoMU-02	3M	621.3672	123.3277	19.85%	DelSub												
<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>2.25</td> <td>AgeAde, SchTer</td> </tr> <tr> <td>Total</td> <td>1</td> <td>2.25</td> <td></td> </tr> </tbody> </table>						Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	2.25	AgeAde, SchTer	Total	1	2.25	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	1	2.25	AgeAde, SchTer														
Total	1	2.25															

WCA Discussion

Palikea-01; Hesarb fence

This WCA is centered around a wild *H. arbuscula* population (Figure 2.1.26). Weeding in this WCA will hopefully encourage *H. arbuscula* regeneration. The 100 m² enclosure is relatively free from alien species from past years of weeding. NRS made one maintenance weeding trip to the enclosure and pulled alien seedlings as well as sprayed invasive grasses. NRS is reluctant to kill the large *S. terebinthifolius* trees that may be providing shade to the *H. arbuscula*. Because of this, *S. terebinthifolius* seedlings and offshoots will have to be killed each year. NRS will plan to visit this site two times in the next year.

Palikea-02; Palawai Hesarb unfenced

Last year NRS discovered *E. stipioides* along the trail to the *H. arbuscula* enclosure (Figure 2.1.26). In an effort to prevent spread to the enclosure and possible to areas outside of Palikea NRS spray regularly. This year NRS sprayed the area four times and has found this approach effective in reducing *E. stipioides* occurrence. Most of the treated area has remained dead with just a few tiny re-sprouts. Unfortunately the ridge crest above the enclosure is more infested and it is likely that this area is connected to the large scale infestation known from the Pu'u Palikea vicinity.

Palikea NoMu-02; Palawai Delsub Pal-C

WCA 02 is located in the lower elevations of Palawai gulch (Figure 2.1.26). This area is almost completely dominated by *S. terebinthifolius*. However, there is one small pocket with many native species. In this area TNC found a wild *D. subcordata* population. This WCA includes this area. NRS hopes that because of weeding the *D. subcordata* will be able to regenerate. NRS made one trip to this area to perform maintenance weeding. NRS will plan to visit the site twice in the next year. The downslope corners of the 400 m² enclosure are dominated by *S. terebinthifolius* however, *A. mustelina* has been observed in this area so no weeding has been done there. The upslope corners have a large population of *A. adenophora*. It would be labor intensive to basal treat this area. NRS should consider spraying with Round-up as long as no native plant or invertebrate species are impacted.

PalikeaNoMu-03; Palikea trail Ehrsti

On the trail out to the Palikea MU (Figure 2.1.26), *E. stipioides* was prevalent and NRS began weeding to prevent spread via NRS to not only others area at Palikea but also to other areas that NRS works. This is the only location on O'ahu where NRS knows this species to be prevalent. This species is extremely good at adhering to the cloths and shoes of workers. NRS has removed it on more than one occasion from project vehicles. It is also suspected that it has spread from this location to the Pahole snail enclosure as well as possibly to 'Ohikilolo. NRS made two trips

to treat the trail this year. Most of the treated area has remained dead with perhaps 10 one-foot areas of re-growth. With a major spray and at least two follow up sprays to kill re-growth per year, this invasive will be greatly impaired in its ability to spread. Unfortunately it is prevalent in the surrounding unmanaged areas and re-treatment will be ongoing.

Palikea-03; Hedpar Halona

This WCA surrounds a wild population of *Hedyotis parvula*, located mostly on the Navy owned cliff face (Figure 2.1.27). Weeding effort in this area is focused on reducing competition from surrounding weeds. One trip was made this year, and effort was spent spraying grass with fusilade and also controlling broadleaf weeds with 20% Garlon 4 herbicide. The area is steep and difficult to navigate with a backpack sprayer. NRS plans to return to this site in the coming reporting year to assess the need for further weeding around the protected plants. There are many areas that are unreachable without a rope. Areas previously treated by NRS without ropes are dangerous. NRS will use ropes in the future.

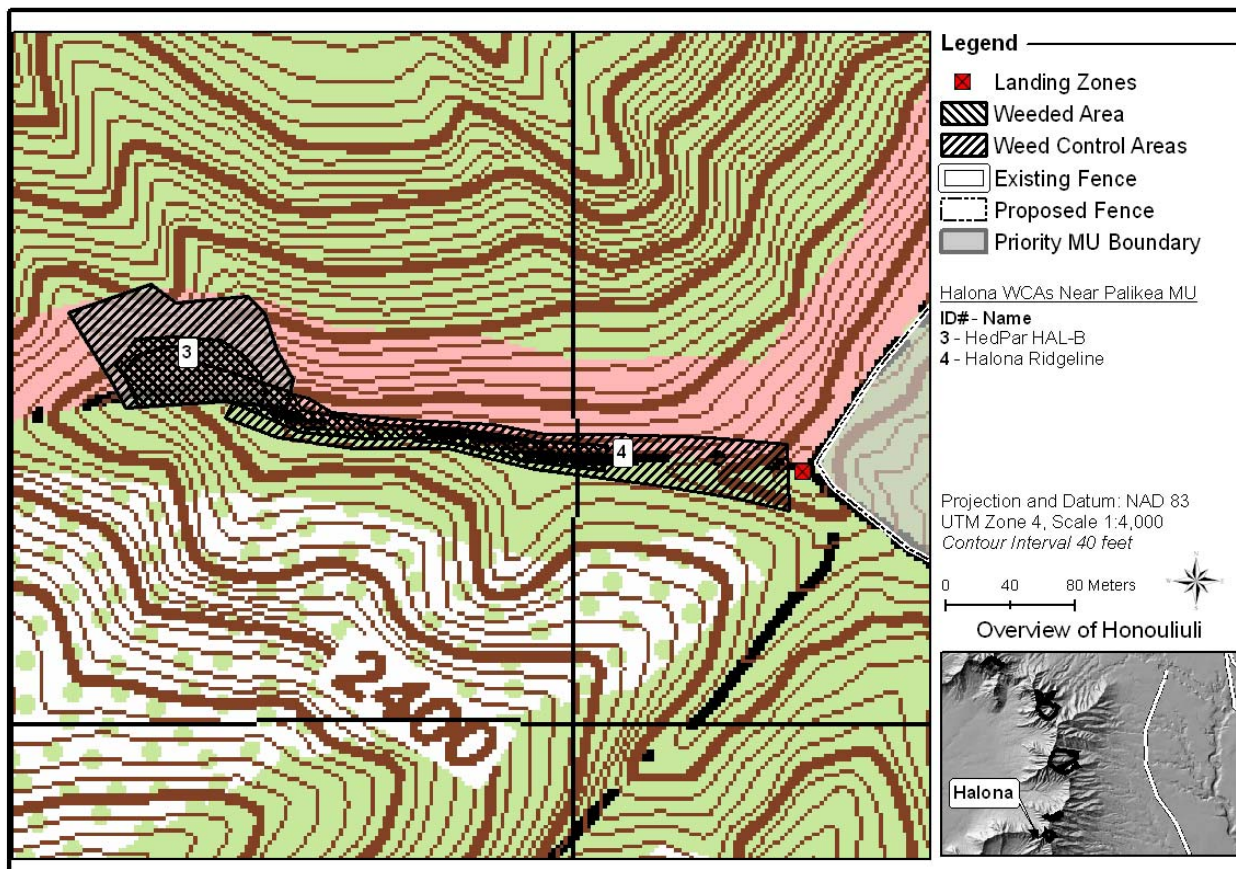


Figure 2.1.27 Weed Control Areas in Hālonā

Palikea-04; Halona Ridgeline

The ridgeline WCA spans from the LZ to Palikea-03 WCA (Figure 2.1.27) and is a newly created WCA devoted to the control of *E. karvinskianus* and a handful of other uncommon weeds that NRS feels are worth keeping to a minimum. The area is alien-dominated, so ecosystem scale control is not done at this WCA. There are a few non-native species that NRS believes would significantly threaten the rare plant populations in the surrounding area if allowed

to infest the area. These species include *Grevillea robusta*, *Psidium cattleianum*, *Sphaeropteris cooperi*, and *Melaleuca quinquenervi*. A few plants of all these species were found on the ridgeline, and NRS feels it is important to ensure they remain at manageable levels. NRS plans to return to the area once in the coming year to control these species.

Palikea-05: Palikea CyaGri Fence

This WCA is comprised of a two acre fence unit constructed around an outplanting of *C. grimesiana* (Figure 2.1.26). This population has been augmented by NRS and TNC and presently contains the largest reintroduction population of *C. grimesiana*. NRS and TNC conducted three weed control trips to this area in the last year. Many of the canopy weeds were removed in previous years and the present weed focus is on understory species including *E. stipoides* that has not yet become established in the area. Within the fence, the understory is lush with native species that have multiplied since the fencing weed control began. This area needs to be maintained with semi-regular weeding. NRS believe that two to three weeding trips per year is adequate. The priorities are to weed in outplanted areas and monitor *C. grimesiana* seedling growth as the weeds stop persisting. *Sphaeropteris cooperi* continue to pop up in and around the fence area and NRS will consistently kill it.

Palikea-06: Palikea Meadowsite

This WCA has been used as a volunteer outplanting site (Figure 2.1.26). The area is flat and *E. stipoides* can be controlled easily with persistent spray. NRS will spray this site at least two times per year.

IP MU: Lower ‘Ōpae‘ula

No weed control has been done in this MU for over two years. The area is home to diverse forest and several rare taxa, and historically has seen significant levels of weed control. NRS stopped weeding in this area due to high pig presence; open weeded areas were targeted by pigs. Once ungulates are removed NRS believe that this MU has a high potential for restoration. A large fence is proposed to be built at Lower ‘Ōpae‘ula. Once the fence is completed NRS will resume weed control.

OIP REPORT

All formatting and reporting follows the same format as Chapter 2 of the MIP Report, Weed Management. The MIP and OIP have similar general weed control requirements; please refer to the Mākua Section 7 Weed Management overview in the introduction of Chapter 2 for a complete discussion of IP weed management requirements. Table 2.2.1 below summarizes weeding effort across OIP MUs.

Table 2.2.1 OIP Management Units: Weed Control from 9/1/05 to 8/31/06

	WCA Total acres	Total Acres Covered	# of Visits	Effort (Person Hrs)
IP MU: East of Oio	0.30	0.30	1	3.00
IP MU: Ekahanui	17.5	8.83	17	111.00
IP MU: Kaala	60.1	29.8	10	181.25
IP MU: Kaleleiki	1.97	0.11	1	20.00
IP MU: Kaluaa and Waieli	32.8	12.4	21	224.50
IP MU: Kaunala	9.86	1.63	6	80.00
IP MU: Makaha	25.6	6.36	12	313.90
IP MU: Oio	6.59	1.82	5	51.00
IP MU: Opaepa/Helemano	192	63.8	13	332.00
IP MU: Pahipahialua	2.96	0.89	4	41.00
IP MU: Poamoho	11.5	3.30	1	23.50
IP MU: Pualii	1.67	0.58	1	15.00
IP MU: West Makaleha	6.61	2.44	5	25.00
Totals	370	132	97	1421.15

Survey Report

Surveys are conducted both on Army land and partner agency land (see Figures 2.2.1 and 2.2.2). Three types of surveys are conducted by NRS: road, landing zone, and transect. Transect survey results are discussed in the relevant discussion in the Management Unit Weed Control Area Report. Road and landing zone survey results are summarized in Tables 2.2.1 and 2.2.2, respectively, and discussed below.

Road Survey Report

Road surveys are conducted once a year, usually in the first quarter of the year. Some of the surveys are conducted along roads used for military training, and some are conducted along

roads used often by NRS. Two road surveys were not conducted this year. RS-KTA-03 was not surveyed because the road was in disrepair and was not drivable; NRS will survey it when road repairs are made. RS-KLOA-3 also is in disrepair, and it appears that the Army has discontinued use of this road. If Army use changes, NRS will resume survey efforts.

Table 2.2.2: Road Survey Summary

SurveySiteCode	SurveySiteName	SiteLength (km)	Army/NRS Use	Significant New Pest Species
Property Name: Dillingham Military Reservation				
RS-DMR-01	Dillingham Roads	2.692	Army and NRS	
Property Name: Kahuku Training Area				
RS-KTA-01	Charlie 1 Gate to Foxtrot Gate	5.81	Army and NRS	
RS-KTA-02	Charlie 2 Gate to Alpha Gate	7.24	Army and NRS	MacUng
RS-KTA-04	Pupukea Gate to Foxtrot Gate	1.891	Army and NRS	
Property Name: Kawaihoa Training Area				
RS-KLOA-01	Poamoho Road	2.871	NRS	
RS-KLOA-02	Kawaiiki Ditch Trail to Brian's Mtn House Road Jnc.	3.469	Army and NRS	ArtCil
RS-KLOA-04	Brian's Mtn House Road Jnc to Helemano Gate	3.439	Army and NRS	
RS-KLOA-06	Ashley Gate to Kawaiiki Ditch Trail	6.583	Army and NRS	
RS-KLOA-07	McCormick Gate to Ashley Gate	4.327	Army and NRS	SchAct
Property Name: Mokuleia Forest Reserve				
RS-KAALA-01	Kaala Road	10.353	NRS	HedGar
Property Name: Schofield Barracks East Range				
RS-SBE-01	East Range Road to Sch-Wai Trailhead	13.938	Army and NRS	
Property Name: Schofield Barracks South Range				
RS-SBS-01	South Range Roads		Army and NRS	SetPal
Property Name: Schofield Barracks West Range				
RS-SBW-01	West Range Firebreak Road	4.093	Army and NRS	

Potentially significant pests were found on a number of road surveys this year (see Table 2.2.1). *Macfadyena unguis-cati* was found on RS-KTA-02; it is not thought to be a particular threat at this time, but NRS will continue to monitor it. *Hedychium gardnerianum* was found on RS-KAALA-01. NRS control *H. gardnerianum* in the course of Weed Control Area (WCA) work at

Ka‘ala. It is a significant threat, and NRS will investigate its location on the road and incorporate control into regular management. *Schefflera actinophylla* was found on RS-KLOA-07. NRS will determine if this species is widespread in the area, and if it is not, will initiate control measures. *Arthrostemma ciliatum* was found on RS-KLOA-02; it is a significant pest, and control work has already begun for this species. See the Incipient Control Area (ICA) Report for more information. *Setaria palmifolia* was found on RS-SBS-01; while not common in this area, this species is widespread elsewhere. NRS will determine its distribution in SBS and make a control decision in the coming year.

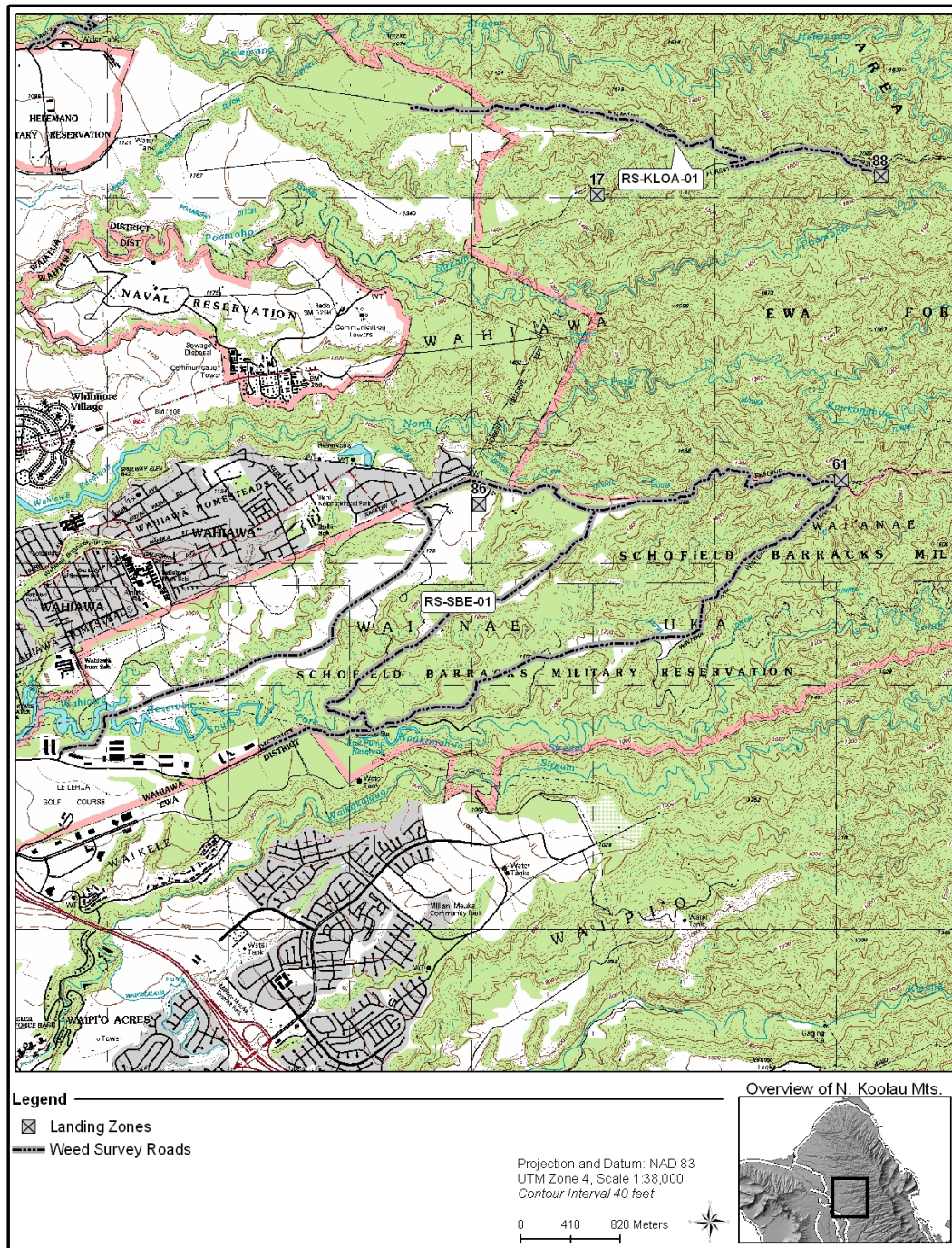


Figure 2.2.1 Landing Zone & Road Surveys, Poamoho to Schofield Barracks East Range



Figure 2.2.2 Landing Zone & Road Surveys, Kahuku and Kawaiolo Military Training Areas

Landing Zone Survey Report

Landing zone (LZ) surveys are generally conducted quarterly. Some LZs are used by Army personnel, and some are strictly used by NRS. If LZs are not used in a given year, NRS do not conduct surveys at them. There are over 50 LZs associated with OIP actions; NRS survey only a portion of them. In the future, NRS plan to implement a policy of completing a survey every time an LZ is used, to achieve a more consistent weed spread picture across management areas. Several new LZs were surveyed this year, including LZ-KTA-101, Pu'u 1010. No significant pests were found on any LZs this year.

Table 2.2.3 Landing Zone Survey Summary
Between October 20, 2005 to August 10, 2006

SurveySiteCode	SurveySiteName	SiteLength (km)	SurveySiteType	First Survey Date	Significant New Pest Species
Property Name: Kahuku Training Area					
LZ-KTA-01	Water Tank Hill LZ		Landing Zone	2003-06-04	
LZ-KTA-101	Puu 1010 [LZ Durham]		Landing Zone	2006-03-15	
LZ-KTA-13	Canes LZ		Landing Zone	2003-04-15	
LZ-KTA-15	Summit Split Rock		Landing Zone	2001-08-14	
LZ-KTA-16	X-Strip		Landing Zone	2006-03-15	
Property Name: Kawaioloa Training Area					
LZ-KLOA-18	Black		Landing Zone	2001-08-14	
LZ-KLOA-21	Elephant's Foot		Landing Zone	2001-08-14	
LZ-KLOA-28	Nixon		Landing Zone	2001-08-14	
LZ-KLOA-30	Peahinaia Summit LZ		Landing Zone	1999-02-09	
LZ-KLOA-35	Puu Kapu		Landing Zone	2004-02-09	
LZ-KLOA-37	Radio		Landing Zone	1999-05-12	
LZ-KLOA-38	Red		Landing Zone	2001-08-14	
LZ-KLOA-42	Weatherport Opaeula		Landing Zone	2002-10-16	
LZ-KLOA-42	Weatherport Opaeula		Landing Zone	2002-10-16	
Property Name: Schofield Barracks East Range					
LZ-SBE-44	Puu Kaaumakua East		Landing Zone	2006-08-10	
LZ-SBE-47	Schofield Waikane Summit		Landing Zone	2005-02-15	
LZ-SBE-63	LycNut_Schwai Trl		Landing Zone	2006-08-08	

Incipient Weed Report

Please refer to Table 2.2.4 and Figures 2.2.3-6 below for a picture of incipient species distribution.

Table 2.2.4 Overview of Incipient Taxa and ICA Distribution

Incipient Target	Location	Number of ICAs
<i>Acacia mangium</i>	KTA	4
<i>Arthrostemum ciliatum</i>	KLOA	2
	SBE	1
<i>Buddleia madagascariensis</i>	SBE	2
<i>Festuca arundacea</i>	Ka'ala	1
<i>Hedychium gardnerianum</i>	Kawailoa	1
	Kīpapa	1
<i>Ilex cassine</i>	SBW	1
<i>Juncus effuses</i>	Ka'ala	3
<i>Leptospermum scoparium</i>	Poamoho	2
<i>Melochia umbellata</i>	KTA	5
<i>Pennisetum setaceum</i>	KTA	1
	SBE	1
	DMR	1
<i>Rhodomyrtus tomentosa</i>	KTA	1
	SBE	1
<i>Senecio madagascariensis</i>	SBS	1
<i>Setaria palmifolia</i>	Opaaula/Helemano	13
<i>Smilax sp.</i>	SBE	1
<i>Tibouchina urvilleana</i>	Whitmore Village	1

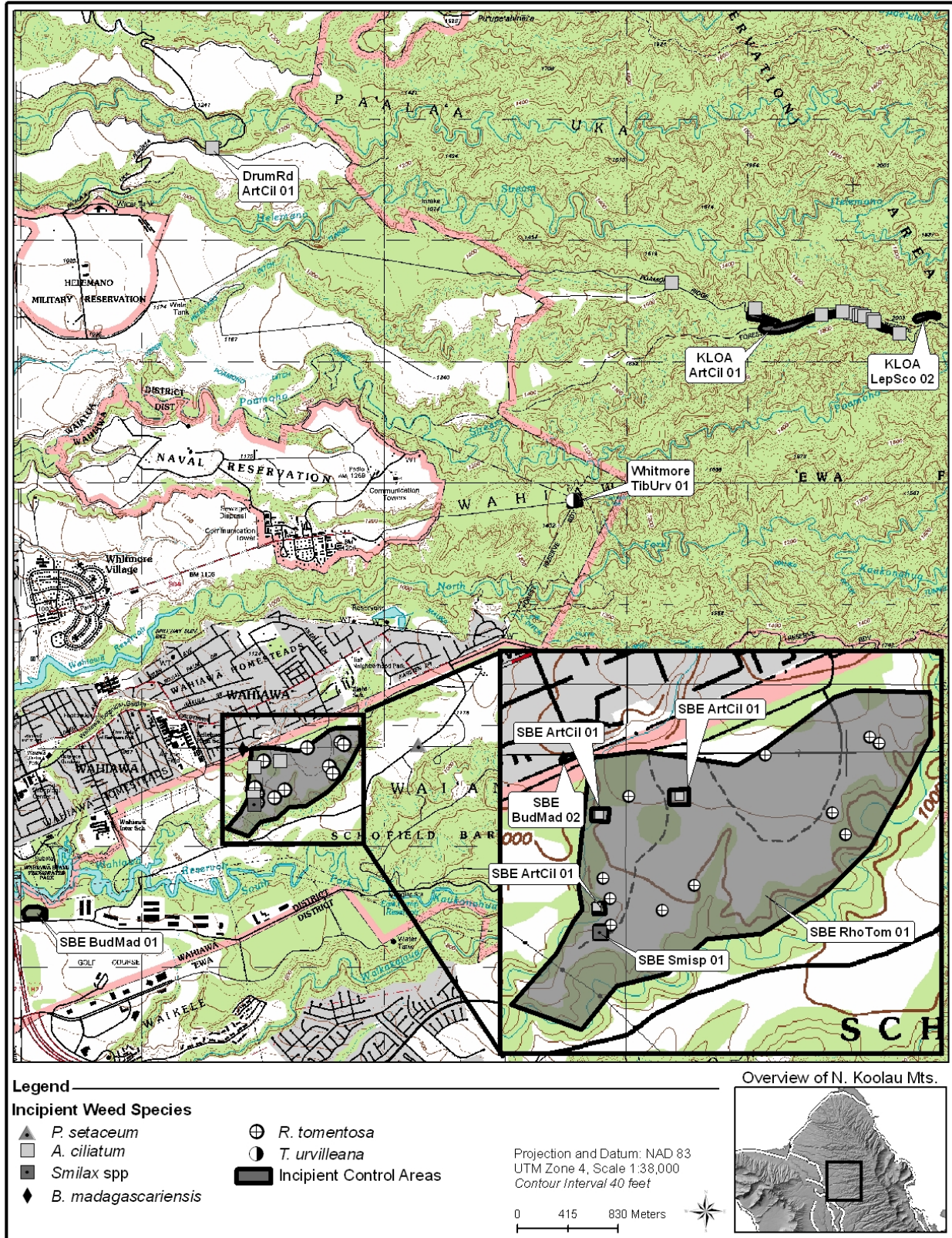


Figure 2.2.3 Location of Incipient Weed Species in KLOA & SBE

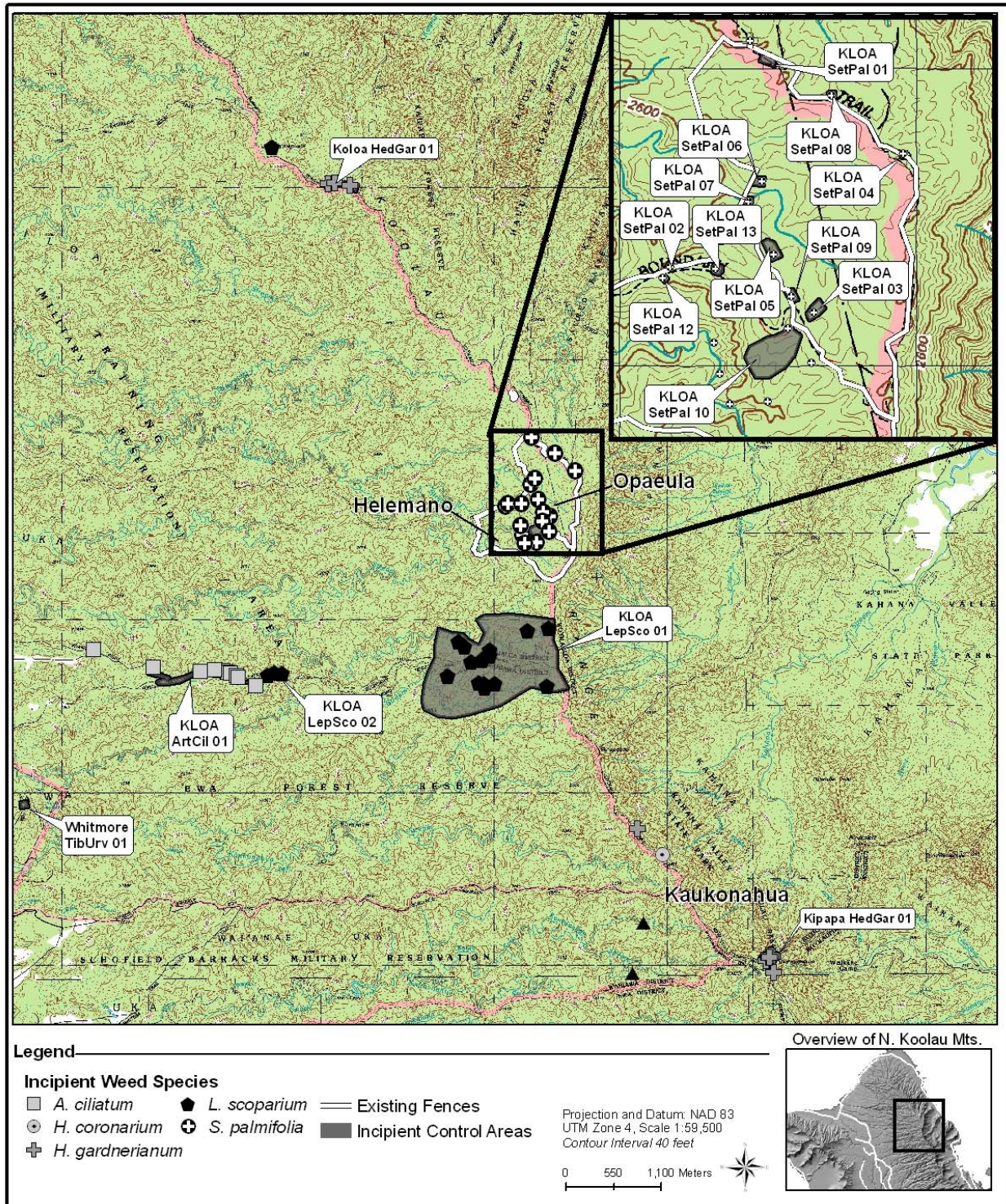


Figure 2.2.4 Location of Incipient Weed Species in KLOA

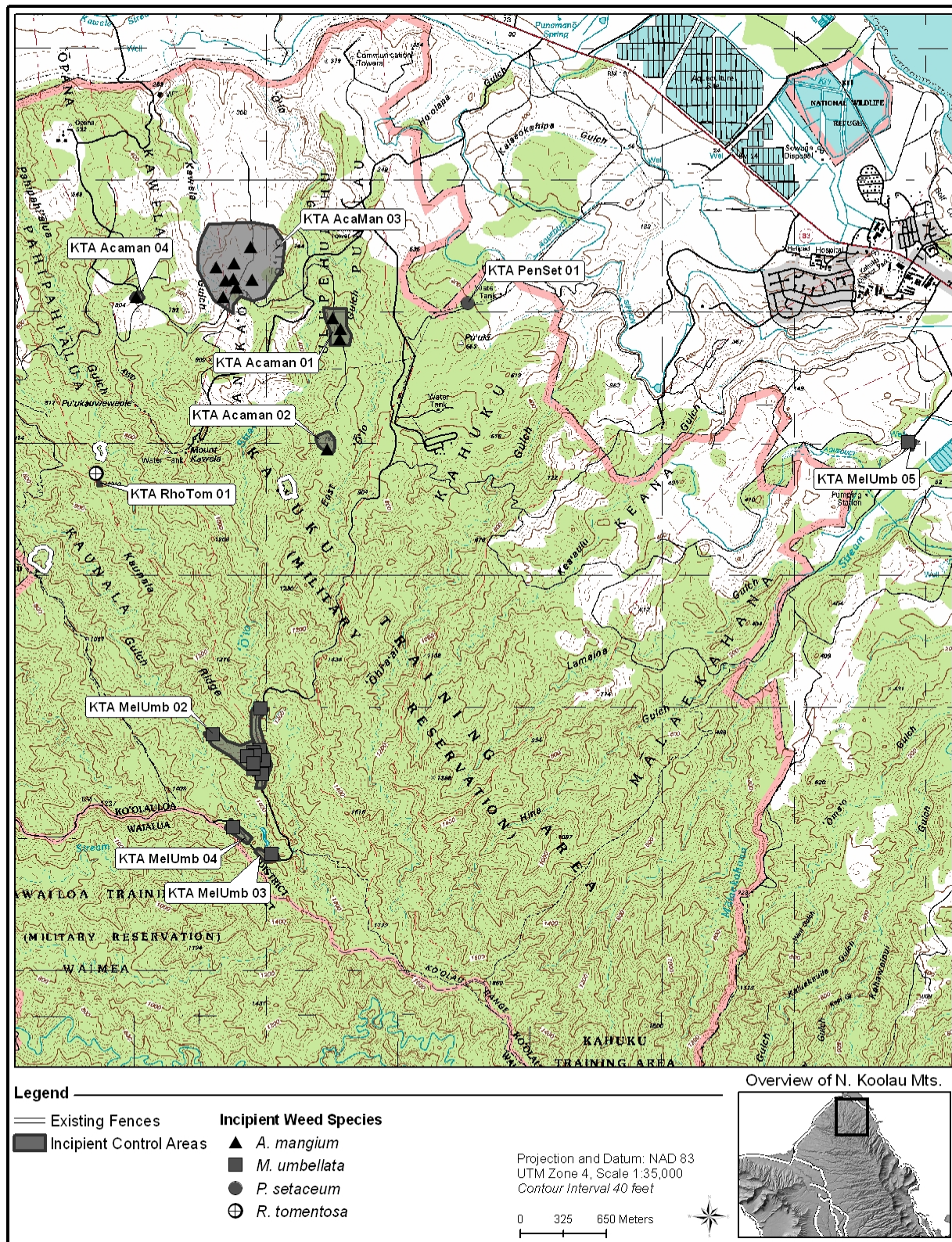


Figure 2.2.5 Location of Incipient Weed Species in Kahuku Training Area

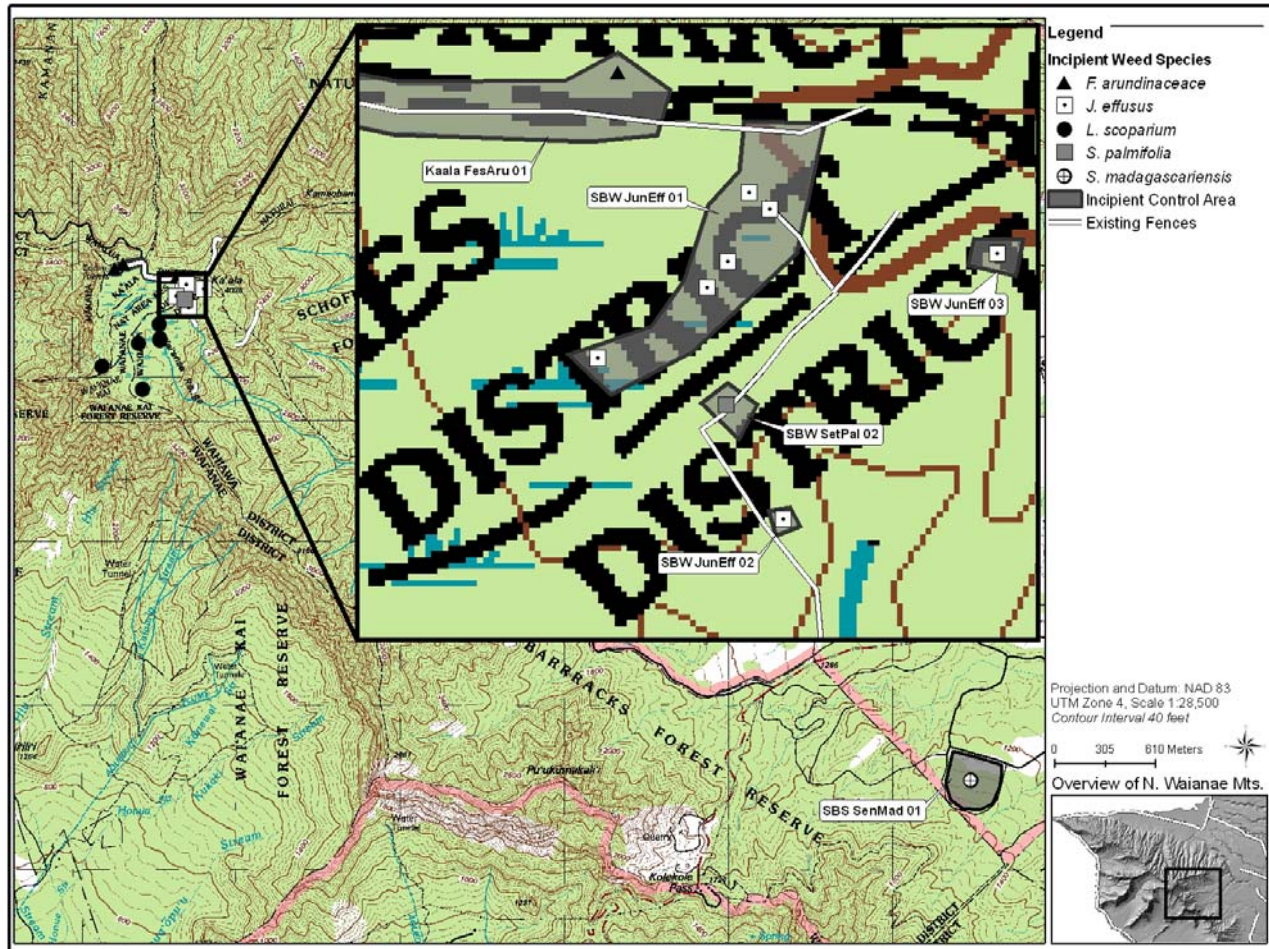


Figure 2.2.6 Locations of Incipient Weed Species in SBW & SBS

Incipient Control Discussion

Acacia mangium

A. mangium is a concern to NRS for a couple of reasons. Firstly, it exhibits qualities of an ecosystem altering weed: it is extremely fast growing, produces a large amount of viable seeds, and has seeds that persist in the seedbank for at least a few years. Secondly, the species is very closely related to the native *Acacia koa*, and there is a chance that the two would hybridize. For these reasons, *A. mangium* is considered a high priority weed for eradication. Found in 2000, and identified by Bishop Museum in 2003, *A. mangium* has been controlled and is currently restricted to four sites in KTA (Figure 2.2.5), two of which continue to produce new plants, while the remaining two did not yield new plants this year. Research is needed to find out the viability of *A. mangium* seeds in the seedbank.

KTA -AcaMan-01; Kahuku AcaMan along Lower Oio Road

Two trips were made to this ICA last year. An aerial survey was done on the first trip and a possible *A. mangium* was found. NRS went back on a second trip, discovered that the possible plant was not *A. mangium*, and swept through the thickest area portion of the ICA, but did cover the entire ICA. Next year, this area will be visited quarterly to perform more extensive sweeps.

KTA -AcaMan-02; Kahuku AcaMan along Upper Oio Road

Three trips were made to this ICA last year and no plants were found. The last immature plant was removed in 2003, and no mature plants were ever seen at this site. NRS will visit this area two times next year to check for any regrowth.

KTA -AcaMan-03; Kahuku AcaMan at Canes Complex

NRS visited this ICA five times last year. NRS performed an aerial survey of the area this past year and found a total of four plants in three previously weeded sites. Over the past year a total of three mature plants were found, and the ICA was expanded to encompass plants that were found nearby but were beyond previously known limits of the ICA (Figure 2.2.5). NRS will continue to weed and survey in this area quarterly. An aerial survey of this site in the coming year is recommended, as the area is large and new plants have been found outside the ICA.

KTA -AcaMan-04; Kahuku AcaMan near Puu 804

NRS surveyed this area three times last year and found no plants. The last mature plant was removed in 2001. NRS plans to survey this site two times in the coming year.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: AcaMan		Acacia mangium			
KTA -AcaMan-01	KTA No MU	2	3.00	2004-09-29	2006-06-27
KTA -AcaMan-02	KTA No MU	3	2.50		2003-01-29
KTA -AcaMan-03	KTA No MU	5	16.50	2006-06-27	2006-06-27
KTA -AcaMan-04	KTA No MU	3	1.50		2004-09-29

Arthrostemma ciliatum

Arthrostemma ciliatum is a member of the *Melasomataceae* family, along with two well known invasive species *Miconia calvescens*, and *Clidemia hirta*. The weed is widely naturalized throughout much of the Ko‘olau Mountains, but is uncommon in KLOA. NRS target *A. ciliatum* in areas where activities like foot traffic or vehicles might lead to the spread of this weed to places where it is not currently found (Figure 2.2.3).

SBE-ArtCil-01; East Range Coqui Area ArtCil Control East

The *A. ciliatum* at this site has the potential to be spread by troops, as the trail along which it spreads is still actively used by military personnel. NRS has seen flagging in the area, probably put up by training troops. NRS has had good seedling kill in this area but need to monitor and kill new seedlings. Extensive surveys of the area are needed to determine the entire extent of *A. ciliatum* at this site before a specific control plan can be made. NRS will consider using a pre-emergent if seedlings continue to appear.

KLOA-ArtCil-01; ArtCil along Poamoho Road

This site occurs along the Poamoho road. This ICA was weeded twice last year using a backpack sprayer. These plants are found roadside, which makes spraying them easy. Two trips will be made to this area next year to treat any regrowth. The weed is common in the area, but plants near the road are destroyed to avoid its transport to new areas via military traffic along the

road. Over the years, NRS control has markedly decreased the amount of *A. ciliatum* in this ICA.

DrumRd-ArtCil-01; ArtCil on Drum Road near Paalaa Stream

NRS weeded this area 4 times last year for a total of 2.1 hours. Twenty-eight plants were killed last year but none were seen on the last trip. NRS will visit this area 4 times next year to check for any regrowth.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: ArtCil		Arthrostemma ciliatum			
DrumRd-ArtCil-01	KLOA No MU	4	2.16	2006-05-29	2006-05-29
KLOA-ArtCil-01	KLOA No MU	1	2.00	2006-04-19	2006-04-19
SBE-ArtCil-01	SBE No MU	4	71.42	2006-07-20	2006-07-20

Buddleia madagascariensis

B. madagascariensis is rare on O‘ahu but is a widespread weed on Kaua‘i. The O‘ahu Invasive Species Committee (OISC) targets this weed on O‘ahu, and it is considered to be one of Hawai‘i’s most invasive horticultural plants. NRS feels it is important to control and eradicate this plant before it becomes established on this island. The plants that were found were probably from seeds introduced accidentally by military traveling from either Kaua‘i or Maui. NRS currently controls this weed at two sites, both in Schofield Barracks East Range (Figure 2.2.3).

SBE-BudMad-01; East Range BudMad along Higgins Road

This site had no seedlings this year. It appears that this plant is dead and no longer a threat. NRS will continue to monitor every six months to verify that this area has no *B. madagascariensis*.

SBE-BudMad-02; East Range BudMad at Coqui site

This site’s plant was dead and no seedlings were found. OISC is also involved in the area and monitors this site as well. NRS will continue to monitor this site during its annual road survey and while visiting the *A. ciliatum* and *R. tomentosa* sites nearby.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: BudMad		Buddleia madagascariensis			
SBE-BudMad-01	SBE No MU	2	0.60	2004-03-15	2006-06-22

Festuca arundinacea

Festuca arundinacea is a deep rooted perennial grass from Europe. It is a cool-season, long-lived grass. There is no evidence of this grass invading large areas of bog, however, since the distribution of this species is so small on Army land, NRS will continue to implement control and monitor the effectiveness of this control.

SBW-FesAru-01

Seed heads were bagged and remaining stalks sprayed. NRS will need to monitor once per quarter. This plant is not a significant threat and will likely stay on the road fringes (Figure 2.2.6). NRS will continue to spray the area and work with the NARS Specialist to eradicate the population. It is likely that this may be a long-term process because of a probable persistent seed bank. If deemed necessary, research can be conducted on the seeds and a management plan developed accordingly. NRS is looking into using pre-emergent herbicide in other areas. The proximity to the bog may rule out using pre-emergent herbicide here.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: FesAru		Festuca arundinacea			
SBW-FesAru-01	Kaala	1	4.00	2006-06-22	2006-06-22

Hedychium gardnerianum

H. gardnerianum, or kahili ginger, is an invasive member of the ginger family (Zingiberaceae). In wet higher elevation forests of Hawai'i, it has become a serious ecosystem-altering understory pest. It is less common on O'ahu than other islands, and control of this weed in its known locations in Ka'ala bog and the Ko'olau summit is a high priority for NRS. *H. gardnerianum* control on Mount Ka'ala is discussed in the MU WCA Report; this taxa is so widespread at Ka'ala that it is no longer treated as an incipient.

Kipapa-HedGar-01; HedGar at Puu Kaaumakua

The goal of this eradication effort is to keep *H. gardnerianum* off the summit and limit it to the windward side (Figure 2.2.4). At Kīpapa, one seedling was found on the leeward side of the trail and one immature plant was found on the crest line of the summit. NRS will kill large patches on the windward side near the summit and continue to monitor the summit one to two times per year.

Koloa-HedGar-01; Kawailoa Kahuku Cabin

No seedlings or plants were found this year. NRS will continue to monitor once or twice per year. Monitoring efforts were focused on the trails. Sites were spotted off the trail in the past (Figure 2.2.4). NRS will survey the area thoroughly next year. Because plants are removed before seeds are produced, the identification of this population still needs to be confirmed.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: HedGar		Hedychium gardnerianum			
Kipapa-HedGar-01	Kipapa	1	8.00	2006-08-10	2006-08-10
Koloa-HedGar-01	Koloa	1	0.25	2005-03-17	2005-06-22

Ilex cassine

Ilex cassine is a member of the holly family (Aquifoliaceae) native to eastern United States. One individual was found this reporting year in Schofield West Range (SBW). It is possible that NRS will be able to successfully eradicate this weed from this MU. The only other place on the island that this plant is known is an old low elevation botanical site in Helemano, where it is a

common component of the alien-dominated forest. It is unclear as to the invasiveness of this species, but NRS does not want new populations to get established in management areas.

SBW-IleCas-01; Haleauau/Pulee Ridge Fire Area

One mature plant was found this year during a fire survey. The site was visited shortly after and NRS killed the plant. The area around the *I. cassine* was monitored and no seedlings or immature plants were found. NRS will continue to monitor this site next year. There is an annual road survey in this area and numerous visits for the O'ahu 'Elepaio, *Chasiempis sandwichensis*, and rare native plants. NRS will make sure that all staff is aware of this new invasive plant and the site it was found to keep an eye out for it. NRS will also make time during regular management to check on this area for any resprouts of *I. cassine*. NRS will check this area at least three times next year and expand the perimeter survey to make sure no other plants exist.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: IleCas		Ilex cassine			
SBW-IleCas-01	SBW No MU	1	0.10	2006-06-26	

Juncus effusus

Juncus effusus is a member of the rush family (Juncaceae), and is an invasive plant in higher elevations on O'ahu. NRS control it at three sites in the Ka'ala bog (Figure 2.2.6). It forms dense aggregations that inhibit natural regeneration of native bog flora. The current control technique for *J. effusus* is manual removal, however, in the coming reporting year NRS plans to experiment with using Rodeo herbicide (formerly Roundup) as a control of this weed.

SBW-JunEff-01; Ka'ala Bog JunEff Core

An Earthday volunteer group helped remove *J. effusus* around the beginning portion of the Ka'ala boardwalk. There still is a large population, but efforts were very effective, if labor-intensive. More volunteer groups can seriously diminish the mass amount of this semi-invasive species.

SBW-JunEff-02;Ka'ala Bog JunEff South

This site will be monitored next year.

SBW-JunEff-03; Ka'ala Bog JunEff Northeast

The *J. effusus* was dug up, bagged, and carried out of the bog. This population had small resprouts a few months later and was retreated during a *H. gardnerianum* sweep. It looks as if this population can be eradicated with a few more visits.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: JunEff		Juncus effusus			
SBW-JunEff-01	Kaala	1	20.00	2006-04-22	2006-04-22
SBW-JunEff-03	Kaala	1	7.00	2006-04-22	

Leptospermum scoparium

On the PIER website, www.hear.org/pier, *L. scoparium* is given a weed risk assessment score of 3, and is deemed a high risk. Its fast growth, quick rate of maturation, and wind dispersed seeds make it highly invasive. Its wet forest habit means it threatens some of the most intact native forest on Oahu. This species is known from the extreme northern end of KLOA, Poamoho, and KTA. While it is very well established in the northern Koolaus, this weed is present in fairly low numbers in the Poamoho region. NRS control efforts focus on Poamoho, but in the future, NRS may expand efforts to the Puu Kainapuaa region of northern KLOA, the frontline of *L. scoparium* expansion in the northern Koolaus.

KLOA-LepSco-01; LepSco Poamoho

Despite a relatively low population in Poamoho, *L. scoparium* is distributed across one ridge and both bordering valleys, and reaching all plants is difficult. Efforts in previous years were successful at reducing population levels, but no control has been conducted in a couple years, and the infestation has rebounded in some areas. This year, NRS focused on clearing areas near the Poamoho trail with the aid of the Youth Conservation Corp. Future efforts will require much more off-trail work, and will be much more challenging. NRS will focus on continuing to sweep known infestation areas.

KLOA-LepSco-02; LepSco Poamoho Trailhead

No control was done in this ICA this year. It was swept last year, and NRS plan to sweep again in the next year.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: LepSco		Leptospermum scoparium			
KLOA-LepSco-01	KLOA No MU	2	75.00	2006-07-25	2006-07-25

Melochia umbellata

M. umbellata is an invasive tree native from southeast Asia and certain islands in the western Pacific Ocean. In Hawai'i, the major infestations are located near Hilo and Puna on the island of Hawai'i. On O'ahu it is only known from five sites, all located in Kahuku Training Area (KTA) (Figure 2.2.5). It is probable that the weed was inadvertently transported there by military personnel or vehicles coming from the Big Island. *M. umbellata* is a fast growing tree capable of invading disturbed areas and replacing native vegetation. It is possible that ICA's 03, 04, and 05 were established by dirt containing *M. umbellata* seeds spread around by vehicles traveling through KTA MelUmb-01. This makes eradication of plants along the road a high priority to avoid further spread of the weed to other areas, possibly even outside KTA.

KTA MelUmb-01; Kahuku MelUmb Along Road

This ICA is one of the highest priority incipient sites that NRS manage. This is the core site for *M. umbellata* in KTA. In the past reporting year a total of 6 trips were taken to survey the ICA for any *M. umbellata*. The seedbank appears to persist for a long time, as five out of the six trips found new seedlings and/or immatures. A total of 13.5 hours were spent surveying along the road. During this time no mature trees were found. NRS will return to the ICA quarterly to scope the area for any new seedlings or plants missed on previous trips. If sweeps are thorough, it is possible that NRS will be able to contain *M. umbellata* at a nearly non-existent level. To

facilitate searches and to exhaust the seedbank, NRS regularly spray the weedy grasses and shrubs along the road.

KTA MelUmb-02; Kahuku MelUmb Below Road

This site is where the original mature *M. umbellata* plants were found. The area is thick with *Psidium cattianum* and other non-native trees, making it unfavorable for *M. umbellata*, which prefers full sunlight. Two scoping trips were taken to this WCA during the 2005-2006 reporting year, one was a ground survey, and one was an aerial survey from a helicopter. The first trip re-located the dead stump of one of the original mature trees, but found no new live plants. On the aerial survey one large, possibly mature tree was seen in the WCA, with at least a couple other small ones nearby. NRS did not have time on the trip to locate and control the plants, but NRS will remove the tree early in the coming reporting year. The large area, dense habitat, and uneven terrain make surveying this ICA difficult and necessitate an aerial survey at least once per year, and ground surveys at least twice a year to ensure complete coverage.

KTA MelUmb-03; Kahuku MelUmb West Outlier

This ICA was created around a single outlying mature plant found in June 2006. The tree was near the road, approximately 700 meters from KTA-MelUmb-01. The tree was killed and the site was re-visited two times since then to look for other plants. None were found. On one of the re-visits the area around the stump was treated with a mixture of Garlon 3 and Roundup © herbicide, broadcast sprayed from a power sprayer to kill roadside vegetation and any possible unseen seedlings. NRS plan to do quick scopes of this ICA at least two times in the coming reporting year. This frequency should be sufficient to control any seedlings that come up before they become mature. An aerial survey of the site at least once in the following year would be optimal to search for any other mature trees in the area.

KTA MelUmb-04; Kahuku MelUmb East Outlier

This ICA is only 100 meters down the road from KTA-MelUmb-03, and like that ICA, was created with the discovery of a single mature tree found on the same day in June. The tree was killed, and like the previous ICA, the area was sprayed with herbicide. NRS plans to re-visit the site and sweep for seedlings at least twice a year. A yearly aerial survey in conjunction with the other sites would be recommended for the following report year.

KTA MelUmb-05; Kahuku MelUmb Delta Gate

Due to the closure of Delta Road during the past year, NRS did not re-visit this ICA. The road repair was completed late this year, and NRS plan to re-continue surveys of the area in the following year.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: MelUmb		Melochia umbellata			
KTA-MelUmb-01	KTA No MU	6	13.50	2006-06-27	2006-08-08
KTA-MelUmb-02	KTA No MU	2	3.00	2006-08-08	2006-08-08
KTA-MelUmb-03	KTA No MU	3	1.02	2006-06-27	
KTA-MelUmb-04	KTA No MU	3	1.02	2006-06-27	

Pennisetum setaceum

For a discussion of this incipient see MIP ICA section.

SBE-PenSet-01; East Range PenSet

NRS and OISC found one plant with a flowering head in 2004 on Centerline Rd. It was pulled and disposed of. The area has been monitored on Road surveys in 2005 and 2006 and no regrowth has occurred. NRS will continue to monitor this area.

KTA-PenSet-01; Kahuku PenSet

The area is thick with weedy vegetation, dominated by tall *P. maximum*, making surveys of this site difficult (Figure 2.2.5). However, no plants were found this year during any of the six trips to the area to search for the grass, indicating that *P. setaceum* may be extirpated from this area. However NRS will continue to survey the area in the coming reporting year to ensure its complete eradication from the ICA.

DMR-PenSet-01; Dillingham Gate PenSet

This site is monitored during the annual Road survey of the area. No plants were spotted. No plants have been seen since 2001, suggesting the taxon may be extirpated. NRS will monitor this site again next year.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: PenSet		Pennisetum setaceum			
DMR-PenSet-01	DMR No MU	1	0.50	2001-08-30	2001-08-30
KTA-PenSet-01	KTA No MU	6	7.75	2003-11-19	2004-09-29
SBE-PenSet-01	SBE No MU	1	8.00	2004-09-21	

Rhodomertus tomentosa

This species is a member of the Myrtaceae family, and was probably introduced to Hawai'i intentionally as an ornamental plant. It is a widespread weed on other islands, but on O'ahu it is locally common only in a few valleys on the Windward side of the Ko'olau, where it forms dense monotypic stands in disturbed areas. It is a rare weed on NRS managed lands, occurring in only two currently known sites (Figures 2.2.3 and 2.2.5). It is important that NRS keep this weed out of management areas, and monitor for any reoccurrences.

SBE-RhoTom-01; East Range RhoTom Control

This site was monitored once this past year. Mature plant total was 25 individuals. NRS will continue to visit this site three times per year, focusing on killing seedlings near areas where mature plants were found. It is easier to spot the plant when it is taller than the grass, so re-visitation rate will be low to give small seedlings time to grow up to a more observable height. Another more laborious strategy would be to weed whack areas known to have had mature *R. tomentosa* to kill seedlings before they begin to mature. NRS will consider spraying pre-emergent herbicide to kill seeds in the soil and reduce seedling emergence. It is also recommended that NRS do more complete surveys of the area to ensure that all plants were found. This may include one aerial survey and extensive ground surveys in the coming year.

KTA-RhoTom-01; Kahuku RhoTom at Puu 1010

One mature individual was found at this site in June of 2005. The tree was killed, and since then NRS have made informal checks as to any sort of regeneration or appearance of seedlings, since the site is adjacent to a commonly used parking area. No plants have been seen since the original one was found. It is unclear how the plant could have dispersed to this location, possibly from mud in tires of motocross riders coming from the infested windward areas. NRS feel that eradication is necessary and possible. It may already be eradicated following the removal of the one mature individual, however, official declaration of the weed's extirpation will require study of the longevity of its seeds in the soil. In the following year NRS plan to scope the site periodically and make a decision as to its status.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: RhoTom		Rhodomyrtus tomentosa			
KTA-RhoTom-01	KTA No MU	1	0.10	2005-06-02	
SBE-RhoTom-01	SBE No MU	2	14.00	2006-06-28	2006-06-28

Senecio madagascariensis

Senecio madagascariensis, a member of the Asteraceae family, is listed as a noxious weed that colonizes disturbed areas such as pastures and roadways. It is of primary concern to ranchers, as the plant contains alkaloids that are potentially fatal to livestock if ingested. This weed is only known from one location on lands managed by NRS, although it is common on the islands of Hawai'i and Maui. It is probable that *S. madagascariensis* was introduced to O'ahu by the accidental transportation of contaminated soil by military personnel or vehicles coming from Hawai'i or Maui.

SBS-SenMad-01; South Range SenMad at FP Halo

This is the single area where *S. madagascariensis* is found on lands managed by NRS (Figure 2.2.6). This year only one trip was taken to the site, and only one mature plant was found. The most common form of control used is hand-pulling of individual plants. If larger populations are present, spraying of herbicide is necessary. The military has since done a lot of earth moving in the area, which may bring more buried seeds to the surface. NRS plan to return to the site early in the coming year to survey for any germination of seeds since the last trip and since the earthworks. In general plant numbers have been low at this site, and only one mature plant was seen on the last survey in February of 2006.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: SenMad		Senecio madagascariensis			
SBS-SenMad-01	SBS No MU	3	7.50	2006-02-27	2005-05-24

Setaria palmifolia

S. palmifolia is an invasive grass that can be found in moist areas throughout the lower elevations of the Ko'olau Mountains on O'ahu. It is an aggressive weed that forms dense monotypic aggregations, replacing native vegetation. It is rare in the higher elevations of the

Ko'olau, where many valuable natural resources still remain. Controlling this weed in KLOA is a high priority for NRS.

Control methods for all the *S. palmifolia* ICA's include hand-pulling when population sizes are small, and backpack spraying when numbers are larger. The latter is the case at the KLOA SetPal-10 (Figure 2.2.4), where there is a large population. Spraying a solution of 1% roundup has been found to be very effective at reducing the population. Timely follow-up with repeat treatments has been the hardest thing to accomplish as the weather can be very unpredictable on the Ko'olau summit.

The seeds of *S. palmifolia* are very small, which make it easily dispersed. It is possible that seeds will be dispersed to new areas if mature plants are not removed from populations. The probable vectors of dispersal include wind, pigs, humans, and stream flows. Research as to the longevity of *S. palmifolia*'s seeds in the soil would be very useful in designing control plans. Each trip seems to reveal a handful of new plants at many of the sites, suggesting that the seedbank may be persistent for a long time, or that surveys are too infrequent, necessitating continued and possibly more frequent visitation. It is recommended that NRS survey each ICA once a quarter to keep *S. palmifolia* at manageable levels.

KLOA SetPal-01; Opaepala SetPal along northern fenceline

One seedling was found here this year.

KLOA SetPal-02; Opaepala SetPal along Peahinaia Trail

This population was found prior to 2002 and was the largest of the five original *S. palmifolia* sites. In that year 90 mature and 42 immature plants were found. Since then numbers have been declining. In a survey in October of the past reporting year four matures and three juveniles were found and pulled. A second trip in July yielded no plants.

KLOA SetPal-03; Opaepala SetPal at 260 Transect 12

In October of this reporting year nine mature and three immature plants were found, while only three immature plants were found there in July.

KLOA SetPal-04; Opaepala SetPal on Transect 14 Station 290

In July of this reporting year only one immature plant was found at this site. This was the first sighting of *S. palmifolia* at this site, resulting in the creation of this ICA. A thorough survey of the area is needed in the coming reporting year.

KLOA SetPal-05; Opaepala SetPal at 370

Two trips made to this site, one in October and one in July of this reporting year, turned up no plants.

KLOA SetPal-06; Opaepala SetPal at Goosehead

The first trip sent to survey this ICA, in October of this reporting year, resulted in one mature and five immature plants being found. The second trip, in July, found no plants.

KLOA SetPal-07; Opaëula SetPal at Hypalon

This species was first found here in January of 2003 and no plants have been found on trips since then, including two surveys that happened in October and July of this reporting year.

KLOA SetPal-08; Opaëula SetPal at Shaka

The one trip sent to survey this ICA in July of this reporting year found no plants. No plants have been found at this site since the initial finding of one mature and two immature plants in January of 2003.

KLOA SetPal-09; Opaëula SetPal on Transect 12 Station 290

This ICA was not surveyed during this reporting year. NRS plan to resume efforts in the next year.

KLOA SetPal-10; SetPal Helemano bowl down to stream

This ICA contains the largest population of *S. palmifolia* known in the MU, and was discovered in August of 2003. Here, hand pulling is not feasible, and backpack spraying of Roundup herbicide at a 1% solution is the current control technique. Two days were spent spraying this population during the past reporting year, and it was noted that the population looked larger since the last treatment in March of 2005. Two outlying patches were found on one of the trips this year, indicating that a wider survey of the area is needed. Also, more frequent control is needed to reduce this population to a manageable level. Quarterly visits should be adequate to control the *S. palmifolia* in this ICA.

KLOA SetPal-12; North Helemano fenceline, west of LZ 66

This ICA was newly created this year, after the discovery of a new population of *S. palmifolia* while clearing the Helemano fenceline. The population consisted of eight matures, four immatures, and three seedlings. Since the population is right on the fenceline, the possibility of spreading seeds from that site via people or pigs walking along the line is high. For this reason extermination of this population is a high priority.

KLOA SetPal-13; Helemano fence/Peahinaia Tral SetPal

This population was newly found this year, on a trip to survey other *S. palmifolia* ICAs nearby. A total of six mature plants were found on that trip in July. A more extensive survey of the area is needed in the coming year.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: SetPal		Setaria palmifolia			
KLOA-SetPal-01	Opaeula/Helemano	1	0.25		2006-07-18
KLOA-SetPal-02	Opaeula/Helemano	3	3.00	2005-10-20	2005-12-06
KLOA-SetPal-03	Opaeula/Helemano	3	2.50	2005-10-20	2006-07-18
KLOA-SetPal-04	Opaeula/Helemano	1	0.25		2006-07-18
KLOA-SetPal-05	Opaeula/Helemano	3	1.75	2004-10-19	2005-05-03
KLOA-SetPal-06	Opaeula/Helemano	3	1.25	2005-10-20	2005-10-20
KLOA-SetPal-07	Opaeula/Helemano	3	0.60		2003-01-13
KLOA-SetPal-08	Opaeula/Helemano	1	1.00		
KLOA-SetPal-10	Opaeula/Helemano	2	8.50	2006-07-19	
KLOA-SetPal-12	Opaeula/Helemano	1	0.25	2006-03-20	2006-03-20
KLOA-SetPal-13	Opaeula/Helemano	1	0.50	2006-07-18	

Smilax sp.

This genera is a group of related species with woody climbing vines, tendrils and thorny stems originating from the Eastern United States. It appears this *Smilax* sp. can invade an area quickly with runners and seeds. NRS is monitoring this site closely. Formal identification of this species would require flower and/or fruit, neither of which have been seen by NRS. Rather than risking seed becoming established on site, NRS will continue eradication efforts.

SBE-Smisp.-01

NRS checks on this site at least twice per year (Figure 2.2.3). This *Smilax* sp. may just be vegetative. NRS has not observed plants flowering or fruiting. NRS is very concerned about this plant because it can be a nuisance with its thorns. It is also possible that it could hybridize with the native *Smilax melastomifolia*. NRS has been spraying the site with Roundup and will continue to do so at least two times next year.

ICACode	IPManagementUnit	# of Visits	Effort (Person Hrs)	Date Last Mature Plant Found	Date Last Non-Mature Plant Found
IncipientTaxon: SmiSp.		Smilax sp.			
SBE-Smilax-01	SBE No MU	2	3.00		2005-10-27

Management Unit Weed Control Area Report

IP MU: East of 'Ō'io

This WCA is centered around a small population of *Eugenia koolauensis* within KTA. Since this population is not targeted as MFS, weed control efforts here are currently minimal.

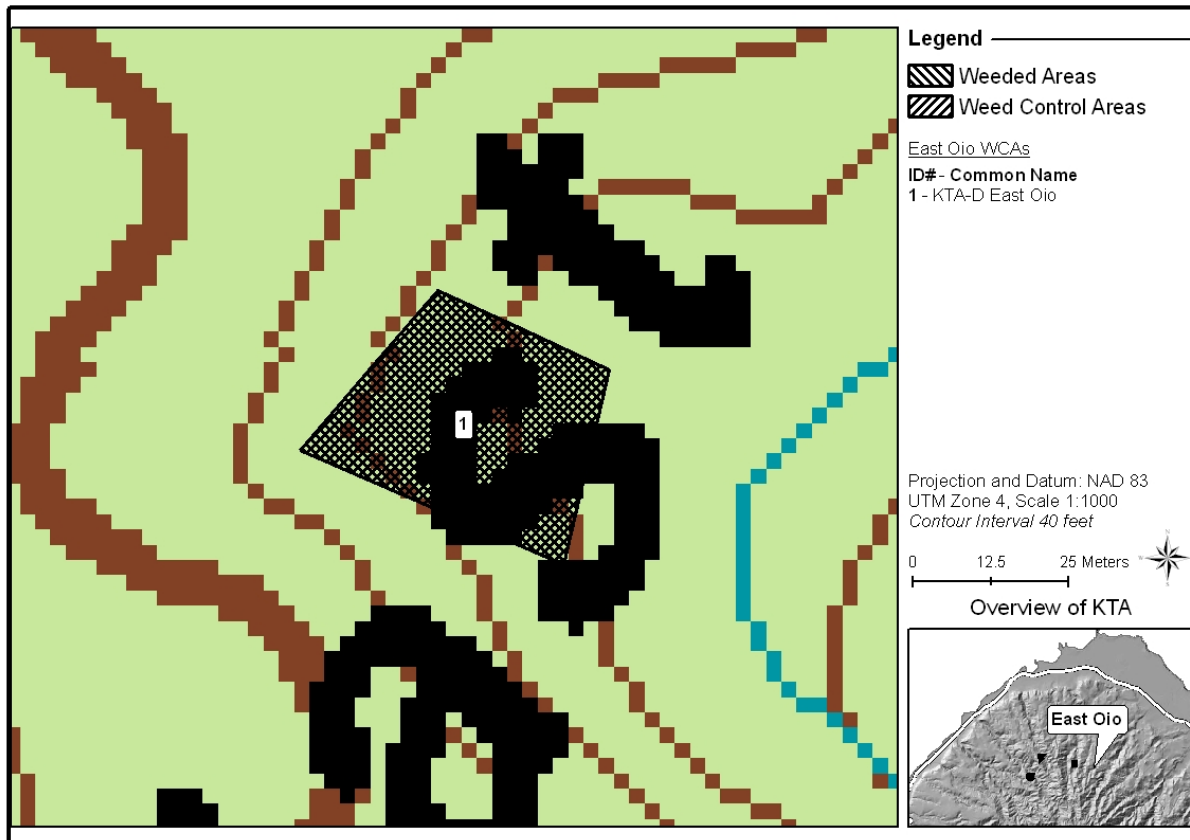


Figure 2.2.7 Weed Control Areas in East 'Ō'io, Kahuku Training Area

WCA Discussion

East 'Ō'io-01; EugKoo KTA-D East 'Ō'io

Due to the predominance of *Psidium cattleianum* at this site, and the low numbers of *E. koolauensis*, weeding at this WCA is limited. The goal of weed control here is to make the area immediately around the plants more hospitable to *E. koolauensis* recruitment. This area was weeded once last year (Fig. 2.2.7). NRS targeted a variety of understory weeds and some small healthy *E. koolauensis* were uncovered. Previous grass control efforts were successful, and no *O. hirtellus* control was needed this year. NRS observed a noticeable increase in native *Carex* species at the site. This area will be visited once next year for weeding, as this level of effort seems to be effective. NRS will continue to focus on understory and grass control. NRS will consider outplanting native trees to reduce the need for understory weeding.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present												
IP MU: East of Oio																	
EastOio-01	3M	1221.016	1221.016	100.00%	EugKoo												
<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>3.00</td> <td>ArdEil, ChrPar, CllHir, PasSub, PsiCat</td> </tr> <tr> <td>Total</td> <td>1</td> <td>3.00</td> <td></td> </tr> </tbody> </table>						Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	3.00	ArdEil, ChrPar, CllHir, PasSub, PsiCat	Total	1	3.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	1	3.00	ArdEil, ChrPar, CllHir, PasSub, PsiCat														
Total	1	3.00															

IP MU: Kaleleiki

This WCA is drawn around a population of *E. koolauensis* found on State Forest Reserve land. NRS conduct management here in conjunction with State personnel. This site is not designated ‘Manage for Stability’ for *E. koolauensis*, thus NRS limit effort here.

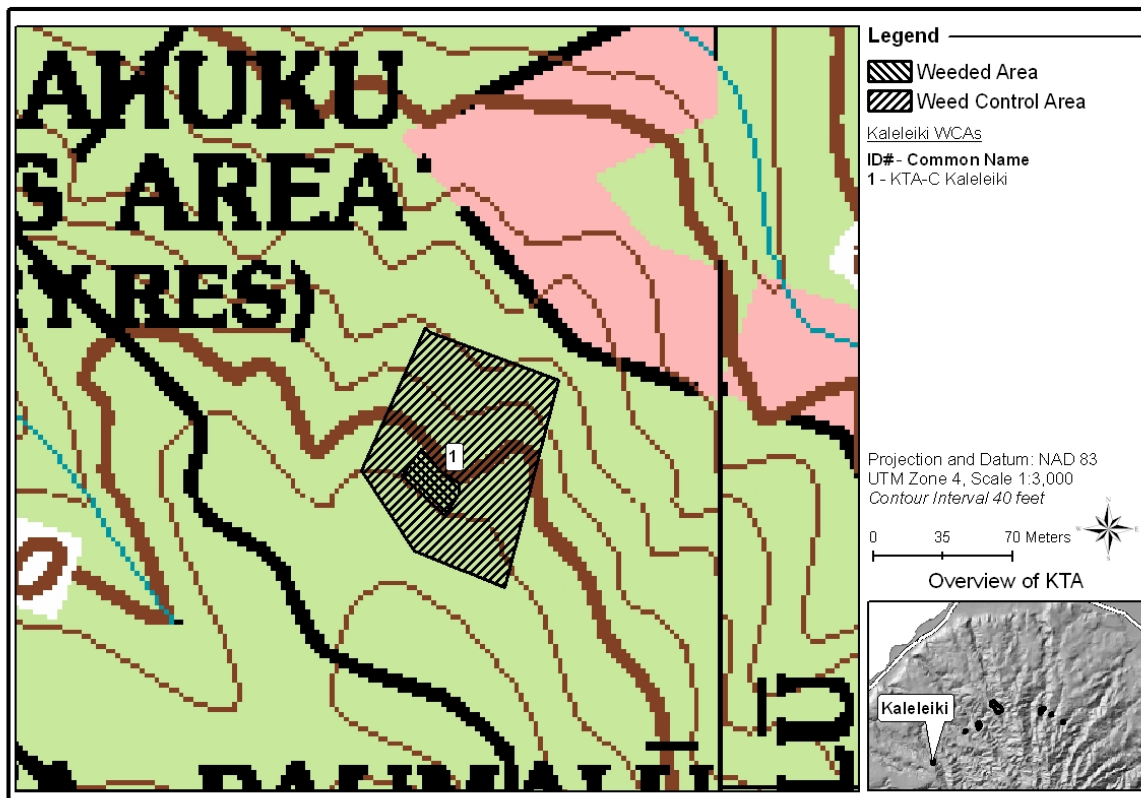


Figure 2.2.8 Weed Control Areas in Kaleleiki, Kahuku Training Area

WCA Discussion

Kaleleiki-01; EugKoo KTA-C Kaleleiki

This WCA is defined by a small ungulate-exclusion fence installed by the State. In the past year, weed control was only performed once at this site (Fig. 2.2.8). NRS targeted understory weeds and grasses around the core of the *Eugenia* population. Grasses appear to pose the most threat to

small *E. koolauensis*, and many immature and seedling plants were found covered in *P. conjugatum*. Canopy weeding was minimized to prevent drastic alteration of microsite conditions. Previous fuel control efforts of *C. equisetifolia* were successful, and there is very little left within the fence. However, *C. equisetifolia* dominates much of the surrounding area; the potential fire threat to this site should be better evaluated in conjunction with the State. Encouragingly, NRS observed many *Rauvolfia sandwichensis* and *Scaevola gaudichaudii* seedlings in light gaps. In the future, NRS hope to visit this site at least twice a year. NRS will continue to focus on understory, grass, and fuel control.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present		
IP MU: Kaleleiki							
Kaleleiki-01	Habitat	7959.375	455.3222	5.72%	EugKoo		
				Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled
				Ecosystem Weed Control	1	20.00	BudAsi, ChrOli, CliHir, PasCon, PasEdu, PsiCat
			Kaleleiki-01 Total # of Visits and Person Hours		1	20.00	

IP MU: Kaunala

One of the largest populations of *E. koolauensis* occurs in this MU. Weed control is centered around the greater part of this population in Kaunala gulch. No work is currently done at the smaller part of this population in Aimu‘u gulch. The Kaunala portion of this population is designated MFS, while the Aimu‘u portion is not. There are two WCAs designated in this MU (Fig. 2.2.9). Kaunala-01 is defined by a fence completed this year to protect *Eugenia*, while Kaunala-02 is around a newly created landing zone.

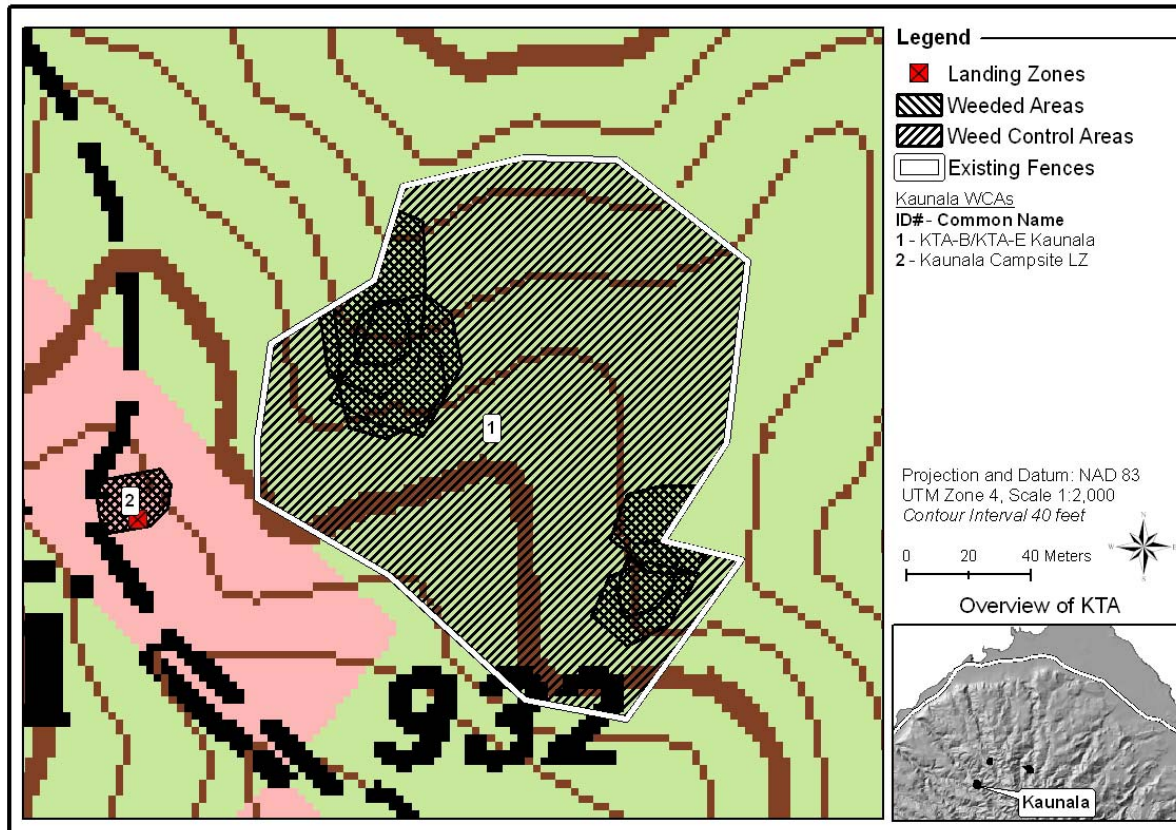


Figure 2.2.9 Weed Control Areas in Kaunala, Kahuku Training Area

WCA Summary Table

WCA Discussion

Kaunala-01; EugKoo KTA-B/E Kaunala

In the past year, NRS focused effort in this WCA on clearing fenceline and building an ungulate-exclosure fence. Hence, weeding effort was not as high as usual. Since this WCA is fairly large and has a very patchy native forest distribution, weed control has centered directly around two core groups of *Eugenia*. Common native forest elements are also targeted for weed control, as their relative rarity makes them vital to restoring the area. NRS hope to encourage growth and recruitment for both common and native species by reducing the weed biomass around them. Primary targets are understory weeds, vines, and grasses, while canopy weeding is limited to prevent a drastic increase in light which *Eugenia* may find harmful.

Fenceline clearing accounts for 20 hours of the 68 hours spent at this WCA. Chainsaws were used to create the fenceline and drop zones; some large open areas were created as a result. Not reflected in the Summary Table is the time spent conducting fuel control in the patch. NRS cut down between 40-50 large *C. equisetifolia*, *G. robusta*, *E. robusta*, and *M. quinqueveria*. Again, some large open areas were created in the process of eliminating these fuel-loading trees. Grass control was conducted on one trip where *O. hirtellus* was treated around the two core areas of *E. koolauensis*. Understory weeding efforts account for 46.5 hours.

Common native plant seeds were collected from this area to store for future outplanting. *Cibotium* species are being considered for future transplanting operations from areas outside the fence to within the fence. Cuttings were also taken from this area to get some plants ready for outplanting as soon as possible. Multiple species were chosen for cuttings and many were experimental. There is a lot of open area and it would be good to get native plants established before any weeds, which should decrease the amount of time spent on weeding in the area.

In the coming year, NRS hope to partner experimental common outplantings with regular weed control to reduce the total effort required at this site while improving overall habitat. NRS plan to visit this site quarterly.

Kaunala-02; Kaunala LZ

This area was cleared once this past year to establish an LZ and a campsite. NRS will continue to weed this area once a year to clear weeds that may get in the way of the helicopter.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present																
IP MU: Kaunala																					
Kaunala-01	Habitat	19761.45	3117.704	15.78%	EugKoo																
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Grass Control</td> <td>1</td> <td>1.50</td> <td>OplHir</td> </tr> <tr> <td>Ecosystem Weed Control</td> <td>4</td> <td>66.50</td> <td>ArdEll, CasEqu, ChrPar, CllHir, PaaSub, PaiCat, SchTer</td> </tr> <tr> <td>Total</td> <td>5</td> <td>68.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Grass Control	1	1.50	OplHir	Ecosystem Weed Control	4	66.50	ArdEll, CasEqu, ChrPar, CllHir, PaaSub, PaiCat, SchTer	Total	5	68.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Grass Control	1	1.50	OplHir																		
Ecosystem Weed Control	4	66.50	ArdEll, CasEqu, ChrPar, CllHir, PaaSub, PaiCat, SchTer																		
Total	5	68.00																			
Kaunala-02	Fenceline Clearing	383.5507	383.5507	100.00%																	
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>12.00</td> <td></td> </tr> <tr> <td>Total</td> <td>1</td> <td>12.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	12.00		Total	1	12.00					
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled																		
Ecosystem Weed Control	1	12.00																			
Total	1	12.00																			

IP MU: ‘Ō‘io

This IP MU contains one WCA, which is delineated by the newly completed ‘Ō‘io fence (Fig. 2.2.10). The fence protects a large population of *E. koolauensis* which is designated MFS. Other *Eugenia* plants in the PU are not designated for intensive management, and thus no weeding has been done around them yet.

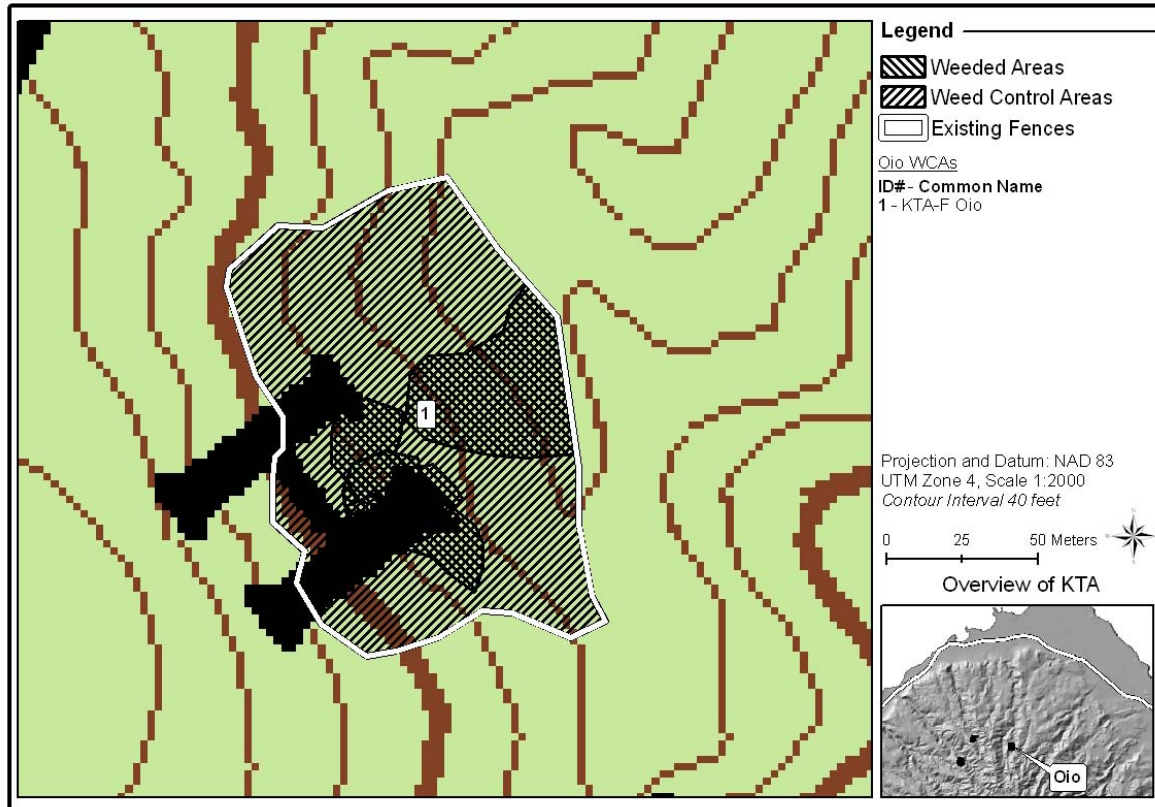


Figure 2.2.10 Weed Control Areas in 'Ō'io, Kahuku Training Area

WCA Discussion

'Ō'io -01; EugKoo KTA-F 'Ō'io

This year, efforts in this MU focused primarily on constructing a fence around *E. koolauensis*. Weed control efforts were much lower than normal. This WCA is very weedy and has few native forest remnants. Much of the patch is dominated by *P. cattleianum* and the WCA is surrounded by *C. equisetifolia*. As a result, the strategy for this site has been to weed understory, vine, and grass components around *E. koolauensis* clusters.

In the past year, NRS spent 34 hours weeding understory species, and retreating *P. cattleianum*. Since *P. cattleianum* is clonal, removing small portions of a stand at a time is not always effective. However, NRS are very cautious about opening the canopy further. *Christella parasitica* is proliferating as other understory weeds are killed, and more time was spent treating it this year. Fenceline clearing accounts for 9 hours of weed effort. Grass spraying accounts for another 8 hours.

In 2004, NRS contracted a tree-trimming service to remove about 40 very large *C. equisetifolia* for fuel control. This effort resulted in the creation of very large light gaps in the WCA. The canopy closure and light levels increased drastically. As a result, NRS witnessed major and diverse weed growth in the area over the past year, and were not able to keep up with the weeding. NRS have to drastically rethink goals for and approaches to the WCA. The area is so weedy that regular understory weeding will not suffice. Instead, in the coming year NRS hope to

outplant common propagated natives into the site (*Acacia koa*, *Carex* sp.); thin-out and transplant naturally occurring *Raovulfia sandwicensis* seedlings from within the site; and transplant *Cibotium chamissoi* from other areas into the fenced area. Weed control will be conducted directly around outplantings. It is hoped that such outplantings will help restore some level of shade to the site in both the short and long term. Restoration of this site will be challenging. NRS plan to visit this site quarterly.

WGACode	WGAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present
IP MU: Oio					
Oio-01	Habitat	13335.19	3683.653	27.62%	EugKoo
Treatment Type		# of Visits	Effort (Person Hrs)	Species Controlled	
Grass Control		2	8.00	OplHir	
Ecosystem Weed Control		3	43.00	AleMol, ArdEll, CasEqu, ChrPar, CllHir, PasEdu, PasSub, PsiCat, RubRos	
Total		5	51.00		

IP MU: Pahipahi‘ālua

This IP MU contains one WCA, which is delineated by the Pahipahi‘ālua fence (Fig. 2.2.11), which was completed this year. The fence protects a population of *E. koolauensis*, consisting of a number of large mature individuals as well as younger age classes scattered throughout the enclosure. This site is designated MFS and is thus managed intensively.

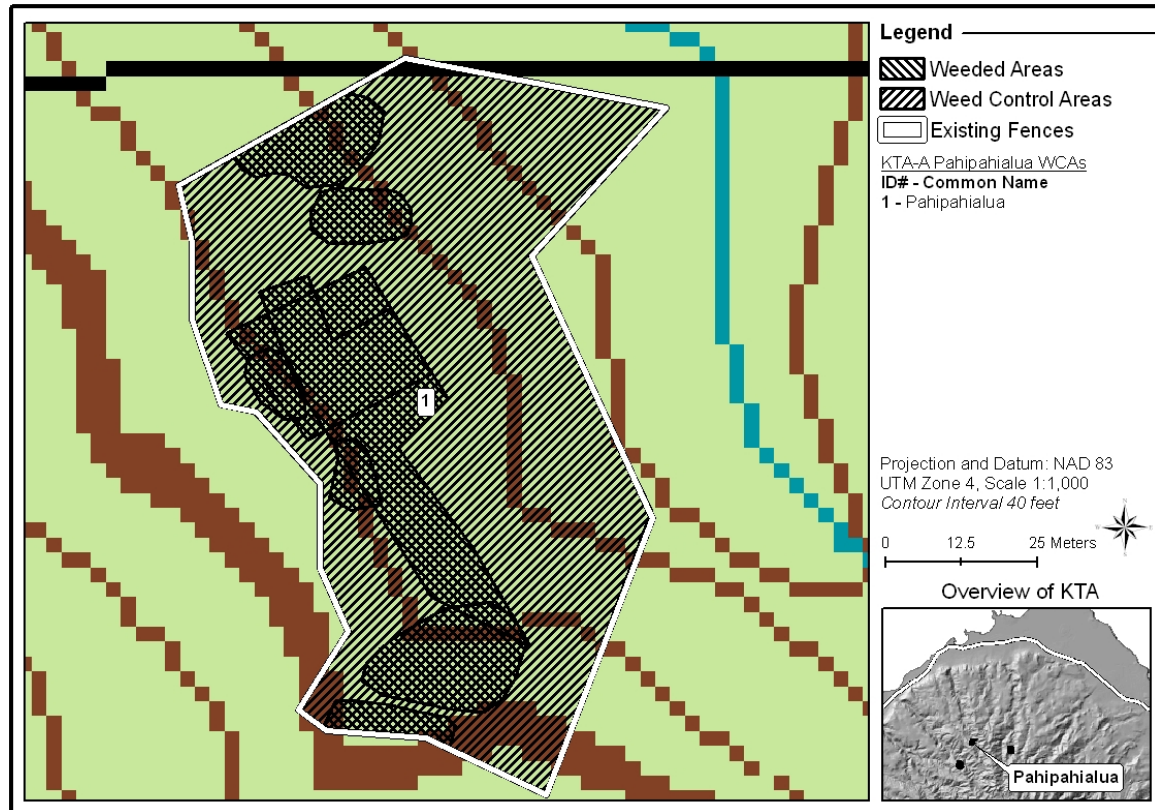


Figure 2.2.11 Weed Control Areas in Pahipahi'ālua, Kahuku Training Area

WCA Discussion

Pahipahi'ālua -01; EugKoo KTA-A Pahipahi'ālua

There are three main groups of *E. koolauensis* within this WCA, and hence there are three main target weeding areas. By observing the effects of light gaps on *E. koolauensis* created by weeding effort near the trees, NRS believe that *E. koolauensis* may be harmed by direct sunlight, and may prefer being in at least partial shade. For this reason, weeding strategy has focused on understory weeds directly around the *E. koolauensis* trees themselves, and canopy weeds away from them, to allow the native canopy trees to begin filling in around the *E. koolauensis* clusters.

In the past year, NRS spent a total of 41 hours of weeding in this WCA. The reason for this low effort is that NRS prioritized fence construction over weed control this year. With the fence complete and pig trampling eliminated, weeding efforts will be more effective. In early 2005, NRS experimented with using foliar sprays of Garlon 4 and Roundup at several dilutions to treat large banks of *A. elliptica* and *C. hirta*. These preliminary trials were effective, and NRS hope to test them further in the coming year. Current efforts use the much slower clip and drip technique. This tool will significantly change the way understory weed control occurs in KTA. One hour out of the 41 spent in this WCA was spent spraying *O. hirtellus*. *Oplismenus hirtellus* may inhibit germination and growth of *E. koolauensis* seedlings. NRS have seen significant *Carex* and mixed native recruitment in a portion of the WCA. NRS plan to control understory and canopy weeds here quarterly in the next year.

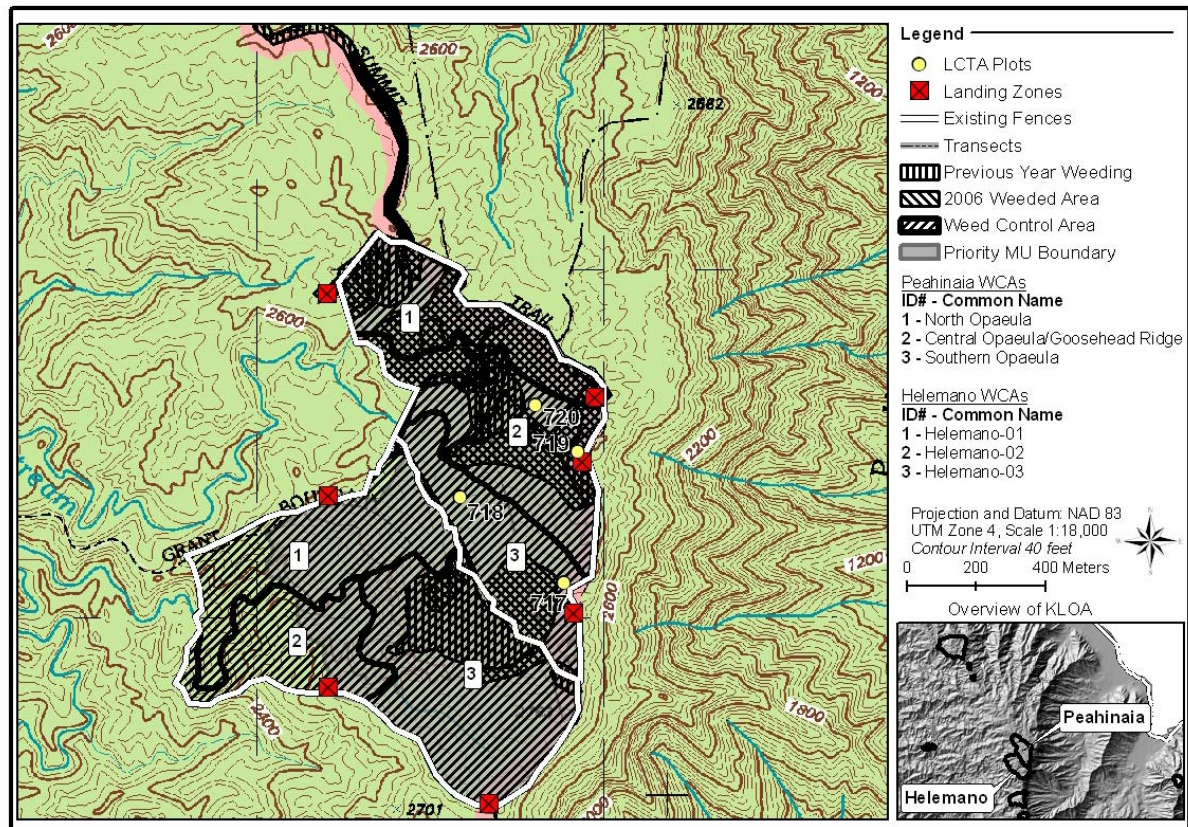


Figure 2.2.12 Weed Control Areas in Helemano & Peahinaia, Kawaiolo Training Area

Transect Discussion

Two transects are read in this MU. NRS found that an incipient invasive, *S. palmifolia*, was observed in new locations along one of the transects. *Setaria palmifolia* control is discussed in the OIP Incipient Weed Report.

WCA Discussion

‘Ōpae‘ula -01; Northern ‘Ōpae‘ula

This year, nearly the entire area of this WCA was swept for *P. cattleinum* (Fig. 2.2.12). This WCA is the closest to the cabin constructed by NRS, and so is the easiest to access on camping trips. A total of 174.5 hours were spent weeding in ‘Ōpae‘ula -01. NRS plan to sweep and treat the remaining areas of this WCA that were not covered this past year. This will require returning to the site at least two times with a large-sized crew. Some of the areas within this WCA are difficult to access due to steep terrain and thick vegetation, which make complete coverage nearly impossible.

‘Ōpae‘ula -02; Central ‘Ōpae‘ula /Goosehead Ridge

This year NRS spent 142.5 hours weeding in this WCA through four trips, covering a large area (Fig. 2.2.12). In the coming year, NRS plan to sweep all the areas in the WCA that were not

swept in the 2005-2006 year. This will require returning to the WCA at least four times with a large crew.

‘Ōpae‘ula -03; Southern ‘Ōpae‘ula

Efforts in this WCA are just beginning, and this year only one trip and 15 hours were spent weeding in this area. Much of the terrain in this WCA is gentle, covered in low, shrubby vegetation, making it easy to work in. However, there is a steep narrow stream gulch on the edge of WCA which may require special effort (Fig. 2.2.12). Next year NRS plan to increase the amount of time spent weeding in this WCA and cover at least half of the remaining area. NRS will return to weed here four times in the next year.

Helemano-03

NRS controlled *P. cattleianum* on one trip. More control will be conducted here when the fence is completed.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present												
IP MU: Opaeula/Helemano																	
Helemano-03	Habitat	287013.7	15801.9	5.51%	ChaRoc, CyaHum, CyaKoo, CyaStj, CyrVir, JoiAscAsc, VioOah, ZanOah												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>0.00</td> <td>PsiCat</td> </tr> <tr> <td>Total</td> <td>1</td> <td>0.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	0.00	PsiCat	Total	1	0.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	1	0.00	PsiCat														
Total	1	0.00															
Opaeula-01	Habitat	144226.9	109491.9	75.92%	CyaKoo, CyrVir, JoiAscAsc, LobGauGau, MyrJud, VioOah												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>7</td> <td>174.50</td> <td>PsiCat, SchAct, TooCil</td> </tr> <tr> <td>Total</td> <td>7</td> <td>174.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	7	174.50	PsiCat, SchAct, TooCil	Total	7	174.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	7	174.50	PsiCat, SchAct, TooCil														
Total	7	174.50															
Opaeula-02	Habitat	202874.3	97158.09	47.89%	CyrVir, VioOah												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>4</td> <td>142.50</td> <td>PsiCat</td> </tr> <tr> <td>Total</td> <td>4</td> <td>142.50</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	4	142.50	PsiCat	Total	4	142.50	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	4	142.50	PsiCat														
Total	4	142.50															
Opaeula-03	Habitat	144094	35834.21	24.87%	ChaRoc, CyrVir, JoiAsc, JoiAscAsc, VioOah												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>1</td> <td>15.00</td> <td>PsiCat</td> </tr> <tr> <td>Total</td> <td>1</td> <td>15.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	1	15.00	PsiCat	Total	1	15.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	1	15.00	PsiCat														
Total	1	15.00															

IP MU: Ka‘ala

NRS have been conducting *Hedychium gardnerianum* and *Psidium cattleianum* sweeps on and around the Ka‘ala Summit on Army land since 1999 and 1998 respectively. *Psidium cattleianum* is widespread but occurs in low numbers in the predominately native portions of Ka‘ala. Stumps are cut near the base and treated with a 20% concentration of Garlon 4 in forestry crop oil. Since the environment is very wet, NRS must also treat the ends of the slash and place the slash off the ground to prevent re-sprouting. *Hedychium gardnerianum* is cut above the pink growing zone of the stem and the rhizome slashed. It is then treated with a 12% concentration of Escort.

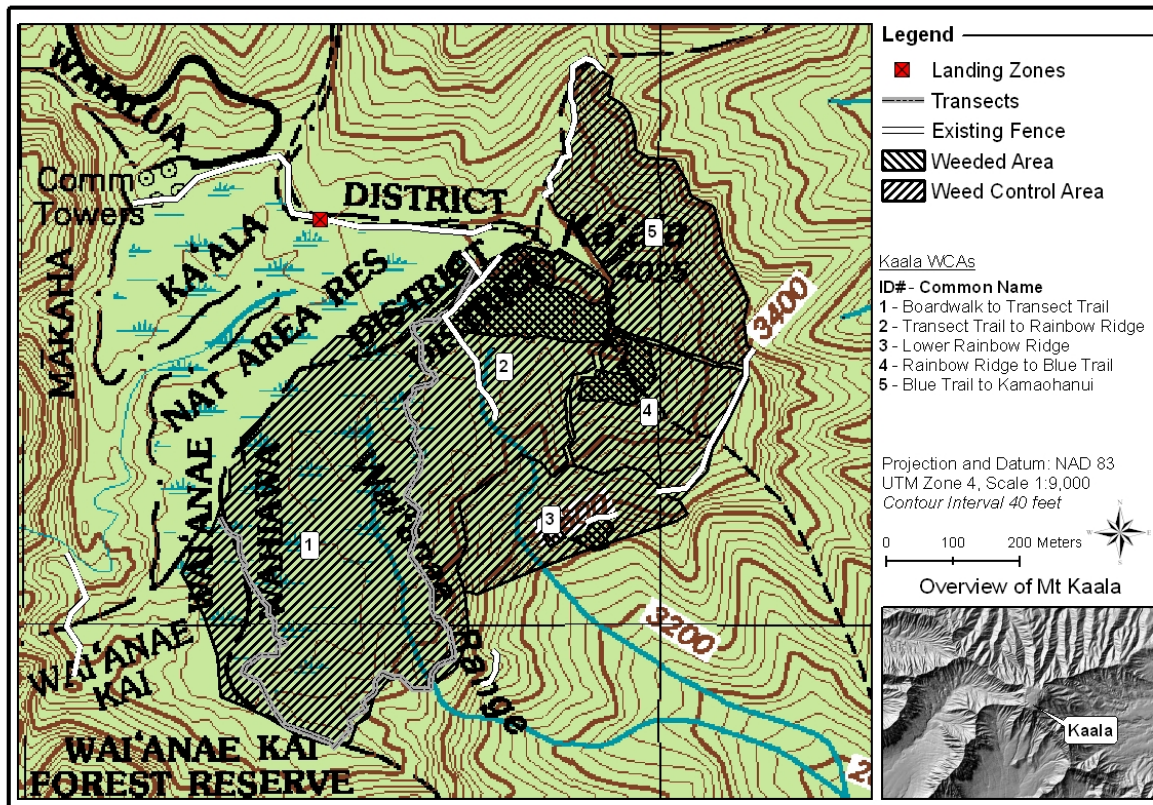


Figure 2.2.13 Weed Control Areas at Ka‘ala Summit, SBW

Hedychium gardnerianum was introduced to Ka‘ala via an ornamental planting at the Federal Aviation Administration (FAA) facilities. The bog and surrounding areas have been divided into five different WCAs to help NRS track management efforts and plan actions (Figure 2.2.1.3). Near this introduction site was a high density aggregation of *H. gardnerianum* (WCA-2). Control efforts initially were focused around this core site. Subsequently, NRS discovered that the population spread south of WCA-3. This site is below the cliffs that encircle Ka‘ala. At the outset, the goal of these control efforts was eradication of *H. gardnerianum* from Ka‘ala. After discovery of the large infestation in WCA-3, NRS have had to reconsider this goal and prioritize areas based on native habitat condition, overlap with target taxa from the OIP, terrain, and feasibility considerations. NRS will first eliminate all mature *H. gardnerianum* from within the fence then focus some effort on the satellite populations outside that will be a constant seed source for the Ka‘ala MU. WCAs should be re-treated on a two-year cycle because it takes just

over two years for ginger plants to mature. Over the last year across Ka‘ala WCAs, the count for immature plants treated was 667, the seedling count was 368 and, 27 mature plants were treated. In addition, 23 rhizomes that were not completely dead were re-treated.

WCA Discussion

Ka‘ala -01; Boardwalk to Transect Trail

The current strategy for this WCA is to eliminate all *H. gardernarium* plants. This WCA contains good habitat for *Schiedea trinervis* and is gradually sloped. No sweeps were conducted in Ka‘ala-01 this year as it was covered well the previous year. NRS will sweep this entire WCA over the next year.

Ka‘ala-02; Transect Trail to Rainbow Ridge

Three sweeps were conducted during this reporting year. In order to bridge the gaps between sweeps, NRS will sweep a small skipped section remaining in this WCA. No mature plants were discovered in sweeps this year.

WCACode	WCAType	WCA TotalArea	Total Area Covered	% Area Covered	IP Taxa Present												
IP MU: Kaala																	
Kaala-02	Habitat	91334.91	67967.73	74.42%	LabCyr, SchTri												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>3</td> <td>82.00</td> <td>HedGar</td> </tr> <tr> <td>Total</td> <td>3</td> <td>82.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	3	82.00	HedGar	Total	3	82.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	3	82.00	HedGar														
Total	3	82.00															
Kaala-03	Habitat	40903.15	5947.144	14.54%	CyaAcu, LabCyr, Nermel, SchTri												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>2</td> <td>30.00</td> <td>HedGar</td> </tr> <tr> <td>Total</td> <td>2</td> <td>30.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	2	30.00	HedGar	Total	2	30.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	2	30.00	HedGar														
Total	2	30.00															
Kaala-04	Habitat	42503.2	20267.08	47.68%	CyaCal, LabCyr, SchTri												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>3</td> <td>66.25</td> <td>EpiObr, HedGar, PsiCat</td> </tr> <tr> <td>Total</td> <td>3</td> <td>66.25</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	3	66.25	EpiObr, HedGar, PsiCat	Total	3	66.25	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	3	66.25	EpiObr, HedGar, PsiCat														
Total	3	66.25															
Kaala-05	Habitat	68543.98	26279.47	38.34%	CyaAcu, CyaCal, LabCyr, SchTri												
					<table border="1"> <thead> <tr> <th>Treatment Type</th> <th># of Visits</th> <th>Effort (Person Hrs)</th> <th>Species Controlled</th> </tr> </thead> <tbody> <tr> <td>Ecosystem Weed Control</td> <td>2</td> <td>3.00</td> <td>HedGar</td> </tr> <tr> <td>Total</td> <td>2</td> <td>3.00</td> <td></td> </tr> </tbody> </table>	Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled	Ecosystem Weed Control	2	3.00	HedGar	Total	2	3.00	
Treatment Type	# of Visits	Effort (Person Hrs)	Species Controlled														
Ecosystem Weed Control	2	3.00	HedGar														
Total	2	3.00															

Ka‘ala-03; Lower Rainbow Ridge

In WCA-3, 4, and 5, NRS will kill all mature plants but expect to have some low level of *H. gardernarium* presence. Terrain will dictate feasibility of control in these WCAs. The priority in these steeper WCAs is to keep *H. gardernarium* out of areas surrounding populations of *Labordia cyrtandrae*. In areas below WCA-3 where large infestations occur, NRS will

investigate the use of aerial spraying to knock down numbers of seed-producing plants. Two sweeps were conducted this year. Only a small portion of the total area, 14.5%, was covered and 25 mature plants were killed. As stated above, this WCA has very high concentrations of *H. gardnerianum*.

Ka‘ala-04; Rainbow Ridge to Blue Trail

One large sweep and three small sweeps were conducted this year. In the last year, one mature plant was killed in this WCA. This area requires experienced staff because the terrain is steep. More sweeps will be done next year.

Ka‘ala-05; Blue Trail to Kamaohanui

One mature plant was found this year for the first time since 2004. This area will be monitored next year.