



2008 Status Report for the Mākua Implementation Plan

December 2008

**Prepared by:
United States Army Garrison, Hawai'i
Directorate of Public Works
Environmental Division
Schofield Barracks, Hawai'i 96857**

Cover Photo: View of Mākua Valley from Kahanahāiki.

Executive Summary

The O‘ahu Army Natural Resources Program (OANRP) has just completed implementing its fourth year of the Mākua Implementation Plan Addendum (2005) and the first year of the O‘ahu Implementation Plan (OIP) (Draft OIP 2005, Final OIP 2008). The Mākua Implementation Plan (MIP) was finalized in May 2003. In January 2005, the Army completed an Addendum which emphasized management of three population units (PUs) per plant taxon in the most intact habitat and 300 individuals of *Achatinella mustelina* in each genetically identified Evolutionarily Significant Unit (ESU). The 2007 Mākua Biological Opinion (BO) issued by the US Fish and Wildlife Service (USFWS) required that the Army provide threat control for all O‘ahu Elepaio pairs in the Mākua action area (AA) and that some species be stabilized on an expedited timeline in order to utilize certain munitions. Expedited stabilization has not begun at this time due to a lack of additional funding for this effort. An amended BO was issued in 2008 that covers additional minimizations measures necessary as a result of the 2007 Waialua fire that destroyed individuals and habitat for *Hibiscus brackenridgei* subsp. *mokueleianus*. This report serves as the annual status report to the Mākua Implementation Team (MIT), and participating landowners on the MIP Year-4 actions that occurred between 1 September 2007 and 31 August 2008.

Year 1 of the Oahu Implementation Plan

Pursuant to the 2003 Oahu Training Areas BO, the Army finalized the Oahu Implementation Plan (OIP) in November 2008. The plan includes specific plans for stabilization of 28 species. This status report does not cover the OIP since the plan was just finalized.

Year 4 of the Mākua Implementation Plan

Program accomplishments for this year include: the construction of eight new fenced management units or population unit fences that encompass almost 200 acres of essential habitat for the implementation plan species; 144 hectares or approximately 356 acres of weed control was conducted; and 861 MIP and/or OIP target plant species were outplanted (725 MIP/136 OIP). Genetic storage goals and *in situ* stabilization continued for all MIP/OIP target species.

Landowner/Agency Communications

The Army continues to work cooperatively under a Memorandum of Understanding (MOU) with both the Board of Water Supply (BWS) and The Nature Conservancy of Hawai‘i (TNCH) for work in Mākaha Valley and TNCH’s Honouliuli Preserve.

This year, the Army worked with TNCH to complete the Pu‘u Palikea MU and the ‘Ēkahanui Subunit II MU. The Army fence crew also completed population size fenced units around *Neraudia angulata*, and *Nototrichium humile* in the Waianae Kai Forest Reserve. In the next year the Army hopes to begin construction on the Manuwai MU in cooperation with the State DLNR NARS and Forest Reserves.

The Nature Conservancy of Hawai‘i continues to look for a suitable land manager to purchase the Honouliuli Preserve parcel from the James Campbell Company. The latest proposal is for either the State Department of Land and Natural Resources (DLNR) or the Office of Hawaiian Affairs (OHA) to become the land manager for this area. The Army will continue to assist TNCH in the identification of a new landowner as much as possible in the interim and will continue to pursue this area as an Army Compatible Use Buffer (ACUB). The ACUB program allows the Army to help a land manager buy property that will assist with encroachment on training lands owned by the Army. To date, the Army has helped purchase properties such as Moanalua Valley, Pupukea Paumalu, and Waimea Valley.

The Army currently, has a renewable six month Right of Entry (ROE) with the Waikāne Investment Corp. to conduct ‘Elepaio predator control within Waikāne Valley. This ROE allows the Army to protect one of the only known populations of ‘Elepaio on the windward side of O‘ahu.

The Army also received a six month ROE with the Dole Pineapple Co. to monitor populations of *Hibiscus brackenridgei* subsp. *mokuleianus* in the area affected by the 2007 Waialua fire. The Army has requested federal funding to construct a fence protecting any individuals that have regenerated following the fire.

The OANRP received a three year license agreement with Kamehameha Schools (KS) that will cover all natural resource management work on KS lands on O‘ahu, and is in the process of being signed by the Army. Once this three year agreement is finalized, the Army will seek an extended ten year agreement that will enable the OANRP to construct ungulate fences for conservation on KS land.

Finally, the Army continues to work toward an agreement to continue conservation work on State land. The Army and the State DLNR legal teams are currently working on an MOU for the Army to access and work on State land on O‘ahu. Once completed, the OANRP will continue to work closely with DLNR staff on all projects and decision making regarding natural resource management on these lands. A major priority for completion of this agreement is the construction of ungulate free management units on State land. The Army would like to work with the state to complete the proposed East Makaleha, West Makaleha, Kapuna subunit IV, and Manuwai MU fences within the next two years. In addition, several more MU fences are proposed on State lands; that would be able to be constructed once a formal agreement is reached.

Fire

The Army Wildland Fire program has moved from being directed by the Army Safety Office to the Directorate of Emergency Services. Approximately 1/3 of the 53 OANRP staff are trained and certified as wildland firefighters (type 2). Currently, the Research Corporation of the University of Hawai‘i (RCUH) Human Resources Department does not allow their staff to fight

fire. However, RCUH staff can assist with mop up operations under the direction of the Army Wildland Fire program.

Funding and staffing levels

There are currently a total of 53 staff comprising three field crews, one fence crew, and various foundational support staff. Compare this to 34 staff at this time last year. The Army received \$4.3M for the MIP program in FY2008. The OANRP is still increasing the number of staff to meet the necessities for implementing the current Makua and O‘ahu Implementation Plans and timelines. The major difficulties associated with increasing staff numbers are the lack of senior staff to orient new hires in the field, finding qualified hires, and the lack of space to house this large number of field crew and their field supplies.

The O‘ahu Army Natural Resources Program (OANRP) is now housed at two locations. Half the staff are located at East Range and the other half are located at the new facility on Schofield Barracks West Range. The new facility was provided and funded by the Army and includes an office building, a greenhouse, a flammable and pesticide storage, and workshop.

Table I. Status summary of MIP plant species for 2008. Bold = reached target stabilization numbers, reached genetic storage collection goals, or ungulate free.

Makua Implementation Plan				
Species	PU	Status (stability #)	Genetic Storage (> 50 seeds from 50 individuals, >3 clones in propagation from 50 individuals)	Ungulate free
Alemacmac	Kahanahaiki to West Makaleha	36/7/0 (50)	0	partial
	Makua	30/0/0 (50)	3 (individuals represented by airlayers)	partial
	Central Kaluaa to Central Waieli	19/9/0 (50)	1 (individuals represented by airlayers)	partial
	Makaha	63/5/2 (50)	0	partial
Cenagragr	Kahanahaiki to Pahole	331/44/11 (50)	39 (clones + seed)	yes
	Central Ekahanui	90/10/16 (50)	27 (50 ind w/ clones)	yes
	Makaha and Waianae Kai	20/0/0 (50)	5 (ind w/ clones)	partial
Chacelkae	Makua	89/45/20 (25)	59 (>50 seeds)	yes
	Kaena to Keawaula	300 (25)	51 (>50 seeds)	yes
	Kaena East of Alau	21/4/20 (50)	19 (>50 seeds)	yes
	Waianae Kai or Puaakanoa	33 or 160/10/0 (25)	0 or 3 (>50 seeds)	no
Chaher	Kapuna to Pahole	57/55/0 (25)	16 (>50 seeds)	partial
	Makaha (reintro)	6/23/0 (25)	n/a	yes
	West Makaleha (reintro)	0	n/a	no

Cyagrioba	Pahole to W Makaleha	34/15/4 (100)	9 (>50 seeds)	yes
	Central Kaluua	11/45/0 (100)	1 (>50 seeds)	yes
	Palikeya (South Palawai)	88/39/0 (100)	13 (>50 seeds)	yes
	Makaha	1/0/0 (100)	1 (>50 seeds)	no
Cyalon	Kapuna to W Makaleha	35/27/1 (75)	16 (>50 seeds)	partial
	Pahole	51/43/15 (75)	36 (>50 seeds)	yes
	Makaha and Waianae Kai	2/10/0 (75)	2 (>50 seeds)	partial
Cyasupsup	Kahanahaiki (reintro)	18/126/0 (50)	3 of 3 available founders	yes
	Central and East Makaleha (reintro)	0	n/a	no
	Makaha (reintro)	0	n/a	yes
	Pahole to Kapuna (reintro)	92/85/0 (50)	n/a	yes
Cyrden	Pahole to Kapuna and West (central?) Makaleha	542/530/173 (50)	50 (>50 seeds)	partial
	Kawaiiki	15/31/39 (50)	0	no
	Opaecula	16/12/0 (50)	0	no
	Kahanahaiki	156/57/27 (50)	21 (50)	yes
Delsub	Kahanahaiki to Keawapilau	139/41/0 (100)	11 (>50 seeds)	partial
	Ekahanui	99/77/0 (100)	6 (>50 seeds)	yes
	Kaluua	26/7/5 (100)	2 (>50 seeds)	yes
	Manuwai (reintro-Palikeya gulch stock)	0	6 (>50 seeds)	no
Dubher	Ohikilolo Makai	358/0/0 (50)	0	yes
	Ohikilolo Mauka	382/6/0 (50)	1 (>3 clones)	yes
	Makaha	36/1/0 (50)	11 (>3 clones)	no
Fluneo	Kahanahaiki to Kapuna	7/67/0 (50)	1 (>3 clones)	partial
	Central and East Makaleha	5/0/0 (50)	2 (>3 clones)	no
	Makaha	10/0/0 (50)	2 (seeds and clones)	partial
	Manuwai	0/0/0 (50)	n/a	no
Gouvit	Keaau	60/1/0 (50)	35 (>50 seeds)	no
	Makaha (reintro-Waianae Kai stock)	0 (2 in waianae kai)	0	yes, wild site fenced
	Makaleha or Manuwai	0	n/a	no
Heddegdeg	Kahanahaiki to Pahole	186/205/101 (50)	30 (>50 seeds)	partial
	Alaiheihē and Manuwai	31/6/1 (50)	23 (>50 seeds)	no
	Central Makaleha and West branch of East Makaleha	21/39/0 (50)	25 (>50 seeds)	no
Hedpar	Ohikilolo	120/28/40 (50)	102 (>50 seeds)	yes
	East Makaleha (reintro?)	0	0	no
	Halona	97/35/19 (50)	62 (>50 seeds)	partial
Hesarb	Waianae Kai	2/1/0 (75)	2 plants represented in nursery	yes
	Haleauau	0/1/0	0	yes
	Makaha	3/3/0 (75)	1 plant represented in nursery	yes
	North Palawai	1/0/0 (75)	8 plants represented in nursery	yes

Hibbramok	Makua	34/2/68 (50)	28 (>50 seeds)	yes
	Haili to Kealia	21/4/9 (50)	2 (>50 seeds)	no
	Kaimuhole to Palikea Gulch (Kaawa) (reintro)	6/1012/0 (50)	11 (>50 seeds)	no
	Keaau (reintro)	0	n/a	no
Melten	Ohikilolo	1235/0/0 (50)	18 (>50 seeds)	yes
	Kamaileunu and Waianae Kai	880/269/297 (50)	0	no
	Mt. Kaala NAR	300/0/0 (50)	0	no
Nerang	Makua	38/79/0 (100)	12 (>50 seeds)	yes
	Manuwai	0	2 (>3 clones)	no
	Waianae Kai Mauka	57/29/54 (100)	3 (>3 clones)	no
	Kaluakauila (reintro)	46/0/0 (100)	n/a	yes
Nothum	Kaluakauila	198/35/0 (25)	4 (3 clones)	yes
	Makua (south side)	69/2/0 (25)	0	partial
	Kaimuhole and Palikea Gulch (Kihakapu)	51/4/0 (25)	11 (3 clones)	no
	Waianae Kai	224/5/0 (25)	2 (3 clones)	partial
Phykaa	Keawapilau (reintro)	2/0/0 (50)	1 (3 clones)	partial
	Makaha (reintro)	29/0/0 (50)	2 (3 clones; waianae kai)	yes
	Manuwai (reintro)	0	3 (3 clones; palikea gulch)	no
	Pahole (reintro)	0/7/0 (50)	2 (3 clones)	yes
Plapripri	Ohikilolo	11/0/0 (50)	11 (>50 seeds)	yes
	Ekahanui	29/37/7 (50)	42 (>50 seeds)	yes
	North Mohiakea	10/16/2 (50)	12 (>50 seeds)	partial
	Halona	16/43/0 (50)	18 (>50 seeds)	partial
Prikaa	Ohikilolo	75/1002/20 (25)	18 (>50 seeds)	yes
	Ohikilolo East and West Makaleha (reintro)	0/84/0 (25)	n/a	yes
	Makaleha to Manuwai	70/4/0 (25)	13 (>50 seeds)	no
Sanmar	Ohikilolo	3/112/0 (100)	34 (>50 seeds)	yes
	Keaau	11/300/40 (100)	48 (>50 seeds)	no
	Kamaileunu	5/188/13 (100)	49 (>50 seeds)	yes
Schkaa	Pahole	41/11/0 (50)	2 (>50 seeds)	yes
	Maakua	10/0/0 (50)	4 (>50 seeds)	no
	South Ekahanui	51/7/0 (50)	12 (clones/seeds)	yes
	Kaluaa and Waieli (reintro)	116/19/0 (50)	n/a	yes
Schnut	Kahanahaiki to Pahole	93/4/0 (50)	29 (clones/seeds)	yes
	Kapuna-Keawapilau ridge	0	0 (no founders available)	no
	Makaha (reintro)	6/0/0 (50)	n/a	yes
Schobo	Kahanahaiki to Pahole	151/130/0 (100)	6 (>50 seeds)	yes
	Keawapilau to West Makaleha	116/19/20 (100)	70 (>50 seeds)	yes
	Makaha (reintro)	0	n/a	yes

Tetfil	Kalena	9/0/6 (50)	5 (>50 seeds)	yes
	Ohikilolo	2542/582/21 (50)	48 (>50 seeds)	yes
	Puhawai	1/2/0 (50)	5 (>50 seeds)	partial
	Waianae Kai	30/8/1 (50)	0	partial
Viochacha	Ohikilolo	435/10/0 (50)	2 (>50 seeds)	yes
	Puu Kumakalii	44/0/0 (50)	11 (>50 seeds)	yes
	Halona	41/3/0 (50)	1 (>50 seeds)	partial
	Makaha	17/2/0 (50)	0	yes

Table II. Status summary for *Achatinella mustelina* 2008. Bold = reached target stabilization numbers or ungulate free.

Species	PU	<i>in situ</i> #s	<i>ex situ</i> #s (# of pops represented)	Ungulate free
Achmus	ESU A (Kahanahaiki/Pahole)	263/148/61 (300)	0/9/2 (1)	partial
	ESU B1 (Ohikilolo)	293/40/36 (300)	1/21/2 (2)	yes
	ESU B2 (East/Central Makaleha)	319/143/73 (300)	0/4/1 (1)	no
	ESU C (SBW/Alaiheihē/Palikea)	49/15/5 (300)	10/65/2 (3)	partial
	ESU D1 (North Kaluaa to SBS, Kaala)	339/204/84 (300)	1/45/3 (2)	partial
	ESU D2 (Makaha)	41/9/10 (+32) (300)	5/17/0 (1)	yes
	ESU E (Puu Kaua/Ekahanui)	322/80/85 (+1) (300)	2/9/1 (1)	yes
	ESU F (Puu Palikea/Mauna Kapu)	110/32/18 (300)	1/15/0 (1)	no

Table of Contents

	<u>Page</u>
Executive Summary	i
Table of Contents	vii
List of Tables	ix
Introduction	xi
 Chapter 1.0 Ecosystem Management Introduction	 1-1
Public Outreach Program Highlights	1-1
Monitoring Program	1-4
Weed Control Program	1-8
Management Unit Threat Control Efforts	1-13
1.1 Ka‘ena	1-17
1.2 Ka‘ena East of Alau	1-18
1.3 Haili to Kealia	1-20
1.4 Kaluakauila	1-21
1.5 Kahanahāiki	1-23
1.6 ‘Ōhikilolo	1-25
1.7 Lower ‘Ōhikilolo	1-27
1.8 MMR no MU	1-29
1.9 Mokulei‘ia Forest Reserve no MU	1-30
1.10 Pahole	1-32
1.11 Pahole no MU	1-34
1.12 Upper Kapuna	1-35
1.13 West Makaleha	1-37
1.14 East Makaleha	1-39
1.15 Kaimuhole	1-40
1.16 Manuwai	1-40
1.17 Lower Ka‘ala NAR no MU	1-41
1.18 Kea‘au	1-42
1.19 Kea‘au and Mākaha	1-42
1.20 Kamaileunu	1-43
1.21 Mākaha	1-44
1.22 Mākaha no MU	1-46
1.23 Wai‘anae Kai	1-47
1.24 Wai‘anae Kai no MU	1-49
1.25 Pu‘u Kūmakali‘i	1-50
1.26 Kalua‘ā and Wai‘eli	1-51
1.27 Kalua‘ā and Wai‘eli no MU	1-53
1.28 Wai‘eli no MU	1-54
1.29 ‘Ēkahanui	1-56
1.30 ‘Ēkahanui no MU	1-58
1.31 Palikea	1-59
1.32 Palikea no MU	1-61
1.33 Mauna Kapu no MU	1-62

Chapter 2.0:	MIP Rare Plant Stabilization Plan Introduction	2-1
2.1	<i>Alectryon macrococcus</i> var. <i>macrococcus</i>	2-7
2.2	<i>Cenchrus agrimonioides</i> var. <i>agrimonioides</i>	2-10
2.3	<i>Chamaesyce celastroides</i> var. <i>kaenana</i>	2-13
2.4	<i>Chamaesyce herbstii</i>	2-16
2.5	<i>Cyanea grimesiana</i> subsp. <i>obatae</i>	2-19
2.6	<i>Cyanea longiflora</i>	2-22
2.7	<i>Cyanea superba</i> subsp. <i>superba</i>	2-25
2.8	<i>Cyrtandra dentata</i>	2-28
2.9	<i>Delissea subcordata</i>	2-31
2.10	<i>Dubautia herbstobatae</i>	2-34
2.11	<i>Flueggea neowawraea</i>	2-37
2.12	<i>Gouania vitifolia</i>	2-40
2.13	<i>Hedyotis degeneri</i> var. <i>degeneri</i>	2-43
2.14	<i>Hedyotis parvula</i>	2-46
2.15	<i>Hesperomannia arbuscula</i>	2-49
2.16	<i>Hibiscus brackenridgei</i> subsp. <i>mokuleianus</i>	2-52
2.17	<i>Melanthera tenuifolia</i>	2-55
2.18	<i>Neraudia angulata</i>	2-58
2.19	<i>Nototrichium humile</i>	2-61
2.20	<i>Phyllostegia kaalaensis</i>	2-64
2.21	<i>Plantago princeps</i> var. <i>princeps</i>	2-67
2.22	<i>Pritchardia kaalae</i>	2-70
2.23	<i>Sanicula mariversa</i>	2-73
2.24	<i>Schiedea kaalae</i>	2-76
2.25	<i>Schiedea nuttallii</i>	2-79
2.26	<i>Schiedea obovata</i>	2-82
2.27	<i>Tetramolopium filiforme</i>	2-85
2.28	<i>Viola chamissoniana</i> subsp. <i>chamissoniana</i>	2-88
Chapter 3.0	MIP <i>Achatinella mustelina</i> Management	3-1
Chapter 4.0	MIP ‘Elepaio Management	4-1

Appendices

Page

1.0	Environmental Outreach	
A.	Examples of educational materials	I
B.	Photos from volunteer service trips	VI
C.	Environmental compliance officer training materials	IX
D.	Examples of Public Relations articles and publications	X
E.	Examples of television features	XIII
2.0	MIP/OIP Belt Plot Sampling Monitoring Protocol	XV
3.0	Palikea MU monitoring protocol and preliminary results	XXII

List of Tables

Table I	Status Summary of MIP Plant Species for 2008	iii
	Status Summary for <i>Achatinella mustelina</i> , 2008	vi
Table 2.1	<i>Alectryon maccrococcus</i> Taxon Status Summary	2-8
2.2	<i>Alectryon maccrococcus</i> Genetic Storage Summary	2-9
2.3	<i>Cenchrus agrimonioides</i> Taxon Satus Summary	2-11
2.4	<i>Cenchrus agrimonioides</i> Genetic Storage Summary	2-12
2.5	<i>Chamaesyce celastroides</i> Taxon Status Summary	2-14
2.6	<i>Chamaesyce celastroides</i> Genetic Storage Summary	2-15
2.7	<i>Chamaesyce herbstii</i> Taxon Status Summary	2-17
2.8	<i>Chamaesyce herbstii</i> Genetic Storage Summary	2-18
2.9	<i>Cyanea grimesiana</i> subsp. <i>obatae</i> Taxon Status Summary	2-20
2.10	<i>Cyanea grimesiana</i> subsp. <i>obatae</i> Genetic Storage Summary	2-21
2.11	<i>Cyanea longiflora</i> Taxon Status Summary	2-23
2.12	<i>Cyanea longiflora</i> Genetic Storage Summary	2-24
2.13	<i>Cyanea superba</i> subsp. <i>superba</i> Taxon Status Summary	2-26
2.14	<i>Cyanea superba</i> subsp. <i>superba</i> Genetic Storage Summary	2-27
2.15	<i>Cyrtandra dentata</i> Taxon Status Summary	2-29
2.16	<i>Cyrtandra dentata</i> Genetic Storage Summary	2-30
2.17	<i>Delissea subcordata</i> Taxon Status Summary	2-32
2.18	<i>Delissea subcordata</i> Genetic Storage Summary	2-33
2.19	<i>Dubautia herbstobatae</i> Taxon Status Summary	2-35
2.20	<i>Dubautia herbstobatae</i> Genetic Storage Summary	2-36
2.21	<i>Fluggea neowawrea</i> Taxon Status Summary	2-38
2.22	<i>Fluggea neowawrea</i> Genetic Storage Summary	2-39
2.23	<i>Gouania vitifolia</i> Taxon Status Summary	2-41
2.24	<i>Gouania vitifolia</i> Genetic Storage Summary	2-42
2.25	<i>Hedyotis degeneri</i> Taxon Status Summary	2-44
2.26	<i>Hedyotis degeneri</i> Genetic Storage Summary	2-45
2.27	<i>Hedyotis parvula</i> Taxon Status Summary	2-47
2.28	<i>Hedyotis parvula</i> Genetic Storage Summary	2-48
2.29	<i>Hesperomannia arbuscula</i> Taxon Status Summary	2-50
2.30	<i>Hesperomannia arbuscula</i> Genetic Storage Summary	2-51
2.31	<i>Hibiscus brackenridgei</i> subsp. <i>mokuleianus</i> Taxon Status Summary	2-53
2.32	<i>Hibiscus brackenridgei</i> subsp. <i>mokuleianus</i> Genetic Storage Summary	2-54
2.33	<i>Melanthera tenuifolia</i> Taxon Status Summary	2-56
2.34	<i>Melanthera tenuifolia</i> Genetic Storage Summary	2-57
2.35	<i>Neraudia angulata</i> Taxon Status Summary	2-59
2.36	<i>Neraudia angulata</i> Genetic Storage Summary	2-60
2.37	<i>Nototrichium humile</i> Taxon Status Summary	2-62
2.38	<i>Nototrichium humile</i> Genetic Storage Summary	2-63
2.39	<i>Phyllostegia kaalaensis</i> Taxon Status Summary	2-65
2.40	<i>Phyllostegia kaalaensis</i> Genetic Storage Summary	2-66
2.41	<i>Plantago princeps</i> var. <i>princeps</i> Taxon Status Summary	2-68
2.42	<i>Plantago princeps</i> var. <i>princeps</i> Genetic Storage Summary	2-69

2.43	<i>Pritchardia kaalae</i> Taxon Status Summary	2-71
2.44	<i>Pritchardia kaalae</i> Genetic Storage Summary	2-72
2.45	<i>Sanicula mariversa</i> Taxon Status Summary	2-74
2.46	<i>Sanicula mariversa</i> Genetic Storage Summary	2-75
2.47	<i>Schiedea kaalae</i> Taxon Status Summary	2-77
2.48	<i>Schiedea kaalae</i> Genetic Storage Summary	2-78
2.49	<i>Schiedea nutallii</i> Taxon Status Summary	2-80
2.50	<i>Schiedea nutallii</i> Genetic Storage Summary	2-81
2.51	<i>Schiedea obovata</i> Taxon Satus Summary	2-83
2.52	<i>Schiedea obovata</i> Genetic Storage Summary	2-84
2.53	<i>Tetramalopium filiforme</i> Taxon Status Summary	2-86
2.54	<i>Tetramalopium filiforme</i> Genetic Storage Summary	2-87
2.55	<i>Viola chamissoniana</i> supsp. <i>chamissoniana</i> Taxon Status Summary	2-89
2.56	<i>Viola chamissoniana</i> subsp. <i>chamissoniana</i> Genetic Storage Summary	2-90
Table 3.1	Captive Snail Propagation Summary for <i>Achatinella mustelina</i>	3-3
3.2	<i>Achatinella mustelina</i> Laboratory Population Deaths 2004-2008	3-6
3.3	<i>Achatinella mustelina</i> in ESU-A Manage for Stability Sites	3-9
3.4	<i>Achatinella mustelina</i> in ESU-B1 Manage for Stability Sites	3-10
3.5	<i>Achatinella mustelina</i> in ESU-B2 Manage for Stability Sites	3-11
3.6	<i>Achatinella mustelina</i> in ESU-C Manage for Stability Sites	3-12
3.7	<i>Achatinella mustelina</i> in ESU-D1 Manage for Stability Sites	3-13
3.8	<i>Achatinella mustelina</i> in ESU-D2 Manage for Stability Sites	3-14
3.9	<i>Achatinella mustelina</i> in ESU-E Manage for Stability Sites	3-15
3.10	<i>Achatinella mustelina</i> in ESU-F Manage for Stability Sites	3-16
Table 4.1	Current Status of ‘Elepaio in Mākua Action Area	4-1
4.2	‘Elepaio Breeding Success 2008, Mākua Action Area	4-2
4.3	‘Elepaio Banding Data, Mākua Action Area	4-2

Introduction

Year 4 of the Mākua Implementation Plan

The Mākua Implementation Plan (MIP) was finalized in May 2003. In June 2007, the US Fish and Wildlife Service (USFWS) approved the Addendum which emphasized management of three population units (PUs) per plant taxon in the most intact habitat and 300 individuals of *Achatinella mustelina* in each genetically identified Evolutionarily Significant Unit (ESU). The 2007 Mākua Biological Opinion (BO) issued by USFWS also required that the Army provide threat control for all Oahu Elepaio pairs in the Mākua action area (AA) and that some species be stabilized on an expedited timeline. Expedited stabilization has not begun at this time due to a lack of additional funding for this effort. This report serves as the annual status report to the Mākua Implementation Team (MIT), and participating landowners on the MIP Year-4 actions that occurred between 1 September 2007 and 31 August 2008.

Current Status of the Oahu Implementation Plan

The Oahu Implementation Plan (OIP) was finalized in November 2008 and includes specific plans for the species covered in the 2003 Oahu Biological Opinion and the management units (MUs) necessary for the stabilization of those 28 species. Therefore, the OIP species were not covered in this report.

2008 Reporting Highlights

A significant effort was made to streamline the report this year. Lengthy discussions of management units (MUs) and species have been replaced with tables generated from the Oahu Army Natural Resources database.

Chapter 1 covers ungulate, weed, and rat control for each MU and some areas that are managed outside of implementation plan MUs; either for incipient weeds control or rare species genetic storage collections. Chapters 2 and 3 cover the highlights of rare plant and rare snail management respectively. Chapter 4 covers 'elepaio management inside the Mākua AA. All other 'elepaio management is covered by the OIP and is not presented in this report. In addition, a separate report will be written by OANRP covering the 'elepaio 5-year reviews pursuant to the 2003 Biological Opinion for Oahu Training Areas. Chapter 4 is followed by the appendices. In previous years a research chapter was also included, however, the research specialist position was not filled for a large portion of this year. The research program will be reported on in subsequent years.

The format of this document is as follows:

Chapter 1 Ecosystem Management

Chapter 2 Rare Plant Management

Chapter 3 *Achatinella mustelina* Management

Chapter 4 O'ahu 'Elepaio Management

Appendix 1- Environmental Outreach

1A. Examples of educational materials developed and produced

1B Photos from volunteer service trips

1C Environmental compliance officer training materials

1D Examples of P.R. articles and publications

1E Examples of television features

Appendix 2- MIP/OIP Monitoring Program Protocol 1.2.1

Appendix 3- Palikea Management Unit Monitoring Strategy Overview and Preliminary Results

Landowner/Agency Communications

The Army continues to work cooperatively under a Memorandum of Understanding (MOU) with both the Board of Water Supply (BWS) and The Nature Conservancy of Hawai'i (TNCH) for work in Mākaha Valley and TNCH's Honouliuli Preserve.

This year, the Army worked with TNCH to complete the Puu Palikea MU and the Ekahanui Subunit II MU. The Army fence crew also completed population size fenced units around *Neraudia angulata*, and *Nototrichium humile* in the Waianae Kai Forest Reserve. In the next year, the Army hopes to begin construction on the Manuwai MU in cooperation with the State DLNR NARS and Forest Reserves.

The Nature Conservancy of Hawai'i continues to look for a suitable land manager to purchase the Honouliuli Preserve parcel from the James Campbell Company. The latest proposal is for either the State Department of Land and Natural Resources (DLNR) or the Office of Hawaiian Affairs (OHA) to become the land manager for this area. The Army will continue to serve as a member of the Honouliuli Advisory Group for TNCH in the interim and will continue to pursue this area as an Army Compatible Use Buffer (ACUB). The ACUB program allows the Army to help a land manager buy property that will assist with encroachment on training lands owned by the Army. To date, the Army has helped purchase properties such as Moanalua Valley, Pupukea Paumalu, and Waimea Valley with ACUB funding.

The Army currently, has a renewable six month Right of Entry (ROE) with the Waikāne Investment Corp. to conduct 'elepaio predator control within Waikāne Valley. This ROE allows the Army to protect one of the only known populations of 'elepaio on the windward side of the O'ahu.

The Army also received a six month ROE with the Dole Pineapple Co. to monitor populations of *Hibiscus brackenridgei* subsp. *mokuleianus* in the area affected by the 2007 Waialua fire. The Army has programmed for money in fiscal year 2009 to construct a fence protecting any individuals that have regenerated following the fire and a grazed fuel break along the gulch entrances.

The OANRP received a three year license agreement with Kamehameha Schools (KS) that will cover all natural resource management work on KS lands on O'ahu, and is in the process of being signed by the Army. Once this three year agreement is finalized, the Army will seek an extended ten year agreement that will enable the OANRP to construct ungulate fences for conservation on KS land.

Finally, the Army continues to work toward an agreement to continue conservation work on State land. The Army and the State DLNR legal teams are currently working on an MOU for the Army to access and work on State land on O'ahu. Once completed, the OANRP will continue to

work closely with DLNR staff on all projects and decision making regarding natural resource management on these lands. A major priority for completion of this agreement is the construction of ungulate free management units on State land. The Army would like to work with the state to complete the proposed East Makaleha, West Makaleha, Kapuna subunit IV, and Manuwai MU fences within the next two years. In addition, several more MU fences are proposed on State lands; that would be able to be constructed once a formal agreement is reached.

Fire

The Army Wildland Fire program has moved from the Army Safety Office to the Directorate of Emergency Services. Approximately 1/3 of the 53 OANRP staff are trained and certified as wildland firefighters (type 2), although the Research Corporation of the University of Hawai‘i (RCUH) Human Resources Department does not allow their staff to fight fire. However, RCUH staff can assist with mop up operations under the direction of the Army Wildland Fire program.

Funding and staffing levels

There are currently a total of 53 staff throughout three field crews, one fence crew, and various support staff. The Army received \$4.3M for the MIP program in FY2008.

The Oahu Army Natural Resources Program (OANRP) is now housed at two locations. Half the staff are located at East Range and the other half are located at the new facility on Schofield Barracks West Range. The new facility was provided and funded by the Army and includes an office building, a greenhouse, a flammable and pesticide storage, and workshop.

Chapter 1.0: Ecosystem Management

Notable projects from the 2007-2008 reporting year are briefly discussed in the Project Highlights section of this chapter. The reporting year is defined as Sept.1, 2007 through August 31, 2008. Threat control efforts are then summarized for each Management Unit (MU) or non-MU land division. Ungulate control, rodent control, and weed control data is presented, with a minimum of discussion. For full explanations of project prioritization and field techniques, please refer to the 2007 Status Report for the MIP and Draft OIP.

Project Highlights

Public Outreach Program

-Continued existing and developed additional volunteer-based projects at appropriate sites within OIP and MIP management areas (see Appendix 1.B for photos).

- Total in-field volunteer hours = 4006
- Total in-field Volunteer Trips = 56

In-Field Volunteer Trips		
Management Unit	Projects	Total Number of Trips
Kahanahaiki		
	Invasive weed control	10
	Incipient weed control; <i>Acacia mearnsii</i>	1
	Common native outplanting	11
Ka'ala		
	Invasive weed control	8
	Incipient weed control; <i>Juncus effusus</i>	14
KTA		
	Common native outplanting	2
Palikea		
	Incipient weed control	4
Makaha		
	Invasive weed control	6

- Total baseyard volunteer hours = 133
 - Baseyard projects:
 - Propagule processing
 - Nursery maintenance
 - Herbarium organization
 - Outreach Material preparation

-Developed and produced educational materials focused on natural resource issues specific to O'ahu Army training areas (see Appendix 1.A for examples).

- Brochures:
 - Army Natural Resource Program Overview

- O‘ahu Army Natural Resource Program Overview
 - Natural Resources on Makua Military Reservation
 - PTA Natural Resource Program Overview
- Displays:
 - Army Natural Resource Program Overview
 - Natural Resources on Makua Military Reservation
 - PTA Natural Resource Program Overview
 - Natural resource activity board for kids (used at Environmental Awareness Day, Army Family Housing Earth Day event, and Makua Media day)
- Posters:
 - Restoring the Ka‘ala Summit: Volunteers Valued for their Time and More (for Conservation Conference)
 - ‘Elepaio in Moanalua Valley (for Moanalua Valley dedication)
 - KTA weeds of concern
- Field identification information:
 - Ka‘ala – A Biological and Cultural Overview (done, but needs to be printed)
 - KTA weeds of concern field cards
 - *Tibouchina herbacea* field cards
 - *Megalagrion xanthomeles* site identification sign for Tripler Hospital population
- Signage:
 - Malama ‘Aina sign for fences (installed in Wai‘anae Kai)
 - *Tibouchina herbacea* incipient weed flyer for posting along hiking trails
- Presentations:
 - OANRP presentation for middle-school age (Stevenson M.S.)
 - OANRP presentation for college age (UH Botany dept.)

-Developed and executed presentations to disseminate information on natural resources specific to Army training lands to local schools and community groups.

- Developed and Implemented Classroom Presentations to 135 Middle School Students
- Developed Interactive Displays and shared information on Natural Resources with over 400 Elementary students through attendance at the Annual Agriculture and Environmental Awareness Day
- Developed Display and attended Kahuku High School Career Day; shared information on careers in conservation with over 300 H.S. students.
- Attended the University of Hawai‘i Career Fair and interacted with over 100 college students to recruit future volunteers or OANRP staff

-Participated in inter-agency collaborative natural resource activities and coordinated events to support such activities.

- Attended and helped support coordination of the Moanalua Valley dedication ceremony, for the acquisition of the Valley through the Army’s ACUB program. Ceremony attended by multiple agencies, organizations, legislators, Colonel Killian, the public, and media.
- Coordinated two educational ‘elepaio hikes for the general public in Moanalua Valley.
- Participated in the Hawaii Conservation Alliance, including attending planning meetings for the 2008 Hawaii Conservation Conference.

- Participated in the Koolau Mountains Watershed Partnership
- Maintained a volunteer database and regular communication with 393 volunteers on a monthly basis.
- Developed internships at Army Natural Resources that were coordinated with cooperating agencies and organizations.
- Interns from Hawai'i Youth Conservation Corp (HYCC) contributed a total of 1632 volunteer hours over the summer months of June and July
 - The HYCC interns included 38 individuals, each contributing 40 hours of volunteer time over a four day time period, for a total of 1420 person hours.
 - Three additional individuals gained valuable career skills and experience in the field of Natural Resource Management through three-month long paid internships.
- Developed and produced educational materials and presentations for Army troops highlighting the relationship between troop training activities and the natural resources on Army training lands (see Appendix 1.C for examples).
- Developed and distributed Natural Resource Management Brochure for officers who attend the Environmental Compliance Course
 - Developed and Implemented 45 min. Presentation for the Environmental Compliance Course
 - Brochures and Presentation were given to six classes, totaling 143 officers.
- Wrote articles, press-releases, and bulletins, and provided coordination and accurate information to the local, state, regional, and national media and agencies (see Appendices 1.D and 1.E for examples).
- 16 total articles featuring OANRP in the last year, examples include:
 - "State Flower Down but Not Out" – Hawaii Army Weekly
 - "Involving Community in Army Conservation Week" – National Public Works Digest
 - "Conservation Camp" – Environmental Update
 - "Volunteer Efforts on O'ahu Hit an All-time High" – DPW Newsletter
 - "Adding One to a Plant Population Brings Worldwide Total to 19" – EMP Bulletin
 - "Largest Fire in Years on O'ahu Takes a Toll on the State Flower" – EMP Bulletin
 - "Rare Damselfly Rediscovered in the Leeward Koolaus" – EMP Bulletin
 - 3 television news features on KHNL News Channel 8, Earth & Sea Project series:
 - "Big Efforts to Save a Tiny Animal"
 - "Military Preserves Endangered Plants"
 - "Students Work on Restoring Mt. Ka'ala"
 - Contributed wildland fire information to be featured in state-wide fire safety booklet.
 - Participated in the Honolulu Fire Department Wildland Fire press conference.
 - Editors/producers/distributors of Ecosystem Management Program Bulletin, quarterly newsletter. Sent to inclusive list of state, non-profit, federal, and educational institutions.

Monitoring Program: Palikea Vegetation Monitoring

Management Unit Vegetation Monitoring

In the last year, the Army contracted USGS Botanist, Dr. James Jacobi, to consult with NRS on the MIP/OIP monitoring program. The most pressing need of the monitoring program was to develop vegetation monitoring protocols for Management Units. Most critical was the need to capture baseline data to track vegetation changes resulting from MU fence construction and feral animal removal. Dr. Jacobi adapted a standard vegetation transect methodology to capture data necessary for MIP/OIP reporting and feedback. The timing of this project coincided with the completion of the Palikea MU fence, thus, it was monitored first. The methodology is described in detail in Appendix 2, *Monitoring Protocol 1.2.1, Belt Plot Sampling for Understory, Weeds, and Canopy*. The primary data collected was percent cover for understory and canopy vegetation.

103 plots (5m x 10m) were established along five transects across the 23 acre Palikea MU. It took 28 person days to install and read these plots. Dr. Jacobi analyzed the initial data and results are included in Appendix 3, along with other Palikea monitoring highlights. Based on this “pilot” monitoring, the recommendation is to install at least 105 plots across each MU. NRS will use this number to guide future MU transect monitoring projects.

Figure 1.1 shows that only 35% of the MU understory is alien vegetation. Thus, at baseline, the Palikea MU meets the long-term MIP goal of <50% understory weeds. Native understory across the MU is currently 40%. Figure 1.2 shows that 32% of the understory in the Palikea MU is bare ground. This bare ground may be colonized either by weeds or native species. NRS must be vigilant in weed control to ensure that the weed levels area maintained at <50%.

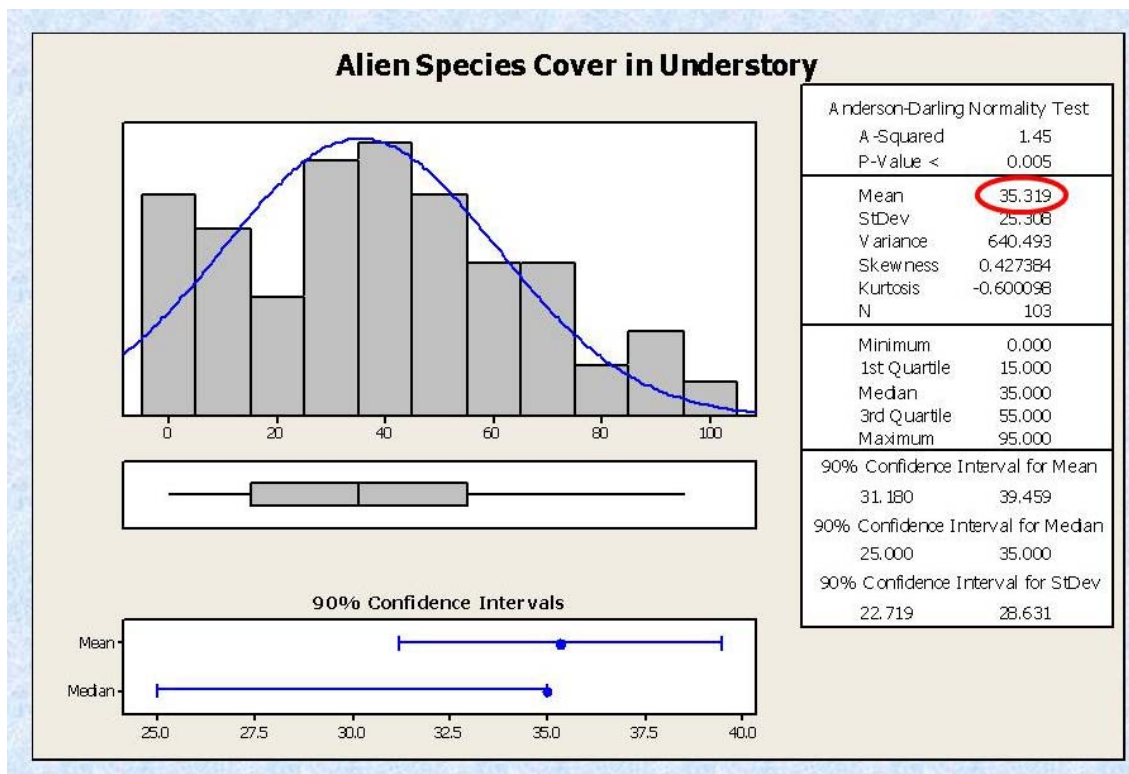


Figure 1.1 Palikea Alien Species Cover in Understory

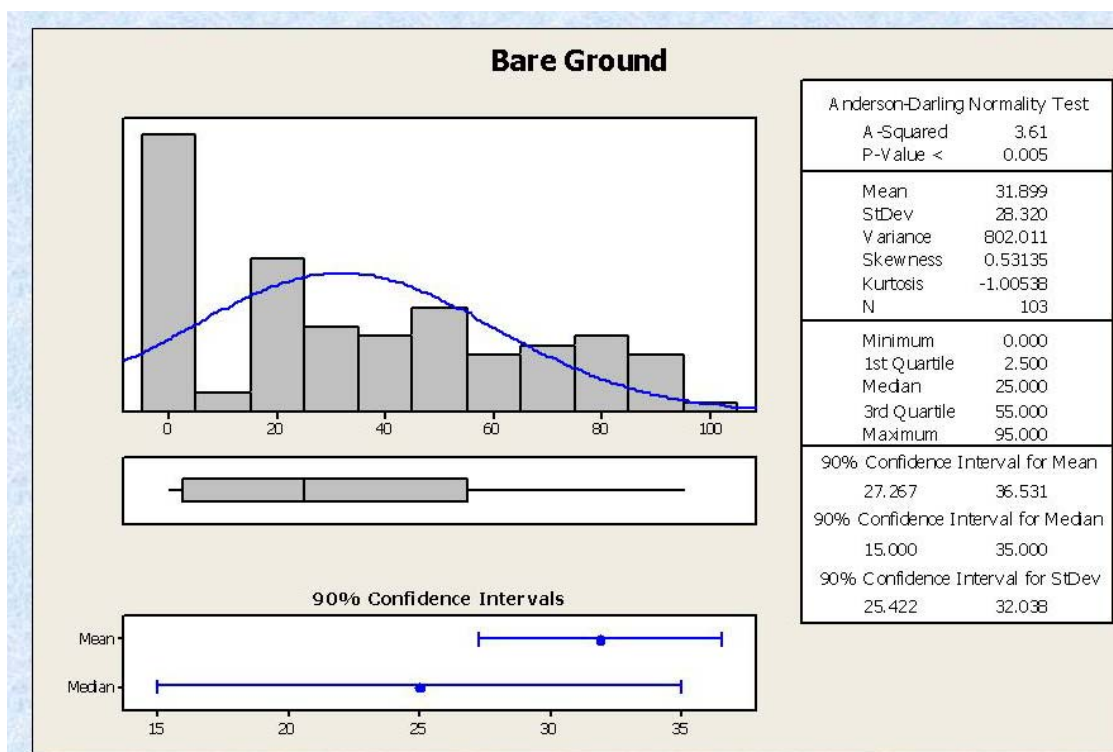


Figure 1.2 Palikea Bare Ground

Belt transect monitoring data can be used to develop weed control plans and better inform weed control approach and strategy, particularly when data is stratified by vegetation type (the plots established were placed into one of four vegetation strata). Figures 1.3 and 1.4 show that the starting points amongst vegetation strata are dramatically different.

Some of the vegetation communities within the Palikea MU are more important for use in stabilizing target MIP and OIP species. For example, the wet crest vegetation is the zone where most of the *Achatinella mustelina* are found in the MU. Baseline data show that the native canopy is <20% and alien canopy is approximately 50%. Based on these data NRS may research ways to convert the alien dominated canopy to a more native state in order to restore *Achatinella* habitat. The most challenging weed in this vegetation type is *Morella faya* which has displaced the native *Metrosideros polymorpha* canopy. *Morella faya* is not a preferred host for *Achatinella mustelina*.

The gulch zone community is the most suitable habitat for *Cyanea grimesiana*. A small enclosure has been in place in this zone for almost 10 years. Within this fence astounding recovery of native ferns including *Diplazium sandwichianum* was observed. Regular weed control was conducted in order to tip the balance toward native understory within this small fence. NRS expect to approach weeding in much the same way across the newly fenced gulch zone community. Monitoring can inform us of the most successful weed control frequency and strategy.

Plans for monitoring for the upcoming year will focus on newly fenced MUs to capture baseline data prior to vegetation changes resulting from ungulate removal. The next MUs slated for monitoring are Ekahanui, Makaha, Manuwai and Kapuna. These plans are tentative pending landowner permission. Also, we will attempt to monitor the existing Kahanahaiki MU even though it has been fenced for 10+ years. NRS can use monitoring results to make informed decisions regarding on going weed control projects. NRS will re-monitor belt transects every 3 years. If data on a particular vegetation type is required sooner, NRS may choose to re-monitor a subset of the plots within an MU on a timeline suitable to provide feedback for management. In order to strengthen the conclusions NRS can draw about canopy change in the MU, NRS may install some permanent vegetation plots with larger dimensions. Canopy cover estimates are difficult in the belt transect methodology because of the small plot size.

Monitoring protocol 1.2.1 in Appendix 2 detects MU-wide, landscape-level changes over time. Thus, NRS would like to investigate ways to track weed control work on the smaller scales and in real time to inform and adapt weeding approaches within Weed Control Areas. It is a high priority to develop a monitoring protocol which is quick to install and can be read prior to each weed control trip.

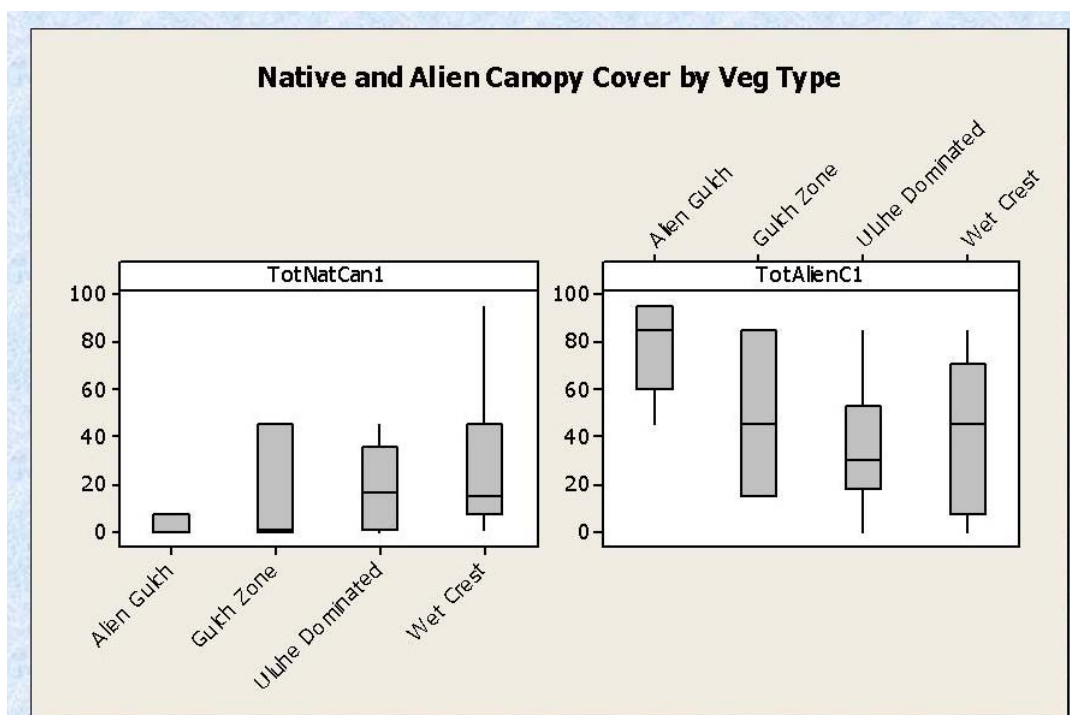


Figure 1.3 Palikea Native and Alien Canopy Cover by Veg Type

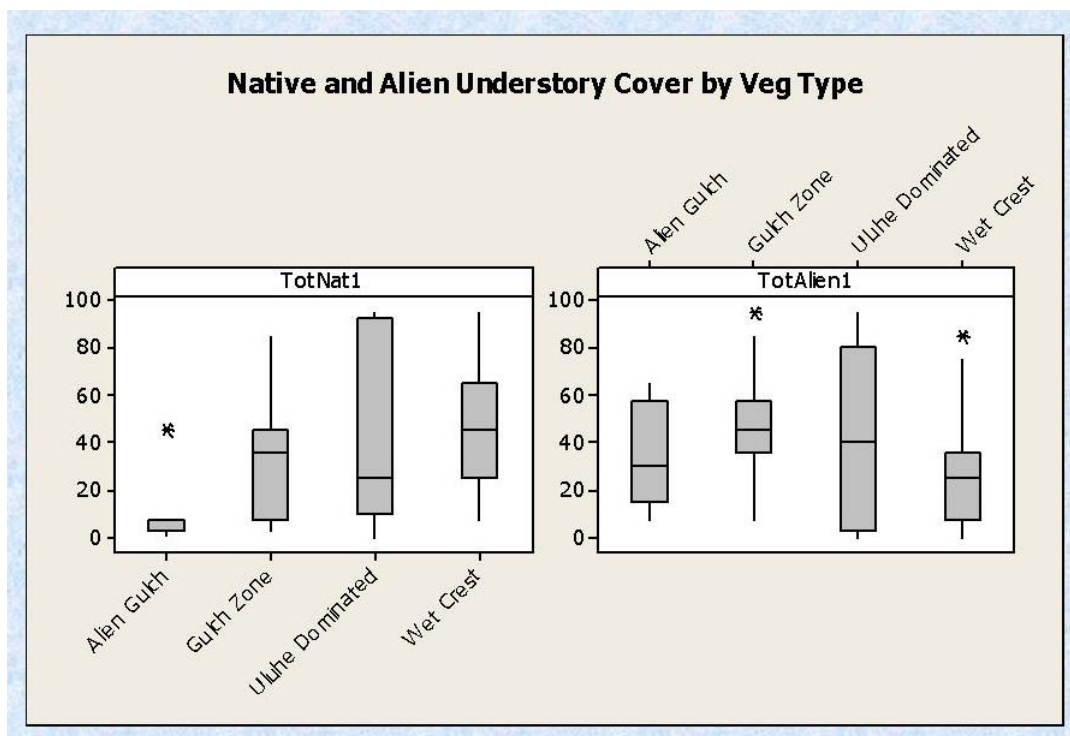


Figure 1.4 Palikea Native and Alien Understory Cover by Veg Type

Weed Control Program

Interagency Coordination

-O‘ahu Early Detection (OED)

- OED submitted a successful pre-proposal to the DOD Legacy Grant Office. If final approval is obtained, the grant will enable OED to conduct thorough incipient weed surveys on military lands across the state, including all Army lands. The surveys will focus on paved roads running through residential, commercial, and business districts on base, as opposed to roads running through training facilities. OANRP wrote a letter of support for the OED legacy proposal. NRS focus on the training ranges and undeveloped lands on base; OED’s surveys will complement NRS work and provide a more complete inventory of the installations botanical elements. Many unusual trees were planted in residential areas, and Army installations tend to be poorly surveyed, as access is restricted.
- In April of 2008, NRS accompanied OED on a survey of Schofield Barracks. Focusing on the residential area northeast of Waianae Avenue, OED and NRS documented two adventive/naturalizing species, *Megaskepsma erythrochlamys* and *Dovyalis hebecarpa*. Landscaping includes close to a dozen unusual trees, unique garden specimens, most of which are non-invasive. On the same date, OED visited the garden department in the PX; no target species were being sold.

-O‘ahu Invasive Species Committee (OISC)

- *Miconia calvenscens* surveys in the Wahiawa region, including a small segment of Schofield Barracks East Range, did not find any naturalized plants. *M. calvenscens* once grew at the Wahiawa Botanic Garden
- *Eleuthrodactyls coqui*, the coqui frog, no longer sings in the SBE/Leileihua Road neighborhood. Control efforts, which began in 2001, successfully exterminated this six acre population. It has been almost two years since any frogs were heard calling at the infestation site; generally, after one year without calling, it is assumed that there are no coqui in an area. NRS participated in the Coqui Frog Working Group, guiding control efforts. OANRP contributed funds and some logistical help.
- OANRP continues to participate in the strategy, planning, and control meetings held by OISC.

-College of Tropical Agriculture and Human Resources, CTAHR, Dr. James Leary, Invasive Weed Management

- OANRP are collaborating with Dr. James Leary on the development of Herbicide Ballistic Technology, HBT. This method, currently being researched and tested by Dr. Leary, involves focused delivery of small amounts of herbicide to target plants via paintball equipment.
- Trials of HBT are ongoing at KTA. Several species have been tested, including *Schinus terebinthifolius*, *Schefflera actinophylla*, and *Grevillea robusta*. Results are pending. Additional trials of other high priority weed species will be installed in the coming year.
- NRS will assist Dr. Leary by providing some study sites, giving feedback on logistics of HBT use under field conditions, and identifying priority target species. To make HBT a reality, field staff need both written safety guidelines and formal training. NRS will work with Dr. Leary to develop Standard Operating Procedures for safe HBT application.

- Possible future applications of HBT include aerial (helicopter) missions. OANRP is about to enter a contract with the Aircraft Management Division (AMD) which regulates safe helicopter use by natural resource management agencies. NRS will look at AMD regulations and investigate the feasibility of aerial HBT.
- With this unique technology, the feasibility of weed control for trees and ginger over vast areas becomes much more realistic. Working from helicopters or ridgelines with clear vantages, weeds can be controlled much more quickly and efficiently than current techniques allow. Traditional treatment requires NRS to hike to each weed, possibly girdle/fell it, and apply herbicide basally. Over large areas, particularly in mid-high elevations in both the Waianae and Koolaus, this would require a huge amount of NRS time. In addition, current mandates prioritize small-scale efforts around listed taxa over large-scale efforts in native areas. By reducing effort needed, HBT would allow NRS to begin to work on the landscape level, in addition to continuing to focus on the areas immediately around rare taxa.

-Coordinating Group on Alien Pest Species (CGAPS)

- OANRP participates in quarterly CGAPS meetings. These meetings provide an opportunity for various agencies to communicate and work together to address policy and funding concerns.

Restoration Techniques: Common Native Outplanting

- In 2007-2008, OANRP experimented on a moderate scale with the use of common native plants as restoration tools. In previous years, NRS conducted limited plantings in Kahanahaiki. Some of these plantings flourished, suggesting that large scale plantings could be a viable means of improving habitat quality, reducing herbicide usage, and utilizing volunteer labor.

- Logistical considerations for implementing common native outplantings:

- Growers. NRS decided to contract out the propagation of common natives. Currently, in-house horticultural staff time and greenhouse space is limited; these valuable resources are focused on listed taxa. Ferns were grown by La‘au Hawaii, while all other stock were grown by Hui Ku Maoli Ola. Any plants destined for NARS lands were grown by NARS horticulturists. Managing these contracts is not simple, and NRS hope to improve communication with growers in the coming year.
- Sanitation. NRS handled sanitation of all plants grown by contractors; NARS staff dealt with sanitation of NARS plants. All contract-grown plants underwent thorough cleaning and decontamination. This includes removal of weeds, pesticide regimens to eliminate arthropods and fungi, and hot water treatment to kill any slugs and snails. The hot water treatment was made possible by Department of Agriculture, who provided this service free of charge. Tiny snails, *Liardetia* sp., were discovered by La‘au Hawaii on greenhouse stock in early 2008. The hot water treatment was effective at killing the snails, as the pictures show.



Left: *Liardetia* are tiny. Right: *Liardetia* post hot water treatment. Note the white, stretched out bodies of the dead animals.

- **Planting.** Almost all common natives were planted with volunteer labor. Planting projects are well suited for volunteers, as they do not require special skills or potentially dangerous tools. The use of volunteer labor also enabled NRS to effectively increase overall management effort.

- Summary of planting efforts in 2007-08

Species	#	Planting Location	Volunteer/Staff Time
<i>Acacia koa</i>	31	Kahanahaiki	Volunteer
<i>Microlepidia strigosa</i>	120	Kahanahaiki	Volunteer
<i>Hedyotis terminalis</i>	478	Kahanahaiki	Volunteer
<i>Sapindus O'ahuensis</i>	114	Kaluakauila	Staff
<i>Plumbago zeylanica</i>	54	Kaluakauila	Staff
<i>Dodonea viscosa</i>	20	Kaluakauila	Staff
<i>Psyrdrax odoratum</i>	168	Kahuku	Volunteer
<i>Carex wahuensis</i>	218	Kahuku	Volunteer
<i>Microlepidia strigosa</i>	90	Ohikilolo	Volunteer
<i>Acacia koa</i>	20	Ohikilolo	Staff

- Data tracking and post-planting monitoring of common natives is important in determining success of the program. NRS revised the Common Native Reintroduction form at the end of the year to better facilitate monitoring. Plant height, health and maturity are recorded at planting. The same parameters will be recorded again in the coming year. NRS propose monitoring a portion of each outplanting, rather than all individuals. This will reduce data tracking effort.

- Plans for the 2008-09 planting season are moderate. NRS are working with the same growers. Two planting sessions are scheduled, one in December, and a second in January-February.

Invasive Species: *Tibouchina herbacea*

- On August 6, 2008, *Tibouchina herbacea* was discovered by NRS on the Koolau Summit Trail in the Poamoho region. Only one plant was found, no others were seen in the area. OED staff at Bishop Museum provided species identification.
- This aggressive weed is not known to be naturalized on O‘ahu, although it is widespread on both the Big Island and Maui. *T. herbacea* poses a major threat to Ko‘olau forests, especially the near-pristine summit regions. Not only does it thrive in wet forest conditions, it also produces hundreds of tiny seeds and can spread vegetatively. Broken pieces—even small ones—can root and form new plants. The seeds are easily transported via wind, birds, and pigs; hikers unwittingly carry them on shoes, clothes, and backpacks. *T. herbacea* prefers wet and mesic forest, where it thrives in areas with open understory. It grows in both sun and shade, although it prefers sunny gaps. It can grow through uluhe, but truly thrives in disturbed areas, particularly sites damaged by pigs or landslides. A pest plant abstract for *T. herbacea* prepared by The Nature Conservancy notes that it has taken *T. herbacea* less than a decade to spread across almost all appropriate habitats in the west Maui mountains.
- There are no documented occurrences of naturalized *T. herbacea* on O‘ahu. However, one plant was found along the H3. It is suspected that seed from the Big Island hitched a ride on equipment used in the construction of the highway. OISC removed the plant and monitors the site regularly for seedlings. No other plants were found in surveys of the surrounding area.
- At Poamoho, NRS recorded the *T. herbacea* location via GPS, removed the plant in its entirety, and installed a pvc pole/tag marker.
- NRS sought input, advice, and expertise from agencies on other islands where *T. herbacea* is present. In particular, Pat Bily of TNC Maui and Randy Barlett of Maui Land and Pineapple provided important insight into what control of a large-scale *T. herbacea* infestation might mean. They also provided photographs, descriptions of invasive behavior, and survey suggestions.
- OISC, the State of Hawaii Division of Forestry and Wildlife (DOFAW), and Kamehameha Schools worked with NRS to develop and distribute *T. herbacea* information flyers. OISC agreed to act as the point of contact for possible sightings.
- An email version of the flyer was posted to invasive species list serves, hiking clubs, and sent to contacts in the hunting community. Another version was published by NRS in the EMP Bulletin, which has a wider distribution. The story was picked up by local media, and made the evening news.
- In conjunction with other agencies, OANRP plans to conduct both ground and aerial surveys in a 2km buffer around the known *T. herbacea* site at Poamoho. This will be the first step in management. Future management efforts will hinge on the results of these surveys. OANRP hopes to prevent *T. herbacea* from becoming established in the Ko‘olau range.

Stryker Transformation Projects**-Drum Road**

- Consulted with US Army Corp of Engineers (USACE) and contractors to ensure that construction work on Drum Road did not and will not negatively impact any listed taxa or promote the spread of any noxious weeds.
- NRS regularly review Drum Road construction updates from USACE.

- There is a *Melochia umbellata* infestation along a portion of Drum Road in Kahuku Training Area (KTA). This tree thrives in open, disturbed areas, including road cuts, and has tiny, wind-dispersed seeds. NRS communicated with the USACE and contractors to ensure that protective measures were taken to reduce the risk of spread of *M. umbellata*. NRS also conducted two site visits with construction staff. On these site visits, the beginning and ending points of the infestation were discussed and markers (Seibert Stakes) were installed. NRS sent photos of *M. umbellata* to construction staff, and also showed them young plants growing along the road. All dirt/debris/fill generated in the *M. umbellata* region will stay on-site.
- Positive communication established with USACE. NRS prioritize responding to requests from USACE. USACE managers recognize the need to consult with the Natural Resources Office, and have been proactive in seeking NRS input in some projects.
- The Department of Transportation (DOT) has developed invasive species savvy contract language. NRS hope to review this in the coming year, and encourage the Army to adopt similar such language.

-Schofield Barracks East Range (SBE) Vehicle Wash Rack

- Soil and accumulated debris from the SBE wash rack is periodically removed and disposed of by the Compliance Branch of DPW Environmental. All material is spread on the ground at one site on SBE. The disposal site is at a prominent junction on the Centerline road.
- On a road survey in April of 2008, NRS discovered *Senecio madagascariensis*, a noxious weed, growing at the disposal site. At the time, NRS didn't know the location was the disposal site; the provenance of the *S. madagascariensis* at this site was a mystery.
- NRS joined the Compliance Branch for a field visit on (date). NRS mapped the location of the soil disposal site via GPS. NRS conveyed invasive species concerns, citing *S. madagascariensis*, which probably was washed off a vehicle recently returned from PTA, where *S. madagascariensis* is ubiquitous.
- The disposal site has been used by groups of training soldiers as a turn around and staging area. ITAM also used the site as a temporary holding area for fill. NRS and the Compliance Branch will install Seibert Stakes and informational signage to ensure that there is no traffic on the disposal site in the future.
- Quarterly surveys of the disposal site will be implemented in the coming year. NRS will maintain communication with the Compliance Branch.

-KTA Dip Pond/Wash Rack

- Two new facilities, a dip pond and vehicle wash rack, are planned for KTA. NRS surveyed the proposed field sites for the facilities, including the proposed waterline routes. The proposed sites are located in highly degraded shrub land; no listed taxa are nearby.
- One of the proposed waterline routes goes by a *Pennisetum setaceum* infestation. While no plants have been found for several years, NRS recommended that the infestation site be avoided during construction. This route is not the engineer's top choice; NRS await the final design plans.

Management Unit Threat Control Efforts

Ungulate Control

The O‘ahu Army Natural Resources Program currently has a six person fence crew. This crew participates in all aspects of the ungulate control program including fenceline scoping, fenceline clearing, construction, maintenance, and hunting for eradication within fenced units. This year the Fence Crew completed the Palikea MU, the Ekahanui subunit II MU and several smaller population unit fences in cooperation with the State Forest Reserves.

In addition the OANRP has been utilizing baited, self closing pig traps for eradicating ungulates within MUs and working with Intellesense Corporation on remote monitoring of these pig traps. In this case, sensors determine if the trap is closed (i.e. door is sprung) and relay the information wirelessly, to provide online updates. Ideally, this system will help avoid the need for checking the traps in person at remote sites and will alert the ungulate program if animals are in the traps.

Data Tables

Example of ‘Ungulate Control Efforts Summary’ Table

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Pahole	Complete	215/215	The NARS contracted the construction of this unit in 1998. In 2006, several small pigs breached the fence and were able to breed before detection. To date, a total of 23 pigs have been removed via snares. NRS and NARS staff believe that there are no pigs left within the unit but continue to survey and expand snaring to areas not covered.	Pigs

Acreage Protected/Proposed: This column shows the difference between the size of the proposed MU listed in the MIP addendum and the actual MU size after completion. Differences in size may be due to the ease of building a slightly different route than planned or due new information on the populations to be protected found when doing monitoring the area.

Ungulate Control: This column provides a description of the ungulate control actions over the past year and lists the concerns or needs for the MU in the future.

2009 Plans

- Continue utilizing fence crew to construct the MIP and OIP MU fences.
- Continue working with Intellesense Corporation on remote ungulate monitoring projects.
- Begin the construction of the Manuwai MU, Kaluaa and Waieli Subunit III MU.
- Construct several smaller PU fences including: the Keaau Mākaha MU for *Sanicula maritima*, Wai‘anae Kai Mauka for *Nerodia angulata*, Napepe‘iau‘olelo for *Hesperomannia arbuscula*.

Rodent Control Overview

Rodent control was conducted in 20 control grids within 14 management areas of the Waianae mountain range for the protection of endangered plants, tree snails, and ‘Elepaio. Rodent control afforded protection for 10 endangered plants species, portions of all six ESU areas for *Achatinella mustelina*, and one sub population of ‘Elepaio.

Data Tables

Example of ‘Rodent Control Efforts Summary’ Table

Ohikilolo MU

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Achmus	ESU-B1	MMR-E	3.0	YR	14	62%	14	5	5
Prikaa	Ohikilolo	MMR-A, B, D	7.1	YR	31	64%	41	38	5

PU/ESU/ Sub Population: This column lists the Population Unit (PU) in which the plant species is located, Ecologically Significant Unit (ESU) in which the population of *Achatinella mustelina* is apart of, or the Sub Population in which ‘Elepaio at located.

Population Reference Site: This column lists the specific population for plants and snails, and individual ‘Elepaio territories.

Area Protected (acres): The acreage of area protected is determined by the array and spacing distance between bait stations and/or snap traps.

Baiting Duration: AL = Snap traps maintained while air-layers are present on plants (indefinite time period). BS = ‘Elepaio breeding season (Late December through the end of June, bimonthly visits), FF = Bait stations and snap traps maintained during flowering and fruiting periods (bimonthly), YR = Bait stations and snap traps maintained year round (continuous baiting, 4-6 week interval).

of Stations: Number of bait stations deployed for the protection of a species.

Percent Bait Taken: The percentage is determined by dividing the number of bait blocks taken from bait stations by the total number of bait blocks available.

of Traps: Number of snap traps deployed for the protection of a species.

Number of Rats Trapped: Total number of rats snap trapped at each site.

of Visits: Number of times the site was visited for the maintenance of bait stations and snap traps.

Data Interpretation

For years NRS has been controlling rats through the use of snap traps and rodenticide deployed in bait stations for the protection of endangered plants, tree snails, and 'Elepaio. The control efforts have had an impact on the localized rat populations, but to what degree is unknown. The plant species that have benefited directly from rat control have been *Cyanea grimesiana* subsp. *obatae*, *Plantago princeps* var. *princeps*, *Pritchardia kaale*, and *Hesperomannia arbuscula*. Predation of these plant species by rats have been stopped completely or are at undetectable levels in locations where rat control has been taking place. Ground shell plots of *Achatinella mustelina* have been inconclusive in during predation of snails by rats. In 2008, mark-recapture of tree snails for determining population estimates was started in two ESUs. These population estimates will aid in monitoring population stability over time. Starting in 2009, NRS will begin monitoring rat activity in rodent control areas through the use of tracking tunnels and wax tag markers. Determining rat indices of activity at each control site will give NRS a better understanding of whether current control efforts are sufficient or more effort will be needed.

2009 Plans

- Rodent activity monitoring (tracking tunnels & wax tag markers)
- Develop database (Access)
- Audit data collection and organization
- Deploy New Zealand style snap trapping grids (wooden boxes)
- Assist USFWS with eradication of rats from Lehua Island to gain technical knowledge of aerial-broad cast of rodenticide
- Develop plans for aerial and/or hand-broad cast of rodenticide
- Scoping and planning for potential predator proof fencing

Weed Control

Invasive plant control was conducted over more than a 170 Weed Control Areas (WCA) and more than 150 Incipient Control Areas (ICA). Weed control focused on primarily on regions around threatened and endangered taxa.

Data Tables

Three tables are presented for each Management Unit. The first, titled Weed Control Areas, summarizes weed control effort for all WCAs within the MU. The total area of all WCAs is stated, as well as the actual area weeded this year. Often, WCAs are drawn to encompass larger areas than NRS are able to manage; low percentages of area weeded are not unexpected. Comments or interesting observations are recorded in the Notes column.

The second table, titled Incipient Control Areas, summarizes all ICA control within the MU. This data is presented by species. In addition to reporting acreage of ICAS, person hours, and number of trips, the date of the last known mature plant is recorded. NRS strive to visit each ICA often enough to prevent incipient plants from maturing.

The third table, titled Surveys, summarizes survey data for the MU. NRS conduct three types of surveys: road, LZ, and transect. Any significant new pests found on a survey are noted. While NRS survey almost all access and Army training roads, coverage of LZs is much less complete at this time.

2009 Plans

- Focus on developing Weed Control Plans (WCP) for all MUs. This process will take several years; a subset of MUs will be prioritized for 2009. WCPs will be designed to provide direction for management actions for a five year period.
- Enter all weed actions into the Scheduling Database. This will promote better follow-through and communication on invasive species tasks.
- Continue quality checks of weed data entering the weed database.
- Pursue testing and implementation of HBT.
- Work with DPW, Range Control, and ITAM to minimize invasive species spread via construction projects.
- Continue to develop the common native outplanting program to facilitate active restoration of degraded/problematic areas.
- Begin regular surveys of both NRS and Army LZs not currently monitored.

1.1 Management Unit: Ka'ena

MIP Species in MU

MUName: Kaena

TaxonName

Population Unit Name/ESU Site

TaxonGroup: Plant

Chamaesyce celastroides var. *kaenana* Kaena and Keawaula (Keawaula)

Chamaesyce celastroides var. *kaenana* Kaena and Keawaula (Kaena)

Ungulate Control Efforts

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Ka'ena	-	-	None needed	None

Rodent Control Program Summary

Rodent control has not been deemed necessary for this MU at this time.

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
2	2.17	1.55	71.61%	95.5	11	1 new site; control begun around newly discovered extension of the Chacelkae population.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs designated at this time

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	See Kaena East of Alau
LZ	0	N/A	N/A	N/A	No LZs in region
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.2 Management Unit: Ka'ena East of Alau**MIP Species in MU****MUName: Kaena East of Alau**

TaxonName

Population Unit Name/ESU Site

TaxonGroup: PlantChamaesyce celastroides var.
kaenana

Kaena (East of Alau)

Ungulate Control Efforts

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Ka'ena East of Alau	-	-	None needed	None

Rodent Control Program Summary

Rodent control has not been deemed necessary for this MU at this time.

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
1	0.14	0.07	50.22%	4	1	1 trip per year sufficient to maintain area around wild Chacelkae at this site.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs designated at this time

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	1	0	3.48km	0	AgaSis along road, not spreading significantly at this time.
LZ	0	N/A	N/A	N/A	No LZs in region
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.3 Management Unit: Haili to Kealia**MIP Species in MU****MUName: Haili to Kealia**

TaxonName

Population Unit Name/ESU Site

TaxonGroup: PlantHibiscus brackenridgei subsp.
mukuleianus

Haili to Kawaiu

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Haili to Kealia	-	-	None needed	None

Rodent Control Program Summary

Rodent control has not been deemed necessary for this MU at this time.

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
2	0.47	0.22	46.64%	45.5	5	Effort focused on HibBraMok reintroductions.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Achyranthes aspera</i>	1	0.38	07-09-2008	1.5	2	New site found this year.

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	1	0	2.69km	0	One road survey in Dillingham Military Reservation. AchAsp widespread along road.
LZ	0	N/A	N/A	N/A	No LZs in region
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.4 Management Unit: Kaluakauila

MIP Species in MU

MUName: Kaluakauila

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Makua
Delissea subcordata	Kealia
Melanthera tenuifolia	Kaluakauila
Neraudia angulata	Kaluakauila
Nototrichium humile	Kaluakauila

Taxon Group: Vertebrate

Chasiempis sandwichensis ibidis	Kaluakauila
---------------------------------	-------------

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Kaluakauila	Complete	104/104	This MU is fenced and ungulate free.	None

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Euphae	Kaluakauila	MMR-A	10.8	YR	57	40%	59	29	7
Nothum	Kaluakauila	MMR- A, J, L - N							

Baiting Duration: YR = Year Round (continuous baiting, 4-6 week interval).

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
3	10.41	3.64	34.99%	54	6	Focused efforts in 2 of 3 WCAs, although did work in all 3. Re-cleared firebreak on ridge.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Cirsium vulgare</i>	1	0.027	12-20-2006, immature	0	0	Did not visit this year. Only immature plants known from this area
<i>Syzigium jambos</i>	1	0.0064	04-03-2006	0	0	Check area during fence monitoring. Only one juvenile plant known from area, treated in 2006.

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	See Mokuleia Forest Reserve
LZ	1	0	N/A	0	Will survey other LZs in region in coming year
Transect	0	N/A	N/A	N/A	No transects read at current time

1.5 Management Unit: Kahanahāiki

MIP Species in MU

MUName: Kahanahaiki

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	A
-----------------------	---

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Kahanahaiki to West Makaleha
--	------------------------------

Cenchrus agrimonioides var. agrimonioides	Kahanahaiki and Pahole
---	------------------------

Cyanea superba subsp. superba	Kahanahaiki
-------------------------------	-------------

Cyrtandra dentata	Kahanahaiki
-------------------	-------------

Delissea subcordata	Kahanahaiki to Keawapilau
---------------------	---------------------------

Flueggea neowawraea	Kahanahaiki to Kapuna
---------------------	-----------------------

Hedyotis degeneri var. degeneri	Kahanahaiki to Pahole
---------------------------------	-----------------------

Nototrichium humile	Kahanahaiki
---------------------	-------------

Schiedea nuttallii	Kahanahaiki to Pahole
--------------------	-----------------------

Schiedea obovata	Kahanahaiki to Pahole
------------------	-----------------------

Taxon Group: Vertebrate

Chasiempis sandwichensis ibidis	Kahanahaiki
---------------------------------	-------------

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Kahanahāiki	Partial	64/94	Subunit I has been completed and ungulate free since 1998. Subunit II is proposed for construction in 2012. The line is scoped and ready to build. Snaring is performed in this unit to keep pig pressure off of the Subunit I fence line and to protect the native resources in Subunit II.	Pigs

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Achmus	ESU-A	MMR-A	1.6	YR	6	44%	15	20	9

Baiting duration: YR = Year Round (continuous baiting, 4-6 week interval).

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
13	17.78	4.61	25.92%	402	34	1 new site. Worked in 9 of 12 WCAs. High person hours due to significant volunteer effort, facilitated by the public outreach program

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Acacia mearnsii</i>	2	4.62	08-19-2008	25.33	7	Utilizing volunteer labor on this project
<i>Achyranthes aspera</i>	3	1.21	04-25-2006	3.68	9	At two sites, plants have not been seen for at least 2 years
<i>Axonopus compressus</i>	1	0.0089	03-03-2008	1.83	3	New site
<i>Casuarina glauca</i>	1	0.29	08-08-2005	2	1	
<i>Dicliptera chinensis</i>	1	0.0064	03-12-2008	0.5	1	New site, beginning control in coming year
<i>Nephrolepis multiflora</i>	1	0.0027	03-12-2008	0.5	1	New site, beginning control in coming year
<i>Rubus argutus</i>	1	0.056	06-06-1999	1	1	No plants seen since 2003, site may be extirpated. Check seed life
<i>Triumpheta semitriloba</i>	5	0.69	04-28-2008	7.15	15	Low numbers of plants found at all sites

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
------	--------------	---------------	--------	------------------------------	-------

Road	0	N/A	N/A	N/A	See Pahole No MU
LZ	0	N/A	N/A	N/A	No LZs in region
Transect	2	0	500m each	0	

1.6 Management Unit: ‘Ōhikilolo

MIP Species in MU

MUName: Ohikilolo

TaxonName

Population Unit Name/ESU Site

TaxonGroup: Invertebrate

Achatinella mustelina

B1

TaxonGroup: Plant

Alectryon macrococcus var.
macrococcus

Makua

Dubautia herbstobatae

Ohikilolo Makai

Dubautia herbstobatae

Ohikilolo Mauka

Flueggea neowawraea

Ohikilolo

Hedyotis parvula

Ohikilolo

Melanthra tenuifolia

Ohikilolo

Neraudia angulata

Makua

Nototrichium humile

Makua (south side)

Plantago princeps var. princeps

Ohikilolo

Pritchardia kaalae

Ohikilolo

Pritchardia kaalae

Ohikilolo East and West Makaleha

Sanicula mariversa

Ohikilolo

Tetramolopium filiforme

Makaha/Ohikilolo Ridge

Tetramolopium filiforme

Ohikilolo

Viola chamissoniana subsp.
chamissoniana

Ohikilolo

Taxon Group: Vertebrate

Chasiempis sandwichensis ibidis

Lower Makua

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
‘Ōhikilolo	Partial	7/200	The valley bottom portion of this large fenced MU is slated for completion in 2013. The ‘Ōhikilolo ridge fence (i.e. South Mākua perimeter) is complete but is in need of some repair work. In 2007 and 2008, goats continued to breach this fence in small numbers. NRS removed seven via snares and continue to make needed repairs to the fence. NRS is considering replacement of some of the older portions of this fence in 2012. NRS is still contemplating the best course of action for the completion of this MU fence. Six smaller PU fences are also completed and ungulate free.	Pigs

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Achmus	ESU-B1	MMR-E	3.0	YR	14	62%	14	5	5
Prikaa	Ohikilolo	MMR-A, B, D	7.1	YR	31	64%	41	38	5

Baiting Duration: YR = Year Round (continuous baiting, 4-6 week interval).

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
19	52.74	2.75	5.22%	10	141.2	Worked in 7 of 19 WCAs. NRS unable to visit many WCAs due to access restrictions to Lower Makua. Most work focused on the Ohikilolo ridgeline.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Araucaria columnaris</i>	1	2.82	09-19-2001	2.5	2	
<i>Cirsium vulgare</i>	1	1.48	06-15-2005	0.5	1	

<i>Ehrharta stipoides</i>	1	1.01	10-11-2007	1	1	
<i>Fraxinus uhdei</i>	1	0.033	12-13-2006	0	0	One mature tree known from site.
<i>Rubus argutus</i>	2	0.71	07-19-2007	2	1.5	At one site, only 1 immature plant had ever been seen.

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	No roads in region.
LZ	3	0	N/A	0	Vegetation communities static
Transect	2	N/A	500m each	0	Vegetation communities static

1.7 Management Unit: Lower 'Ōhikilolo

MIP Species in MU

MUName: Lower Ohikilolo

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Plant

Chamaesyce celastroides var. kaenana	Makua
Hibiscus brackenridgei subsp. mokuleianus	Makua
Melanthra tenuifolia	Ohikilolo

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Lower 'Ōhikilolo	Complete	70/70	The 'Ōhikilolo ridge fence and the strategic fences are all complete and goat free.	Pigs Possibly

Rodent Control Program Summary

Rodent control has not been deemed necessary for this MU at this time.

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
4	6.81	6.24	91.71%	500.5	28	Worked extensively in all WCAs. Large amount of staff time required to maintain fuel breaks.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Pennisetum setaceum</i>	1	0.00049	06-13-2006, immature	0	0	Did not visit site this year. Only 1 immature plant has been found at this site. No plants seen for over 2 years. Continue to check regularly during WCA work in region.

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	See MMR No MU
LZ	0	N/A	N/A	N/A	No LZs in region.
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.8 Management Unit: MMR No MU

MIP Species in MU

MUName: Makua No MU

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	B1
-----------------------	----

Achatinella mustelina	A
-----------------------	---

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Makua
--	-------

Flueggea neowawraea	Kahanahaiki to Kapuna
---------------------	-----------------------

Nototrichium humile	Makua (East rim)
---------------------	------------------

Taxon Group: Vertebrate

Chasiempis sandwichensis ibidis	Lower Makua
---------------------------------	-------------

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Chasanibi	Mākua	MMR-02, 03, 15	4.3	BS	16	28%	32	24	3

Population Reference Site: Territories in which rat control took place. Baiting Duration: BS = Breeding Season (January through June)

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
8	16.65	0.54	3.23%	49.5	4	Worked in 3 of 8 WCAs. Most of these are low priority, and many lie in the Lower Makua region (restricted access). 1 new site, around HibBraMok reintroduction at Makua Range Control.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Desmodium intortum</i>	1	0.049	10-11-2004	3.5	2	
<i>Rubus argutus</i>	2	1.24	10-24-2006	11.1	5	
<i>Triumpheta semitriloba</i>	1	0.13	09-10-2007	0	0	Did not visit this site this year. Overlaps with another ICA, need to resolve boundaries and naming of these sites

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	1	0	12.12km	0	
LZ	1	0	N/A	0	Survey LZs at Range Control and Lower Makua trailhead in coming year
Transect	0	N/A	N/A	N/A	No transects read at current time

1.9 Management Unit: Mokule‘ia Forest Reserve No MU**Weed Control Program Summary****Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
						No WCAS designated at this time

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Acacia mearnsii</i>	1	0.11	10-03-2006	0	0	Did not visit site last year.
<i>Rubus argutus</i>	1	0.15	06-01-2005	0	0	Did not visit site last year.
<i>Sphaeropteris cooperii</i>	1	0.096	10-16-2007	0.5	1	New site. One plant found along road Kuaokala road

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	3	0	28.4km	Cordia dichotoma	The 3 roads surveyed are the Pahole Road, Kaala Road, and Kuaokala Road. Cordia dichotoma was found on along the Pahole Road. It was identified by OED staff, and appears to be naturalizing. While no weed risk assessment has been conducted for CorDic, other Cordia species were considered to have low invasive potential.
LZ	0	N/A	N/A	N/A	Need to begin surveys at Nike site.
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.10 Management Unit: Pahole

MIP Species in MU

MUName: Pahole

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

<i>Achatinella mustelina</i>	A
------------------------------	---

TaxonGroup: Plant

<i>Alectryon macrococcus</i> var. <i>macrococcus</i>	Kahanahaiki to West Makaleha
<i>Cenchrus agrimonioides</i> var. <i>agrimonioides</i>	Kahanahaiki and Pahole
<i>Chamaesyce herbstii</i>	Kapuna to Pahole
<i>Cyanea grimesiana</i> subsp. <i>obatae</i>	Pahole to West Makaleha
<i>Cyanea longiflora</i>	Pahole
<i>Cyanea superba</i> subsp. <i>superba</i>	Pahole to Kapuna
<i>Cyrtandra dentata</i>	Pahole to Kapuna to West Makaleha
<i>Delissea subcordata</i>	Kahanahaiki to Keawapilau
<i>Flueggea neowawraea</i>	Kahanahaiki to Kapuna
<i>Hedyotis degeneri</i> var. <i>degeneri</i>	Kahanahaiki to Pahole
<i>Nototrichium humile</i>	Pahole Gulch
<i>Phyllostegia kaalaensis</i>	Pahole
<i>Plantago princeps</i> var. <i>princeps</i>	Pahole
<i>Schiedea kaalae</i>	Pahole
<i>Schiedea nuttallii</i>	Kahanahaiki to Pahole
<i>Schiedea obovata</i>	Kahanahaiki to Pahole

Taxon Group: Vertebrate

<i>Chasiempis sandwichensis ibidis</i>	Pahole
--	--------

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Pahole	Complete	215/215	The NARS contracted the construction of this unit in 1998. In 2006, several small pigs breached the fence and were able to breed before detection. To date, a total of 23 pigs have been removed via snares. NRS and NARS staff believe that there are no pigs left within the unit but continue to survey and expand snaring to areas not covered.	Pigs

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Achmus	ESU-A	PAH-B	1.9	YR	8	47%	16	52	10

Baiting Duration: YR = Year Round (continuous baiting, 4-6 week interval).

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
8	16.01	1.72	10.73%	133.75	15	Worked 7 or 8 WCAs. Focused control in rare plant habitat. 1 new site WCA established around CenAgr reintroduction

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Ehrharta stipoides</i>	3	1.01	05-07-2008	8.25	9	
<i>Montanoa hibiscifolia</i>	1	215.86	01-28-2008	8.5	6	
<i>Pterolepis glomerata</i>	1	0.021	11-19-2007	0.5	2	
<i>Tecoma capensis</i>	1	0.065	02-28-2008	31	4	
<i>Triumpheta semitriloba</i>	1	2.58	04-01-2008	13	4	
<i>Zingiber zerumbet</i>	1	0.46	10-16-2007	8.25	3	New site.

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	See Mokule‘ia Forest Reserve No MU
LZ	0	N/A	N/A	N/A	Will survey LZs once they are established
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.11 Management Unit: Pahole No MU**Weed Control Program Summary****Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
3	7.76	5.81	74.94%	12	1	Worked in 1 of 3 WCAs. Focused on weeds along Pahole road, as per agreement with the State.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Ehrharta stipoides</i>	1	0.00064	05-04-2007	0.5	2	
<i>Montanoa hibiscifolia</i>	1	0.025	12-11-2007	3.8	4	

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	See Mokule‘ia Forest Reserve No MU
LZ	0	N/A	N/A	N/A	No LZs currently used.
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.12 Management Unit: Upper Kapuna

MIP Species in MU

MUName: Upper Kapuna

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	A
-----------------------	---

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Kahanahaiki to West Makaleha
Chamaesyce herbstii	Kapuna to Pahole
Cyanea longiflora	Kapuna to West Makaleha
Cyanea superba subsp. superba	Pahole to Kapuna
Cyrtandra dentata	Pahole to Kapuna to West Makaleha
Delissea subcordata	Palikea Gulch
Delissea subcordata	Kahanahaiki to Keawapilau
Flueggea neowawraea	Kahanahaiki to Kapuna
Hesperomannia arbuscula	Kapuna
Phyllostegia kaalaensis	Pahole
Phyllostegia kaalaensis	Keawapilau to Kapuna
Schiedea kaalae	Pahole
Schiedea nuttallii	Kapuna-Keawapilau Ridge
Schiedea obovata	Keawapilau to West Makaleha

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Upper Kapuna	Complete	432/224	NARS staff contracted the construction of these four separate subunits, all of which are completed. Subunits I and II are pig free but III and IV are not. At this time, NARS staff are conducting volunteer hunts and running baited traps for pig control. When the volunteer hunter program is complete, snares and more traps will be incorporated into the program. NRS will assist at this point.	Pigs Goats

Rodent Control Program Summary

NRS sometimes conducts seasonal rodent control to facilitate *Cyanea superba* fruit collection.

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
11	4.47	0.91	20.33%	35.25	9	Worked in 4 of 11 WCAs. Focused on rare plant reintroduction sites. Of the 7 WCAs where no work was done, 3 require only yearly visits, and 4 are deemed low priority (fencelines, LZs, genetic storage collection populations).

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Angiopteris evecta</i>	3	4.45	02-21-2008	8.45	6	2 new sites. Need to survey to determine full range of Angeve in this MU.
<i>Desmodium intortum</i>	2	3.25	08-20-2008, immature	4.9	6	Identification complications with D. sandwicensis problematic.
<i>Ehrharta stipoides</i>	3	0.73	05-27-2008	9.75	10	1 new site.
<i>Fraxinus uhdei</i>	1	5.55	06-25-2007	0	0	Did not visit this year. Long term project
<i>Grevillea robusta</i>	1	98.32	05-02-2007	0	0	Did not visit this year. Long term project
<i>Neonotonia wightii</i>	2	1.01	08-20-2008	8	8	
<i>Rubus argutus</i>	2	0.12	06-24-2008, immature	2.5	2	1 new site. No plants known to be mature at either site, but very probable that mature plants were present at one point in time.
<i>Sphaeropteris cooperii</i>	1	0.057	10-03-2006	0.25	1	A few scattered individuals found.
<i>Triumpheta semitriloba</i>	1	0.42	09-10-2007	5	1	This site overlaps with another ICA, need to resolve location, naming. Also, need to reevaluate to see if truly incipient. Consult with NARS staff to see how they would like NRS to handle

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	Consider beginning surveys of access road to Kapuna; would be an offshoot of the Pahole Road
LZ	0	N/A	N/A	N/A	Begin surveys of LZs in coming year.
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.13 Management Unit: West Makaleha

MIP Species in MU

MUName: West Makaleha

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Plant

Cyanea grimesiana subsp. obatae	Pahole to West Makaleha
Cyanea longiflora	Kapuna to West Makaleha
Cyrtandra dentata	Pahole to Kapuna to West Makaleha
Delissea subcordata	Palikeya Gulch
Flueggea neowawraea	West Makaleha
Pritchardia kaalae	Ohikilolo
Schiedea obovata	Keawapilau to West Makaleha

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
West Makaleha	Partial	7/93	The <i>Schiedea obovata</i> and <i>Cyanea grimesiana</i> subsp. <i>obatae</i> PU fences are complete and pig free. A large MU fence has been proposed for construction in 2012. A final EA was approved with a Finding of No Significant Impact. Limited ungulate control has been done in the past in cooperation with NARS staff.	Pigs Goats

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Cyagrioba	West Makaleha	LEH-A	1.9	YR	8	61%	16	18	7
Delsub	West Makaleha	LEH-A	1.4	YR	5	73%	10	12	7

Baiting Duration: YR = Year Round (continuous baiting, 4-6 week interval).

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
2	2.68	1.15	43.09%	14.5	4	Visited one of 2 sites. Focused on more sensitive CyaGri habitat

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs established at this time

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	No roads in MU
LZ	0	N/A	N/A	N/A	Will survey LZs once they are established
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.14 Management Unit: East Makaleha

MIP Species in MU

MUName: East Makaleha

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	B2
-----------------------	----

TaxonGroup: Plant

Cyanea superba subsp. superba	Central and East Makaleha
Flueggea neowawraea	Central and East Makaleha
Hedyotis degeneri var. degeneri	East branch of East Makaleha
Pritchardia kaalae	Makaleha to Manuwai

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
East Makaleha	No	0/231	This unit is proposed for construction in 2010. Limited goat control has been done in the past in Central and East branches of Makaleha in cooperation with NARS staff.	Pigs Goats

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Prikaa	Makaleha	LEH-A	4.9	YR	19	84%	29	12	4

Baiting Duration: YR = Year Round (continuous baiting, 4-6 week interval).

Weed Control Program Summary

No weed control actions underway at this time. NRS will begin active management once the fence is complete.

1.15 Management Unit: Kaimuhole

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Kaimuhole	No	0/100	An Right of Entry is complete for rare plant monitoring. The Army has budgeted funds for the construction of this unit through 2011. NRS is still working out the details of this unit and looking to contract out the construction. An EA is needed for this MU.	Pigs Goats

Rodent Control Program Summary

Rodent control has not been deemed necessary for this MU at this time.

Weed Control Program Summary

No weed control actions underway at this time. NRS will begin active management once the fence is complete.

1.16 Management Unit: Manuwai

MIP Species in MU

MUName: Manuwai Subunit I

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Plant

Neraudia angulata	Manuwai
Phyllostegia kaalaensis	Manuwai

MUName: Manuwai Subunit II

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	C
-----------------------	---

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Manuwai
Delissea subcordata	Manuwai
Flueggea neowawraea	Mt. Kaala NAR
Hedyotis degeneri var. degeneri	Alaihehe and Manuwai
Melanthera tenuifolia	Mt. Kaala NAR
Pritchardia kaalae	Makaleha to Manuwai

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Manuwai	No	0/166	This unit is slated for construction in 2009 in cooperation with DLNR. A final EA was approved with a Finding of No Significant Impact. Limited ungulate control has been done in the past in Lower Ka'ala NAR in cooperation with NARS staff.	Pigs Goats

Rodent Control Program Summary

No rodent control actions underway at this time. Once the fence is complete, NRS will revisit the need for rodent control.

Weed Control Program Summary

No weed control actions underway at this time. NRS will begin active management once the fence is complete.

1.17 Management Unit: Lower Kaala NAR no MU**Weed Control Program Summary****Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
1	2.44	1.67	68.40%	8	1	Began work in this area in conjunction with State staff. Road maintenance. New WCA

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs identified at this time

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	Consider monitoring LKN road once begin work in nearby MUs.
LZ	0	N/A	N/A	N/A	Begin surveys once LZs are in use.
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.18 Management Unit: Kea‘au

MIP Species in MU

MUName: Keaau GouVit

TaxonName

Population Unit Name/ESU Site

TaxonGroup: Plant

Hibiscus brackenridgei subsp.
mokuleianus

Keaau

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Kea‘au	No	0/29	This <i>Gouania vitifolia</i> PU fence is slated for construction in 2009. The line has been partially scoped, an EA needs to be completed, and needs final approval from DLNR.	Pigs Goats

Rodent Control Program Summary

Rodent control has not been deemed necessary for this MU at this time.

Weed Control Program Summary

No weed control actions underway at this time. NRS will begin active management once the fence is complete.

1.19 Management Unit: Kea‘au and Mākaha

MIP Species in MU

MUName: Keaau and Makaha

TaxonName

Population Unit Name/ESU Site

TaxonGroup: Plant

Sanicula mariversa

Keaau

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Kea‘au and Mākaha	No	0/5	This <i>Sanicula mariversa</i> PU fence is slated for construction in 2009. The line has been scoped and measured and will be build in cooperation with DLNR .	Goats

Rodent Control Program Summary

Rodent control has not been deemed necessary for this MU at this time.

Weed Control Program Summary

No weed control actions underway at this time. NRS will begin active management once the fence is complete.

1.20 Management Unit: Kamaileunu**MIP Species in MU**

MUName: Kamaileunu

TaxonName

Population Unit Name/ESU Site

TaxonGroup: Plant

Sanicula maritima

Kamaileunu

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Kamaile'unu	Complete	5/2	This unit was completed in the last year. Upon scoping of the habitat the size of the completed fence was slightly larger than proposed, providing more habitat for restoration.	Pigs, Goats

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
1	2.08	0.09	4.19%	2	1	New site; created within new fence.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs designated at this time

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	No roads nearby
LZ	0	N/A	N/A	N/A	One LZ in region, will survey
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.21 Management Unit: Mākaha**MIP Species in MU****MUName: Makaha****TaxonName****Population Unit Name/ESU Site****TaxonGroup: Invertebrate***Achatinella mustelina*

D2

TaxonGroup: Plant*Alectryon macrococcus* var.
macrococcus

Makaha

Cenchrus agrimonioides var.
agrimonioides

Makaha and Waianae Kai

Chamaesyce herbstii

Makaha

Cyanea grimesiana subsp. *obatae*

Makaha

Cyanea longiflora

Makaha and Waianae Kai

Cyanea superba subsp. *superba*

Makaha

Flueggea neowawraea

Makaha

Hesperomannia arbuscula

Makaha

Melanthera tenuifolia

Kamaileunu and Waianae Kai

Phyllostegia kaalaensis

Makaha

Schiedea nuttallii

Makaha

Viola chamissoniana subsp.
chamissoniana

Makaha

Taxon Group: Vertebrate*Chasiempis sandwichensis* *ibidis* Makua Action Area in Makaha

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Mākaha	Partial	85/163	Subunit I is completed but not ungulate free. Several community/staff hunts have been completed and 18 pigs have been removed since June 2007. Subunit II and Subunit III are slated for construction in 2014. Need to scope and amend BWS MOU to contain fencing language or get CDUP. NRS has completed a small <i>Cyanea longiflora</i> PU fence within Subunit II.	Pigs Goats

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Cyagrioba	Makaha	MAK-A	0.8	FF	2	73%	4	0	2
Hesarb	Makaha	MAK-A	0.8	FF	2	NA	7	2	1

Baiting Duration: FF = during flowering and fruiting periods (bimonthly).

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
12	17.91	2	11.18%	419.5	22	Worked in 7 of 12 WCAs. 1 new WCA. Focused limited staff time on rare species habitat. High number of person hours is the result of work by Waianae High School students.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs identified in this region

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	No roads in region.
LZ	0	N/A	N/A	N/A	Will begin to conduct surveys at all LZs in this MU.
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.22 Management Unit: Mākaha No MU

MIP Species in the Area

MUName: Makaha No MU

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	D2
-----------------------	----

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Makaha
Dubautia herbstobatae	Makaha/Ohikilolo
Dubautia herbstobatae	Makaha
Flueggea neowawraea	Makaha
Melanthera tenuifolia	Kamaileunu and Waianae Kai
Neraudia angulata	Makaha
Nototrichium humile	Makaha
Pritchardia kaalae	Makaha
Tetramolopium filiforme	Makaha/Ohikilolo Ridge
Viola chamissoniana subsp. chamissoniana	Ohikilolo
Viola chamissoniana subsp. chamissoniana	Makaha/Ohikilolo Ridge
Viola chamissoniana subsp. chamissoniana	Makaha
Viola chamissoniana subsp. chamissoniana	Kamaileunu

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
2	1.1	0.08	7.55%	2	2	1 new site, installed within the new Kawīwī fence. Both WCAs controlled this year.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Ehrharta stipoides</i>	1	0.062	11-08-2007	0.25	1	New site. One plant found in parking region, growing out of asphalt. Probably tracked to region by NRS.

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	1	0	N/A	N/A	Did not survey this year. Road is paved and relatively low risk for weed spread. This survey will be prioritized in the coming year.
LZ	0	N/A	N/A	N/A	Will begin to conduct surveys at all LZs in this MU.
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.23 Management Unit: Wai‘anae Kai**MIP Species in MU****MUName: Waianae Kai**

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Plant

Neraudia angulata	Waianae Kai Makai
Nototrichium humile	Waianae Kai
Tetramolopium filiforme	Waianae Kai

MUName: Waianae Kai NerAng Mauka

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Plant

Neraudia angulata	Waianae Kai Mauka
-------------------	-------------------

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Wai'anāe Kai	Partial	.5/9	The <i>Hesperomannia arbuscula</i> and <i>Gouania vitifolia</i> PU fences are completed. There are two separate PU fences proposed for <i>Neraudia angulata</i> and one for <i>Nototrichium humile</i> . They will total about nine acres when completed. The Nerang PU fence has been scoped and partially cleared. The Nothum PU has been scoped and partially completed. The Nerang WAI-D PU fence has yet to be scoped. All three should be completed by the end of 2009.	Pigs Goats

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
1	0.93	0.05	5.08%	3	1	Continue to focus in NerAng habitat.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs established at this time

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	Consider monitoring Waianae Kai access road
LZ	0	N/A	N/A	N/A	Will survey LZs once they are established
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.24 Management Unit: Wai‘anae Kai No MU

MIP Species in the Area

MUName: Waianae Kai No MU

TaxonName	Population Unit Name/ESU Site
Chamaesyce celastroides var. kaenana	Waianae Kai
Neraudia angulata	Waianae Kai Makai

TaxonGroup: Plant

Chamaesyce celastroides var. kaenana	Waianae Kai
Neraudia angulata	Waianae Kai Makai

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
2	3.1	1.12	36.22%	183	6	Visited 1 of 2 sites. 1 new site. Effort focused on interagency work at the Kumaipo burn site.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs established at this time

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	Consider surveying access road.
LZ	0	N/A	N/A	N/A	Begin surveying LZs in coming year.
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.25 Management Unit: Pu'u Kūmakali'i

MIP Species in MU

MUName: Puu Kumakalii

TaxonName	Population Unit Name/ESU Site
TaxonGroup: Invertebrate	
Achatinella mustelina	D
TaxonGroup: Plant	
Tetramolopium filiforme	Puhawai
Viola chamissoniana subsp. chamissoniana	Puu Kumakalii

TaxonGroup: Invertebrate

TaxonGroup: Plant

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Pu'u Kūmakali'i	-	-	None needed	None

Rodent Control Program Summary

Rodent control has not been deemed necessary for this MU at this time.

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
1	0	0	0%	0	0	Did not visit this year. Steep cliff, sensitive area, visit every few years.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Schefflera actinophylla</i>	1	1.18	02-27-2006	0	0	Did not visit this year. One mature tree found at this site. Low priority.

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	No roads in region
LZ	0	N/A	N/A	N/A	Begin surveys in coming year.
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.26 Management Unit: Kalua‘ā and Wai‘eli

MIP Species in MU

MUName: Kaluaa and Waieli III

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	D1
-----------------------	----

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Central Kaluaa to Central Waieli
--	----------------------------------

MUName: Kaluaa and Waieli Subunit I

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	D
-----------------------	---

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Central Kaluaa to Central Waieli
Cyanea grimesiana subsp. obatae	South Kaluaa
Cyanea grimesiana subsp. obatae	Central Kaluaa
Delissea subcordata	Kaluaa
Schiedea kaalae	Kaluaa and Waieli

MUName: Kaluaa and Waieli Subunit II

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Central Kaluaa to Central Waieli
Cyanea grimesiana subsp. obatae	South Kaluaa
Flueggea neowawraea	Kaluaa
Plantago princeps var. princeps	Waieli
Schiedea kaalae	Kaluaa and Waieli

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Kalua'a and Wai'eli	Partial	132/154	Subunits I and II are completed and ungulate free. Subunit III is slated for construction in 2009. A possible line has been scoped and awaits approval from TNC.	Pigs

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats Trapped	# of Visits
Achmus	ESU-D1	KAL-A	2.6	YR	12	54%	24	9	8
Phyhir	Waiali	ELI-A							
Plapripri	Waiali	ELI-A							
Stekan	Kaluaa	KAL-D							

Baiting Duration: YR = Year Round (continuous baiting, 4-6 week interval).

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
14	11.89	2.8	23.51%	132.25	9	Worked in 5 of 14 WCAs. Focused in rare plant and snail habitat. 1 new site around proposed reintroduction.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Angiopteris evecta</i>	1	0.083	05-29-2007	0	0	Did not visit this year. Small population, biannual visits sufficient
<i>Ardesia elliptica</i>	1	35.28	05-31-2007	0	0	Did not visit this year. Crew short-staffed during much of year.
<i>Casuarina glauca</i>	1	0.014	01-04-2007	0	0	Did not visit this year. Population not actively expanding, NRS plan to remove slowly, as time is available

<i>Montanoa hibiscifolia</i>	1	2.12	05-31-2007	0	0	Did not visit this year
<i>Morella faya</i>	1	26.07	07-12-2007	0	0	Did not visit this year. Population not actively expanding, NRS plan to remove slowly, as time is available
<i>Panicum maximum</i>	1	0.58	04-04-2007	0	0	Did not visit this year
<i>Solanum capsicoides</i>	1	12.22	08-28-2008	5.5	2	New site.
<i>Toona ciliata</i>	2	0.49	06-26-2008	16	2	2 new sites
<i>Trema orientalis</i>	1	0.006	07-19-2007	0	0	Did not visit this year
<i>Setaria palmifolia</i>	1	0.034	11-29-06	0	0	Did not visit this year. NRS check incidentally during other field operations. ICA along a trail.

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	
LZ	0	N/A	N/A	N/A	Plan to begin surveys at all LZs
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.27 Management Unit: Kalua‘ā and Wai‘eli No Mu

MIP Species in the Area

MUName: Kalalua No MU

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

<i>Achatinella mustelina</i>	D
------------------------------	---

TaxonGroup: Plant

<i>Alectryon macrococcus</i> var. <i>macrococcus</i>	South Kaluaa
<i>Cyanea grimesiana</i> subsp. <i>obatae</i>	South Kaluaa

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
1	0.0006	0.0006	100.00%	0.5	1	New site. Very small area around CryMan

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs identified at this time.

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	Consider installing road survey through agricultural fields once ownership of land is settled.
LZ	0	N/A	N/A	N/A	Plan to begin surveys at all LZs
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.28 Management Unit: Wai‘eli No MU

MIP Species in the Area

MUName: Waieli No MU

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	D1
-----------------------	----

Achatinella mustelina	D
-----------------------	---

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	North Waieli
--	--------------

Alectryon macrococcus var. macrococcus	Central Kaluua to Central Waieli
--	----------------------------------

Viola chamissoniana subsp. chamissoniana	Puu Hapapa
--	------------

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats Trapped	# of Visits
Achmus	ESU-D1	SBS-B	1.9	YR	8	22%	14	10	7

Baiting Duration: YR = Year Round (continuous baiting, 4-6 week interval).

1.29 Management Unit: ‘Ēkahanui

MIP Species in MU

MUName: Ekahanui Subunit I

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	E
-----------------------	---

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Ekahanui
Chamaesyce herbstii	South Branch of South Ekahanui
Cyanea grimesiana subsp. obatae	North branch of South Ekahanui
Delissea subcordata	Ekahanui
Schiedea kaalae	South Ekahanui

MUName: Ekahanui Subunit II

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	E
-----------------------	---

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Ekahanui
Cenchrus agrimonioides var. agrimonioides	Central Ekahanui
Cyanea grimesiana subsp. obatae	North branch of South Ekahanui
Delissea subcordata	Ekahanui
Plantago princeps var. princeps	Ekahanui
Schiedea kaalae	South Ekahanui

Ungulate Control Effort Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
‘Ēkahanui	Partial	44/203	Subunit I is complete and ungulate free. Subunit II is partially completed and not ungulate free at this time. Only two very small sections (<200m) are needed to complete the fence. Four hunts have been completed with three animals removed.	Pigs

Rodent Control Effort Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats Trapped	# of Visits
Achmus	ESU-E	EKA-A-C, E, F	5.0	YR	21	28%	42	12	8
Plapripri	‘Ēkahanui	EKA-A-C							
Cyagrioba	‘Ēkahanui	EKA-B	1.0	BS, FF	3	56%	0	0	7

Baiting Duration: YR = Year Round (continuous baiting, 4-6 week interval), BS = Elepaio Breeding Season (January through June, bimonthly), FF = during flowering and fruiting periods (bimonthly).

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
11	5.38	0.74	13.72%	38.5	8	Worked in 5 of 11 WCAs. Focused on areas around rare plant reintroductions. The remaining WCAs are low priority (fenceline, restoration areas, genetic storage collection populations)

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs designated at this time

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	No roads
LZ	0	N/A	N/A	N/A	Plan to begin surveys at all LZs
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.30 Management Unit: 'Ēkahanui No MU

MIP Species in the Area

MUName: Ekahanui No MU

TaxonName

Population Unit Name/ESU Site

TaxonGroup: Plant

Alectryon macrococcus var.
macrococcus

Ekahanui

Delissea subcordata

Ekahanui

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
3	0.27	0.08	30.44%	12.5	1	Worked in 1 of 3 WCAs. Focused on AbuSan site. 2 other WCAs are low priority (genetic storage collection populations).

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs designated at this time

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	Consider installing road survey through agricultural fields once ownership of land is settled.
LZ	0	N/A	N/A	N/A	Plan to begin surveys at all LZs, particularly LZ-HON-99 (trailhead)
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.31 Management Unit: Palikea

MIP Species in MU

MUName: Palikea

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

<i>Achatinella mustelina</i>	F
------------------------------	---

TaxonGroup: Plant

<i>Cyanea grimesiana</i> subsp. <i>obatae</i>	Palikea (South Palawai)
<i>Delissea subcordata</i>	Palawai
<i>Hedyotis parvula</i>	Halona
<i>Hesperomannia arbuscula</i>	North Palawai
<i>Viola chamissoniana</i> subsp. <i>chamissoniana</i>	Halona

Ungulate Control Efforts Summary

Management Unit	Status	Acreage Protected/Proposed	Ungulate Control	Threats
Palikea	Partial	36/45	Subunit IA is complete. Subunit IB has been postponed until further consultation with the IT. A new population of <i>Hesperomannia arbuscula</i> was found in Napepe'iau'olelo this year, which is just north of Subunit IB. NRS decided to encompass the habitat surrounding this new population in the interim. The fence has been scoped and measured. It is slated for construction in 2008, NRS is just awaiting approval from TNC to build.	Pigs

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Achmus	ESU-F	PAK-A-C, E-I, L	10.6	YR	35	35%	74	57	9
Cyagrioba	Palikea	PAK-A, B	1.0	YR	3	50%	0	0	9

Baiting Duration: YR = Year Round (continuous baiting, 4-6 week interval). Additional protection of Cyagrioba plants by three nearby rat control grids for Achmus protection.

Weed Control Program Summary**Weed Control Areas**

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
5	10.23	1.27	12%	9	112.6	Worked in 2 of 5 WCAs. Low staffing levels resulted in narrower focus. 3 untreated WCAs are low priority (genetic storage populations)

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
<i>Crocosmia x crocosmifolia</i>	3	1.19	08-22-2008	84	6	New sites. Began control this year using volunteer labor. All control trips were volunteer trips.
<i>Setaria palmifolia</i>	1	0.086	N/A	0	0	Identified site this year, control to commence in next quarter

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	
LZ	0	N/A	N/A	N/A	Begin surveys in region in coming year
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.32 Management Unit: Palikea No MU

MIP Species in the Area

MUName: Palikea No MU

TaxonName	Population Unit Name/ESU Site
-----------	-------------------------------

TaxonGroup: Invertebrate

Achatinella mustelina	C
-----------------------	---

TaxonGroup: Plant

Alectryon macrococcus var. macrococcus	Palikea Gulch
Cyanea grimesiana subsp. obatae	Palikea Gulch
Delissea subcordata	Palikea Gulch
Flueggea neowawraea	Mt. Kaala NAR
Hedyotis degeneri var. degeneri	Alaiheihe and Manuwai
Hibiscus brackenridgei subsp. mokuleianus	Kaimuhole and Palikea Gulch
Nototrichium humile	Kaimuhole and Palikea Gulch (Kihakapu)
Phyllostegia kaalaensis	Palikea Gulch

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Hesarb	North Palawai	PAL-B	0.8	FF	2	16%	4	7	11

Baiting Duration: FF = during flowering and fruiting periods (bimonthly).

Weed Control Program Summary

Weed Control Areas

# of WCAs	WCA Area in Hectares	Hectares Controlled	% Area covered	Person hours	# trips	Notes
4	1.05	0.86	82.35%	6.1	3	Focused on 1 of 4 WCAs. Controlled EhrSti along trail corridor to reduce potential for spread. Other 3 WCAs are low priority areas, requiring annual or biannual visits only.

Incipient Control Areas

Taxa	# of ICAs	Acreage of ICAs	Date last mature plant found	Person hours	# trips	Notes
						No ICAs identified in this region

Surveys

Type	# of surveys	# new surveys	Length	Significant New Pest Species	Notes
Road	0	N/A	N/A	N/A	Consider surveying Palikea access road; incidental observations resulted in discovery of <i>Olea europa</i> , new record for Bishop Museum
LZ	0	N/A	N/A	N/A	Begin surveys in region in coming year
Transect	0	N/A	N/A	N/A	No transects installed at current time

1.33 Management Unit: Mauna Kapu No MU

Rodent Control Efforts Summary

Species	PU/ESU/ Sub Population	Population Reference Site	Area Protected (acres)	Baiting Duration	# of Stations	Percent Bait Taken	# of Traps	# of Rats trapped	# of Visits
Achmus	ESU-F	MAU-A	1.4	YR	5	49%	10	15	9

Baiting Duration: YR = Year Round (continuous baiting, 4-6 week interval).

Chapter 2.0: RARE PLANT STABILIZATION PLAN STATUS

General Rare Plant Issues

This section includes population status updates, the current genetic storage status for each MIP taxon and a brief discussion of highlights from the last year and priority actions for the next year. The requirements for stabilization are to achieve a stable number of mature plants, a population structure which can maintain that number of mature plants, obtain full genetic storage, and control all observed threats at each Manage For Stability (MFS) PU. This will be done by implementing Population Unit (PU) and Management Unit (MU) actions at all of the MFS PUs. All management actions are discussed in the Ecosystem Management section. The current list of MFS PUs were proposed in the 2007 Status Report. Management designation changes discussed at last years IT meeting have been incorporated into this report.

Propagation infrastructure

The new shade-house at the Pahole Mid-elevation Nursery is complete and NRS expect to have the irrigation infrastructure and the rest of the ground work complete in the next year. NRS has continued to work with State NARS Horticulturist, Doug Okamoto, on projects at the Pahole Mid-Elevation Nursery and on stock from Pahole NAR. Another large shade-house has been completed at the new NRS baseyard on Schofield Barracks West Range. These new facilities have greatly increased propagation capabilities and should be able to produce more plants for outplanting in the coming years. The Lyon Arboretum Micropropagation Lab is used to maintain and clone important collections and to germinate seeds from immature fruit. All seed collections are processed and stored at the Schofield Barracks East Range baseyard by NRS staff.

Research Issues

NRS continues to support work by researchers from the University of Hawai‘i on taxa covered by the MIP. In the last year NRS has worked to facilitate research by Lauren Weisenberger (*Schiedea*), Dr. Cliff Morden (*Chamaesyce*), Maggie Spork (*Chamaesyce*) and Richard Pender (*Cyanea superba* subsp. *superba*). All projects are supervised and approved by NRS and all of these projects will continue in the coming year. Research issues related threats to MIP taxa are discussed in detail in the Species Status Summary for each taxon.

Example of Species Status Summary

The species status summary outlines all PU work conducted for each of the 28 MIP taxa. Each species summary has the same format. Each section is explained in detail in the example below:

Requirements for Stability: This section defines requirements for reaching stability for each taxon.

- 3 Population Units (PUs) are designated for all species. However, for species meeting the following criteria 4 PUs have been designated:
 - with presence in both Mākua Action Area (AA) and Schofield AA (Example: *Plantago princeps*)
 - for species occurring in the high fire threat area of the Mākua AA (Example *Chamaesyce celastroides*)
 - for taxa that have no extant wild PUs and therefore rely completely on reintroduction for stability (Example *Cyanea superba*)
- [25-100] reproducing individuals in each PU (justification based on the number of individuals, average life span, life form, and other factors from the final MIP)
- Threats controlled: may include fences, weed control, arthropod and rodent control
- Complete genetic representation of all PUs in storage: may include nursery living collections, seed storage, and tissue culture storage

*Example 'Taxon Status' Table***Table 2.1 Taxon Status Summary**

Action Area: In															
TaxonName: Cenchrus agrimonioides var. agrimonioides								TaxonCode: CenAgrAgr							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2006	NRS Immature 2006	NRS Seedling 2006	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Kahanahaiki and Pahole	Manage for stability	81	11	7	227	30	2	311	47	31	308	41	9	Some reintroductions have died in the last year.	
Total for Taxon:		81	11	7	227	30	2	311	47	31	308	41	9		
Action Area: Out															
TaxonName: Cenchrus agrimonioides var. agrimonioides								TaxonCode: CenAgrAgr							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2006	NRS Immature 2006	NRS Seedling 2006	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Central Ekahanui	Manage for stability	30	3	16	52	1	0	86	3	16	82	4	16	Some reintroductions have died in the last year.	
Makaha and Waianae Kai	Manage for stability	12	0	0	0	0	0	14	0	0	12	0	0	This is a real decline due to ungulate impacts.	
South Huliwai	Genetic Storage	21	0	0	0	0	0	21	0	0	21	0	0	No monitoring in the last year.	
Total for Taxon:		63	3	16	52	1	0	121	3	16	115	4	16		

This table displays the current status of the wild and outplanted plants in each PU and the 2007 population estimates for comparison. The extant PUs are grouped into those in and out of the AA.

Mākua Population Unit Name: Only PUs designated to be Manage for Stability (MFS) or Genetic Storage (GS) are shown in the table. Other PUs with No Management designations are not monitored or managed and will not be reported. Reintroductions for stability or storage which have not yet begun are shown in the table with zeros for population numbers.

Management Designation: The Management Designation for each PU is based on decisions made at the last MIT meeting. Naturally occurring PUs are either MFS or GS. In the case where reintroduction is going to be used to reach stability, the designation is Manage Reintroduction for Stability. When a reintroduction will be used for producing propagules for storage, the designation is Manage Reintroduction for Storage. When four MFS PUs are designated the justification is given in the discussion.

Current Mature, Immature, Seedling (Wild): The first three columns reflect the most up to date population estimates of the wild plants in each PU. In most cases these numbers are generated from NRS monitoring data, but data from the O‘ahu Plant Extinction Prevention Program (PEP) and State NARS staff are used for some PUs. The current estimates reported may have changed from last year if new monitoring data was taken or if the PUs have been split or merged since the last reporting period. If no additional monitoring was conducted in the last year, the estimate given in the 2007 Status Report is used.

Current Augmented Mature, Immature, Seedling: The second set of three columns display the numbers of individuals NRS and partner agencies have outplanted into each PU. In most cases, the number represents augmentations into the existing PU rather than reintroductions of genetic stock from that PU into other areas. While most augmentations of a PU will be from genetic stock from that PU, there are exceptions discussed in the text.

NRS Mature, Immature and Seedling 2007: NRS reports the *sum of the number of wild and outplanted* mature, immature plants and seedlings observed, as reported in the *Taxon Status* Table for each PU in the 2007 MIP Status Report. For new populations discovered since the 2007 MIP Status Report, this column is left blank. If a PU was split, thus creating a new population division, a zero is used in order to distinguish it from entirely new PUs which are left blank.

Total Mature, Immature, Seedling: The **sum** of the current numbers of wild and outplanted individuals in each PU. This number will be used to determine if each PU has reached the goal for the number of reproductive individuals required for stability. These three columns should be compared with the NRS 2007 estimates to determine the trend for each PU in the last year.

Population Trend Notes: Comments on the general population trend of each PU is given here. This may include notes on whether the PU was monitored in the last year, a brief discussion of the changes in population numbers from the 2007 numbers to the current ones, and some explanation of whether the change is due to new plants being discovered in the same site, a new

site being found, reintroductions or augmentations that increased the numbers or fluctuations in the numbers of wild plants. In some cases where the numbers have not changed, NRS has monitored the PU and observed no change. In other cases when the PU has not been monitored, the number from 2007 is used.

Example ‘Genetic Storage Summary’ Table

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >=1 Microprop	# Plants >=1 Army Nursery	# Plants that Met Goal
<i>Cenchrus agrimonioides</i> var. <i>agrimonioides</i>							
Central Ekahanui	30	3	1	15	0	26	6
Kahanahaiki and Pahole	71	11	15	47	0	35	29
Makaha and Waianae Kai	14	0	0	0	0	14	5
South Huliwai	21	0	0	11	0	9	6
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				73	0	84	46

This table shows the status of NRS’s and partner agencies’ (including TNC, Honolulu Board of Water Supply (BWS), PEP and the State NARS) collections.

Number of Potential Founders: This column lists the current live immature and mature plants which have been collected from or may be collected from in the future and the number of dead plants from which collections were made in the past. Immature plants are included as founders for all taxa because of database limitations, but they can only serve as founders for some taxa. For example, for *Hibiscus brackenridgei*, cuttings can be taken from immature plants for propagation. In comparison, for *S. mariversa*, cuttings are not taken and seeds are the primary propagule used in collecting for genetic storage. Therefore, the number of potential founders for *S. mariversa* is over-estimated. ‘Manage reintroduction for stability’ PUs may be on this list but have zero potential founders because the stock for reintroduction is coming from another PU.

Partial Storage Status: According to the plant stabilization plans, for taxa where seed storage is the preferred genetic storage method, up to 50 seeds should be collected from each of up to 50 plants per population. Since the MIP is in the early stages of implementation, NRS felt it was important to show how many plants are part of the way to reaching this goal. The table displays the number of plants for which >10 seeds are in storage. This column does not show the total number of seeds in storage; in some cases thousands of seeds have been collected from one plant. The goal for vegetative collections is a minimum of three clones per plant in either the Lyon Micropropagation Lab or the Army or Pahole Mid-elevation Nursery. Plants with one or more plant in either the Lyon Micropropagation Lab or the nursery are reported here.

Storage Goals Met: This column displays the total number of plants per PU that have met the MIP collection goals. The plant is included if it has 50 seeds in storage, or three clones in

micropropagation or three in the nursery. For some PUs, the number of founders has increased in the last year, therefore; it is feasible that NRS could be farther from reaching our collection goals than last year. In other PUs where collections have been happening for many years, the number of founders represented in genetic storage may exceed the number of plants currently in each PU. In some cases, plants that are being grown for reintroductions are being counted for genetic storage. These plants will eventually leave the greenhouse and the genetic storage goals will be met by retaining clones of all available founders or by seeds in storage.

2.1 *Alectryon macrococcus* var. *macrococcus*

Requirements for stability

- 4 Population Units (PUs)
- 50 reproducing individuals in each PU (long-lived perennial with reproductive problems)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues for Year 4

- The stability goal of 50 reproducing individuals has been met for the Mākaha PU
- Many of the trees in the Central Kalua‘ā to Central Wai‘eli and South Mohiākea PUs were air layered in the last year. Some air layers were killed by rats and Black Twig Borer (BTB) (*Xylosandrus compactus*), others are still on the trees forming roots and a few died after being removed from the tree.
- Monitoring in the last year has been focused on the Central Kalua‘ā to Central Wai‘eli PU and documented a significant decline. The population size reported in 2007 was based on surveys from 2000-2004. Recent observations in those areas reported many dead trees and most of the live trees are in poor condition.

Plans for Year 5

- Continue to monitor the air layers currently installed on trees in the Central Kalua‘ā PU.
- Initiate air layering on trees in the Mākua and Mākaha PUs.
- Continue rat baiting and collection of mature fruit at the Mākua PU.
- Continue research on BTB control using traps baited with ethanol in combination with repellants.
- Conduct thorough census of both the Mākaha and Kahanahāiki to West Makaleha PUs to update population numbers, search for flowering and fruiting trees and prioritize individuals to air layer.
- Search for healthy trees to air layer in the PUs with ‘No Management’ designation.
- Begin construction of a large fence around the remaining wild trees and potential future reintroduction sites in the Wai‘eli Gulch portion of the Central Kalua‘ā to Central Wai‘eli PU.

Table 2.1 Taxon Status Summary

Action Area: In														
TaxonName: <i>Alectryon macrococcus</i> var. <i>macrococcus</i>								TaxonCode: AleMacMac						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kahanahāiki to West Makaleha	Manage for stability	36	4	0	0	3	0	38	8	0	36	7	0	One of the immature plants in the reintroduction was observed dead
Makua	Manage for stability	30	0	0	0	0	0	33	0	0	30	0	0	A few of the known trees were observed dead in the last year
South Mohiākea	Genetic Storage	4	0	0	0	0	0	5	0	0	4	0	0	One additional plant died in the last year
Total for Taxon:		70	4	0	0	3	0	76	8	0	70	7	0	
Action Area: Out														
TaxonName: <i>Alectryon macrococcus</i> var. <i>macrococcus</i>								TaxonCode: AleMacMac						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Central Kāluā to Central Wāialei	Manage for stability	19	1	0	0	8	0	52	9	1	19	9	0	Monitoring in the last year documented a significant decline since 2004
Makaha	Manage for stability	63	5	2	0	0	0	63	5	2	63	5	2	Monitoring in the last year showed no change
Wāianae Kai	Genetic Storage	6	0	0	0	0	0	6	0	0	6	0	0	No monitoring in the last year
Total for Taxon:		88	6	2	0	8	0	121	14	3	88	14	2	

Table 2.2 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num Wild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Alectryon macrococcus</i> var. <i>macrococcus</i>							
Central Kaluaa to Central Waieli	19	1	0	0	0	1	0
Kahanahaiki to West Makaleha	36	4	0	0	0	0	0
Makaha	63	5	0	0	0	0	0
Makua	30	0	0	0	1	3	1
South Mohiakea	4	0	0	0	0	1	0
Waianae Kai	6	0	0	0	0	0	0
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				0	1	5	1

2.2 Cenchrus agrimonioides var. agrimonioides

Requirements for Stability

- 3 Population Units (PUs)
- 50 reproducing individuals in each PU (short-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- The stability goal of 50 reproducing individuals has been met for the Central 'Ēkahanui and Kahanahāiki to Pahole PUs.
- The genetic storage goals will be met by storing seeds from wild and reintroduced plants. Until seed collections can be stored from all founders, clones will be kept in the greenhouse for propagation and will serve as temporary genetic storage.
- NRS has initiated the reintroduction at the Mākaha to Wai'anae Kai PU.
- Reintroduction to balance founders at the Kahanahāiki to Pahole PU according to the planting strategy presented in the 2006 MIP report is ongoing.
- The 'Ēkahanui Management Unit fence was completed around the Central 'Ēkahanui PU.

Plans for Year 5

- Continue to supplement reintroductions at the Mākaha and Wai'anae Kai, Central 'Ēkahanui and Kahanahāiki to Pahole PUs to balance founders.
- Initiate collection of mature seed for genetic storage from the reintroductions in the Kahanahāiki to Pahole PU and Central 'Ēkahanui PUs.
- NRS may work with an outside researcher to design a population viability analysis for the reintroduction sites in the Kahanahāiki to Pahole PU.

Table 2.3 Taxon Status Summary

Action Area: In															
TaxonName: Cenchrus agrimonioides var. agrimonioides								TaxonCode: CenAgrAgr							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Kahanahaiki and Pahole	Manage for stability	81	12	3	250	32	8	308	41	9	331	44	11	Additional plants were reintroduced to existing sites in the last year and new plants have been observed within both wild and reintroduction sites.	
Total for Taxon:		81	12	3	250	32	8	308	41	9	331	44	11		
Action Area: Out															
TaxonName: Cenchrus agrimonioides var. agrimonioides								TaxonCode: CenAgrAgr							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Central Ekahanui	Manage for stability	30	3	16	60	7	0	82	4	16	90	10	16	An additional reintroduction site was established in the last year.	
Makaha and Waianae Kai	Manage for stability	12	0	0	8	0	0	12	0	0	20	0	0	A new reintroduction site was added in the last year.	
South Huliwai	Genetic Storage	21	0	0	0	0	0	21	0	0	21	0	0	Monitoring showed no change in the last year.	
Total for Taxon:		63	3	16	68	7	0	115	4	16	131	10	16		

Table 2.4 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Cenchrus agrimonioides</i> var. <i>agrimonioides</i>							
Central Ekahanui	30	3	1	11	0	27	10
Kahanahaiki and Pahole	81	12	25	47	0	39	39
Makaha and Waianae Kai	12	0	1	3	0	5	1
South Huliwai	21	0	2	10	0	19	12
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				71	0	90	62

2.3 *Chamaesyce celastroides* var. *kaenana*

Requirements for Stability

- 4 Population Units (PU)
- 25 reproducing individuals in each population (long-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues for Year 4

- The stability goal of 25 reproducing individuals has been met for the Mākua, Ka‘ena and Keawa‘ula (Ka‘ena) and Pua‘akānoa Manage for Stability PUs.
- All PUs were monitored in the last year. A few more plants were discovered in the Kaluakauila and Ka‘ena and Keawa‘ula (Keawa‘ula) PUs and no change was observed at the Wai‘anae Kai PU.
- The Genetic Storage goals for the Mākua and Ka‘ena and Keawa‘ula (Ka‘ena) PUs have been met with both having at least 50 plants represented in seed storage.

Plans for Year 5

- Conduct thorough monitoring at the Ka‘ena and Keawa‘ula (Ka‘ena) PU to focus on locating and determining population estimates for the younger age classes.
- Monitor the Ka‘ena (East of ‘Ālau) PU to determine if threat management will allow the number of reproducing plants to increase to 25 or if augmentation is required.
- NRS will continue seed collections for genetic storage from PUs where the storage goals have not been met and those with a high threat from fire.
- Continue to facilitate research on *Chamaesyce* by the UH Botany Department.
- NRS will monitor the accessible plants in the Wai‘anae Kai PU to begin planning genetic storage collections.

Table 2.5 Taxon Status Summary

Action Area: In														
TaxonName: Chamaesyce celastroides var. kaenana								TaxonCode: ChaCelKae						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
East Kahanahaiki	Genetic Storage	2	0	0	0	0	0	2	0	0	2	0	0	Monitoring showed no change in the last year.
Kaluakaula	Genetic Storage	8	4	0	0	0	0	8	4	0	8	4	0	Two more mature plants were discovered in the known site this year.
Makua	Manage for stability	89	45	20	0	0	0	89	45	20	89	45	20	Monitoring showed no change in the last year.
North Kahanahaiki	Genetic Storage	177	0	0	0	0	0	177	0	0	177	0	0	Monitoring showed no change in the last year.
Puaakanoa	Manage for stability	160	10	0	0	0	0	160	10	0	160	10	0	Monitoring showed no change in the last year.
Total for Taxon:		436	59	20	0	0	0	434	59	20	436	59	20	

Action Area: Out														
TaxonName: Chamaesyce celastroides var. kaenana								TaxonCode: ChaCelKae						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kaena (East of A lau)	Manage for stability	21	4	20	0	0	0	21	4	20	21	4	20	Monitoring showed no change in the last year.
Kaena and Keawaula (Kaena)	Manage for stability	300	0	0	0	0	0	300	0	0	300	0	0	Monitoring showed no change in the last year.
Kaena and Keawaula (Keawaula)	Genetic Storage	51	4	2	0	0	0	47	1	2	51	4	2	A few more plants were observed in the known sites.
Waianae Kai	Genetic Storage	33	0	0	0	0	0	33	0	0	33	0	0	Monitoring showed no change in the last year.
Total for Taxon:		405	8	22	0	0	0	401	5	22	405	8	22	

Table 2.6 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Chamaesyce celastroides</i> var. <i>kaenana</i>							
East Kahanahaiki	2	0	0	1	0	0	0
Kaena (East of Alau)	21	4	0	21	0	0	19
Kaena and Keawaula (Kaena)	300	0	0	53	0	0	51
Kaena and Keawaula (Keawaula)	51	4	0	22	0	0	13
Kaluakauila	8	4	0	1	0	0	0
Makua	89	45	6	71	0	0	59
North Kahanahaiki	177	0	17	13	0	0	11
Puaakanoa	160	10	0	14	0	0	3
Waianae Kai	33	0	0	0	0	0	0
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				196	0	0	156

2.4 *Chamaesyce herbstii*

Requirements for Stability

- 3 Population Units (PUs)
- 25 reproducing individuals in each PU (long-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- Stability goal of 25 reproducing individuals met for the Kapuna to Pahole PU. There are 34 mature and 11 immature plants in the wild sites. In addition to the wild sites, 65 plants have been established in a reintroduction in Pahole.
- Large management unit fences now enclose all of the known plants and the reintroduction in Mākaha.
- The reintroductions in both the Kapuna to Pahole and Mākaha PUs have high survivorship. After pigs initially disturbed a few plants after they were planted at the Mākaha reintroduction site, 78% (29/37) have survived. At the Pahole site, 91% (63/69) have survived. Plants reached maturity soon after planting with prolific flowering and fruiting. Two immature plants were observed for the first time this year at the Pahole reintroduction site.
- Mature seed continues to be collected for propagation for reintroduction from the wild plants in the Kapuna to Pahole PU.
- An extensive seed collection was made at the Pahole reintroduction. The seed was used to set up storage studies to determine the most appropriate storage conditions for this taxon. Germination results from seeds stored for propagation have indicated that seeds stored dry and frozen for 4 years have remained viable.
- An individual planted in the Pahole augmentation that was grown from seed collected from a wild plant in Kapuna is suspected to be a hybrid. This plant will be removed from the augmentation this year. Material from this plant has been submitted to Dr. Cliff Morden for genetic analyses. NRS will continue to monitor the site for any other suspected hybrids.

Plans for Year 5

- Continue to collect from wild founders in the Kapuna to Pahole PU to supplement the Pahole and Mākaha reintroductions.
- Supplement both the Mākaha and Pahole reintroduction with plants from underrepresented or additional founders .
- Continue to facilitate research on *Chamaesyce* by the UH Botany Department

Table 2.7 Taxon Status Summary

Action Area: In														
TaxonName: <i>Chamaesyce herbstii</i>								TaxonCode: ChaHer						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kapuna to Pahole	Manage for stability	34	11	0	23	44	0	67	57	0	57	55	0	Additional plants were added to the reintroduction in the last year and new immature plants were observed at that site.
Total for Taxon:		34	11	0	23	44	0	67	57	0	57	55	0	
Action Area: Out														
TaxonName: <i>Chamaesyce herbstii</i>								TaxonCode: ChaHer						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Makaha	Manage reintroduction for stability	0	0	0	6	23	0	0	22	0	6	23	0	A few of the reintroduced plants were observed to be mature in the last year.
West Makaleha	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	To be reintroduced when the MU fence is complete
Total for Taxon:		0	0	0	6	23	0	0	22	0	6	23	0	

Table 2.8 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current	Current	NumWild	# Plants	# Plants	# Plants	# Plants
	Mature	Imm.	Dead	>= 10 in Seedbank	>= 1 Microprop	>= 1 Army Nursery	that Met Goal
<i>Chamaesyce herbstii</i>							
Kapuna to Pahole	34	11	19	21	0	26	17
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				21	0	26	17

2.5 *Cyanea grimesiana* subsp. *obatae*

Requirements for Stability

- 4 Population Units (PUs)
- 100 reproducing individuals in each PU (short-lived perennial with large fluctuations in population size and recent history of decline)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- Genetic storage goals have been met for all available founders in the North branch of South 'Ēkahanui, South Kalua'ā, Mākaha, and Central Kalua'ā PUs.
- Reintroductions have begun in all Manage for Stability PUs.
- Mature, viable seed was collected from the last (fifth) Pahole founder, represented at the Pahole reintroduction. Propagation is currently underway to reintroduce more of this stock into the Pahole reintroduction.
- Seed was sent to the National Center for Genetic Resource Preservation in Colorado for -150°C (LN₂) storage testing.
- A large scale management unit fence was completed at Pu'u Palikea. It includes more *C. grimesiana* habitat for use in additional augmentations of the Palikea (South Pālāwai) PU.
- Another large scale management unit fence was completed at 'Ēkahanui. It includes more *C. grimesiana* habitat for use in additional augmentations of the North branch of South 'Ēkahanui PU.
- Construction of the large scale management unit fence in the Kapuna and Keawapilau portion of the Pahole to West Makaleha PU has been completed by Oahu NARS.

Plans for Year 5

- Supplement the reintroductions at 'Ēkahanui, Pahole and Kalua'ā.
- Prepare Pahole stock for reintroduction. After mature, collect seed for use in additional reintroductions and storage.
- Begin augmentation of the West Makaleha portion of the Pahole to West Makaleha PU
- Continue to collect seed for storage and propagation for future reintroductions from the plant in the Mākaha PU.
- Continue to collect for genetic storage from the individual at Palikea Gulch, and from any newly mature founders in the Pahole to West Makaleha and Palikea (South Pālāwai) PUs.

Table 2.9 Taxon Status Summary

Action Area: In															
TaxonName: <i>Cyanea grimesiana</i> subsp. <i>obatae</i>								TaxonCode: CyaGriOba							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Pahole to West Makaleha	Manage for stability	6	6	4	28	9	0	25	8	9	34	15	4	The seedlings at the wild site were observed as immature in the last year and a new reintroduction site was established in Pahole	
Total for Taxon:		6	6	4	28	9	0	25	8	9	34	15	4		

Action Area: Out															
TaxonName: <i>Cyanea grimesiana</i> subsp. <i>obatae</i>								TaxonCode: CyaGriOba							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Central Kaluua	Manage for stability	1	0	0	10	45	0	19	30	0	11	45	0	Additional plants were added to existing reintroduction sites and some of the reintroduced mature plants have died	
Makaha	Manage for stability	1	0	0	0	0	0	1	0	0	1	0	0	This plant has been observed in the last year	
North branch of South Ekahanui	Genetic Storage	0	0	0	30	0	0	23	14	0	30	0	0	All of the reintroduced plants have matured in the last year	
Palikea (South Palawai)	Manage for stability	10	35	0	78	4	0	71	25	10	88	39	0	An increase in the wild site was observed and additional plants were reintroduced in the last year	
Palikea Gulch	Genetic Storage	0	1	0	0	0	0	0	1	0	0	1	0	This plant has been observed in the last year	
South Kaluua	Genetic Storage	0	0	0	5	14	0	9	8	0	5	14	0	Monitoring showed no change in the last year	
Total for Taxon:		12	36	0	123	63	0	123	78	10	135	99	0		

Table 2.10 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Cyanea grimesiana</i> subsp. <i>obatae</i>							
Central Kaluaa	1	0	0	1	0	1	1
Makaha	1	0	0	1	0	1	1
North branch of South Ekahanui	0	0	2	1	2	2	2
Pahole to West Makaleha	6	6	3	9	0	7	9
Palikea (South Palawai)	10	35	4	13	5	5	13
Palikea Gulch	0	1	0	0	0	0	0
South Kaluaa	0	0	1	1	0	1	1
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				26	7	17	27

2.6 *Cyanea longiflora*

Requirements for Stability:

- 3 Population Units (PUs)
- 75 reproducing individuals in each PU (short-lived perennial with fluctuating population numbers and trend of local decline)
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- A large scale management unit fence was completed by O‘ahu NARS in the Kapuna and Keawapilau portion of the Kapuna to West Makaleha PU. No plants in this PU are threatened by ungulates.
- The reintroduction in West Makaleha has an 83% survivorship since 2005.
- Mature seed was collected for genetic storage and propagation from additional founders in the Kapuna to West Makaleha PU. So far, there are seeds stored from 54 individual plants from all PUs.

Plans for Year 5

- Continue to supplement the reintroductions in the Kapuna to West Makaleha PU and determine new outplanting sites.
- Work with NARS to develop an augmentation strategy for the Pahole PU.
- NRS will continue to collect seeds from unrepresented individuals in all PUs for genetic storage.
- Begin augmentation of the Mākaha and Wai‘anae Kai PU.

Table 2.11 Taxon Status Summary

Action Area: In														
TaxonName: <i>Cyanea longiflora</i>								TaxonCode: CyaLon						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kapuna to West Makaleha	Manage for stability	23	13	1	12	14	0	23	35	4	35	27	1	Many of the reintroduced plants have matured in the last year
Pahole	Manage for stability	51	43	15	0	0	0	50	63	22	51	43	15	The population estimate was revised after thorough monitoring of the wild sites in the last year
Total for Taxon:		74	56	16	12	14	0	73	98	26	86	70	16	

Action Area: Out														
TaxonName: <i>Cyanea longiflora</i>								TaxonCode: CyaLon						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Makaha and Waianae Kai	Manage for stability	2	10	0	0	0	0	3	5	2	2	10	0	The population estimate was revised after thorough monitoring of the wild site in the last year
Total for Taxon:		2	10	0	0	0	0	3	5	2	2	10	0	

Table 2.12 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Cyanea longiflora</i>							
Kapuna to West Makaleha	23	13	2	16	1	4	16
Makaha and Waianae Kai	2	10	2	2	1	1	2
Pahole	51	43	7	36	1	3	36
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				54	3	8	54

2.7 Cyanea superba* subsp. *superba

Requirements for Stability

- 4 Population Units (PUs)
- 50 reproducing individuals in each PU (long-lived perennial with a history of precipitous decline, extirpated in the wild, and extremely low genetic variability)
- Threats controlled
- Complete genetic representation in storage of all PUs

Major Highlights/Issues Year 4

- Stability goal of 50 reproducing individuals met with reintroduction at the Pahole to Kapuna PU.
- The genetic storage goal for the 3 original founders in the Kahanahāiki PU has been met.
- The only remaining F₁ individual from the fourth original founder (MMR-A-2) has died. It was planted in the Kahanahāiki reintroduction site but died before mature seed could be collected.
- Additional plants were added to the reintroductions in Kahanahāiki and Pahole to balance the 3 available founders.
- NRS is currently supporting research to document the reproductive biology of *C. superba* by UH graduate student Richard Pender.
- A large scale management unit fence was completed by O‘ahu NARS in the Kapuna portion of the Pahole to Kapuna PU.

Plans for Year 5

- Begin reintroduction of the Mākaha PU.
- Continue to balance founders at the reintroduction sites in both the Kahanahāiki and Pahole to Kapuna PUs.
- Continue slug control research with Sluggo® in the field.

Table 2.13 Taxon Status Summary

Action Area: In														
TaxonName: <i>Cyanea superba</i> subsp. <i>superba</i>								TaxonCode: CyaSupSup						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kahanahaiki	Manage for stability	0	0	0	18	126	0	19	92	0	18	126	0	Additional plants were added to the reintroduction
Total for Taxon:		0	0	0	18	126	0	19	92	0	18	126	0	
Action Area: Out														
TaxonName: <i>Cyanea superba</i> subsp. <i>superba</i>								TaxonCode: CyaSupSup						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Central and East Makaleha	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	This reintroduction will begin when the MU fence is complete
Makaha	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	This reintroduction will begin in January 2009
Pahole to Kapuna	Manage reintroduction for stability	0	0	0	92	85	0	72	68	0	92	85	0	Additional plants were added to the reintroduction
Total for Taxon:		0	0	0	92	85	0	72	68	0	92	85	0	

Table 2.14 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Cyanea superba</i> subsp. <i>superba</i>							
Kahanahaiki	0	0	6	3	3	3	3
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				3	3	3	3

2. 8 *Cyrtandra dentata*

Requirements for Stability:

- 4 Population Units (PUs)
- 50 reproducing individuals in each PU (short-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- The stability goal of 50 reproducing individuals has been met for the Kahanahāiki and Pahole to Kapuna to West Makaleha PUs.
- The genetic storage goals have been met for the Pahole to Kapuna to West Makaleha PU.
- NRS continue to work on a license agreement with Kamehameha Schools for fencing and other management at the ‘Ōpae‘ula and Kawai Iki PUs.
- A large management unit fence around most of the plants in the Kapuna and Keawapilau sections of the Pahole to Kapuna to West Makaleha PU was completed.

Plans for Year 5

- Monitor the ‘Ōpae‘ula PU and determine the fence line placement.
- Establish genetic storage collections from the Central Makaleha, Kawai Iki and ‘Ōpae‘ula PUs.
- Work with Botanist Joel Lau to update population estimates of pure *C. dentata* in the Kawai Iki PU.

Table 2.15 Status Summary

Action Area: In														
TaxonName: <i>Cyrtandra dentata</i>								TaxonCode: CyrDen						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kahanahaiki	Manage for stability	156	57	27	0	0	0	156	57	27	156	57	27	No monitoring in the last year
Pahole to Kapuna to West Makaleha	Manage for stability	542	530	173	0	0	0	534	520	171	542	530	173	No monitoring in the last year
Total for Taxon:		698	587	200	0	0	0	690	577	198	698	587	200	

Action Area: Out														
TaxonName: <i>Cyrtandra dentata</i>								TaxonCode: CyrDen						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Central Makaleha	Genetic Storage	3	0	0	0	0	0	3	0	0	3	0	0	No monitoring in the last year
Kawaiki (Koolaus)	Manage for stability	15	31	39	0	0	0	15	31	39	15	31	39	No monitoring in the last year
Opaeula (Koolaus)	Manage for stability	16	12	0	0	0	0	16	12	0	16	12	0	No monitoring in the last year
Total for Taxon:		34	43	39	0	0	0	34	43	39	34	43	39	

Table 2.16 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Cyrtandra dentata</i>							
Central Makaleha	3	0	0	0	0	0	0
Kahanahaiki	156	57	0	21	0	0	21
Kawaiiki (Koolaus)	15	31	0	0	0	0	0
Opaeula (Koolaus)	16	12	0	0	0	0	0
Pahole to Kapuna to West Makaleha	542	530	0	49	0	1	50
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				70	0	1	71

2.9 *Delissea subcordata*

Requirements for Stability:

- 4 Population Units (PUs)
- 100 reproducing individuals in each PU (short-lived perennial with population fluctuations and local declines, potentially an obligate out-crosser)
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- Stability goal of 100 reproducing individuals met for the Kahanahāiki to Keawapilau PU.
- Genetic Storage goals have been met with seed storage of all of the mature founders in all PUs except for one new mature plant in the Kalua‘ā PU.
- Reintroductions of Keālia and Palikea Gulch stock for Genetic Storage collections continue to be supplemented in order to balance founders.
- Seedlings have been observed at reintroduction sites in the Kahanahāiki to Keawapilau, Kalua‘ā and ‘Ēkahanui PUs.
- New immature plants were observed at the South Mohiākea, Pālāwai and Kalua‘ā PUs.

Plans for Year 5

- Continue to supplement the augmentations in the Kahanahāiki to Keawapilau, ‘Ēkahanui and Kalua‘ā PUs in order to balance founders at these Manage for Stability PUs.
- Continue to supplement the reintroductions of the Keālia and Palikea Gulch stock for genetic storage.
- Molecular analyses of stock from all PUs by Bishop Museum.
- Collect fruit from any new mature plants in the Kalua‘ā (or any other) PU.
- Continue to collect from all PUs to meet genetic storage goals. When the wild founder plants have died, genetic storage collections will be initiated from reintroductions of that founder.
- Construct a large scale management unit fence in Manuwai to protect sites for future reintroduction.
- Develop the reintroduction strategy for the Manuwai PU.

Table 2.17 Taxon Status Summary

Action Area: In														
TaxonName: <i>Delissea subcordata</i>								TaxonCode: DelSub						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kahanahaiki to Keawapilau	Manage for stability	5	0	0	134	41	0	22	111	0	139	41	0	Many of the reintroduced plants matured and more were outplanted in the last year
South Mohiakea	Genetic Storage	3	3	0	0	0	0	2	0	0	3	3	0	New mature and immature plants were observed in the last year
Total for Taxon:		8	3	0	134	41	0	24	111	0	142	44	0	

Action Area: Out														
TaxonName: <i>Delissea subcordata</i>								TaxonCode: DelSub						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Ekahanui	Manage for stability	3	0	0	95	77	0	113	0	0	98	77	0	More plants were reintroduced into existing sites
Kaluaa	Manage for stability	2	6	0	24	1	5	25	6	7	26	7	5	New immature plants were observed in the known wild site
Kealia	Genetic Storage	2	0	0	7	45	0	7	34	0	9	45	0	Additional plants were outplanted into Kaluakaula in the last year
Manuwai	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	Reintroduction will begin when the MU fence is complete
Palawai	Genetic Storage	3	3	0	0	0	0	4	0	1	3	3	0	New immature wild plants have been observed in the last year
Palikea Gulch	Genetic Storage	1	0	0	52	7	0	11	37	0	53	7	0	More plants reintroduced into Kapuna
Total for Taxon:		11	9	0	178	130	5	160	77	8	189	139	5	

Table 2.18 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Delissea subcordata</i>							
E kahanui	3	0	3	6	0	5	6
Kahanahaiki to Keawapilau	5	0	8	11	1	8	11
Kaluaa	2	6	0	2	0	1	2
Kealia	2	0	0	2	0	1	2
Palavai	3	3	3	6	0	1	6
Palikea Gulch	1	0	5	6	4	5	6
South Mohiakea	3	3	3	3	0	3	4
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				36	5	24	37

2.10 *Dubautia herbstobatae*

Requirements for Stability

- 3 Population Units (PUs)
- 50 reproducing individuals in each PU (short-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- Both the ‘Ōhikilolo Mauka and ‘Ōhikilolo Makai PUs meet the stability goal having more than 50 reproducing individuals.
- NRS pioneered a new access route to the plants at the Mākaha PU allowing for more regular monitoring and management without requiring a helicopter.
- Until seed collection and storage techniques are determined, genetic storage goals will be met by holding clones in the greenhouse. Several founders in the greenhouse collection of clones from the Mākaha, Kamaile‘unu and Wai‘anae Kai PUs flowered this year and seeds were collected as they matured. The plants were kept inside the greenhouse and seed set was extremely low. The plants have now been moved outside to test ambient pollination next year, in the hope that more pollinators will be present and this will increase seed set.

Plans for Year 5

- Conduct a thorough monitoring of the Mākaha PU in order to determine the need to augment or reintroduce stock to meet stability goal of 50 reproducing plants.
- Continue ambient pollination of greenhouse plants to produce enough seed to meet genetic storage goals for the Mākaha, Kamaile‘unu and Wai‘anae Kai PUs.
- Collect cuttings from additional plants in the Mākaha and Wai‘anae Kai PUs to increase founder representation in the greenhouse collection to use for producing seeds for genetic storage.
- Conduct a thorough monitoring of sites within the ‘Ōhikilolo Mauka and ‘Ōhikilolo Makai PUs.
- Determine the need for ungulate protection at the Mākaha PU.

Table 2.19 Taxon Status Summary

Action Area: In														
TaxonName: <i>Dubautia herbstobatae</i>								TaxonCode: DubHer						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Keaa u	Genetic Storage	70	0	0	0	0	0	70	0	0	70	0	0	No monitoring in the last year
Makaha/Ohikilolo	Genetic Storage	350	0	0	0	0	0	350	0	0	350	0	0	No monitoring in the last year
Ohikilolo Makai	Manage for stability	358	0	0	0	0	0	358	0	0	358	0	0	No monitoring in the last year
Ohikilolo Mauka	Manage for stability	382	6	0	0	0	0	382	6	0	382	6	0	No monitoring in the last year
Total for Taxon:		1160	6	0	0	0	0	1160	6	0	1160	6	0	

Action Area: Out														
TaxonName: <i>Dubautia herbstobatae</i>								TaxonCode: DubHer						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kamaileunu	Genetic Storage	0	0	0	0	0	0	0	0	0	0	0	0	No monitoring since 2001
Makaha	Manage for stability	36	1	0	0	0	0	36	1	0	36	1	0	Monitoring showed no change in the last year
Waianae Kai	Genetic Storage	10	4	0	0	0	0	10	4	0	10	4	0	No monitoring in the last year
Total for Taxon:		46	5	0	0	0	0	46	5	0	46	5	0	

Table 2.20 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Dubautia herbstobatae</i>							
Kamaileunu	0	0	1	1	1	1	1
Keaau	70	0	0	0	0	0	0
Makaha	36	1	4	12	0	7	11
Makaha/Ohikilolo	350	0	0	1	0	0	0
Ohikilolo Makai	358	0	0	0	0	0	0
Ohikilolo Mauka	382	6	0	1	0	0	1
Waianae Kai	10	4	0	5	0	4	4
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				20	1	12	17

2.11 *Flueggea neowawraea*

Requirements for Stability

- 4 Population Units (PU)
- 50 reproducing individuals in each PU (long-lived perennial, dioecious, low to no reproduction, all senescent, major pest problems)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues for Year 4

- Collections of clones from mature trees have been established and are being held in a living collection at the Pahole Mid Elevation Nursery from 20 of the 36 known trees.
- Collections from four unrepresented trees in the Pahole NAR section of the Kahanahāiki to Kapuna PU continued and cuttings are being propagated by the State Horticulturist.
- Pollen stored for 1.5 years has been used to pollinate female nursery stock and produced seed with the same high viability as seeds resulting from crosses with fresh pollen.
- The genetic storage goal has been met for one tree from Central Makaleha by storing seeds collected from clones in the greenhouse living collection. NRS expect other founders to reach that goal in the coming year.

Plans for Year 5

- Monitor and collect from the sixteen wild individuals that are not yet represented by clones in the greenhouse.
- Determine the sex of the ten remaining unknown trees.
- Supplement the Mākaha and Kahanahāiki to Kapuna PUs with stock grown from seed collected from the living collection in the greenhouse.
- Continue research on BTB control using traps baited with ethanol in combination with repellants.
- NRS will continue to collect seeds for propagation and genetic storage from the greenhouse collection. The saplings grown from these collections will be used to begin reintroductions in the Central and East Makaleha and Kahanahāiki to Kapuna PUs.

Table 2.21 Taxon Status Summary

Action Area: In														
TaxonName: Flueggea neowawraea								TaxonCode: FluNeo						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kahanahaiki to Kapuna	Manage for stability	7	0	0	0	67	0	7	72	0	7	67	0	Five of the outplanted immature trees have died in the last year
Ohikilolo	Genetic Storage	1	0	0	0	0	0	1	0	0	1	0	0	Monitoring showed no change in the last year
West Makaleha	Genetic Storage	5	0	0	0	0	0	6	0	0	5	0	0	One of the mature trees was mistakenly double counted until this year
Total for Taxon:		13	0	0	0	67	0	14	72	0	13	67	0	

Action Area: Out														
TaxonName: Flueggea neowawraea								TaxonCode: FluNeo						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Central and East Makaleha	Manage for stability	5	0	0	0	0	0	5	0	0	5	0	0	Monitoring showed no change in the last year
Halona	Genetic Storage	2	0	0	0	0	0	2	0	0	2	0	0	No monitoring in the last year
Kauhiuhi	Genetic Storage	1	0	0	0	0	0	1	0	0	1	0	0	No monitoring in the last year
Makaha	Manage for stability	10	0	0	0	0	0	10	0	0	10	0	0	Monitoring showed no change in the last year
Manuwai	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	Reintroductions will begin once MU fences are complete
Mikilua	Genetic Storage	1	0	0	0	0	0	1	0	0	1	0	0	Monitoring showed no change in the last year
Mt. Kaala NAR	Genetic Storage	3	0	0	0	0	0	3	0	0	3	0	0	Monitoring showed no change in the last year
Nanakuli, south branch	Genetic Storage	1	0	0	0	0	0	1	0	0	1	0	0	No monitoring in the last year
Total for Taxon:		23	0	0	0	0	0	23	0	0	23	0	0	

Table 2.22 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num Wild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Flueggea neowawraea</i>							
Central and East Makaleha	5	0	1	1	1	3	2
Halona	2	0	0	0	0	2	0
Kahanahaiki to Kapuna	7	0	0	1	0	3	1
Kauhiuhi	1	0	0	0	0	1	0
Makaha	10	0	0	1	0	7	2
Mikilua	1	0	0	0	0	0	0
Mt. Kaala NAR	3	0	0	1	1	1	1
Nanakuli, south branch	1	0	0	0	0	1	0
Ohikilolo	1	0	1	0	0	1	1
West Makaleha	5	0	0	0	0	3	1
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				4	2	22	8

2.12 *Gouania vitifolia*

Requirements for Stability

- 3 population units (PUs)
- 50 reproducing individuals (suspected dioecy)
- Stable population structure
- Threats controlled
- Genetic storage collections from PUs managed for stability

Major Highlights/Issues for Year 4

- The genetic storage goal has been met for the Kea‘au PU.
- An ungulate fence was completed around the Wai‘anae Kai PU.
- NRS and O‘ahu Plant Extinction Prevention program staff have continued collection of mature seed for genetic storage from the Kea‘au PU. There is seed from 46 individuals in storage.
- Germination protocols have been established and seeds were found to have physical dormancy. This may suggest the following: 1) seeds likely form a persistent soil seed bank; 2) seeds will likely have long-term *ex situ* storage potential.

Plans for Year 5

- Survey historic locations in Makaleha.
- Determine suitable habitat in Mākaha, Makaleha and Manuwai for reintroduction
- Work with DOFAW to improve the fire access road to provide better access in case of a fire that threatens the Kea‘au PU.
- Continue collections of seed from the Kea‘au PU until storage goals are met.
- Secure clones of the Wai‘anae PU in the greenhouse living collection for genetic storage.
- Pollination and breeding system studies will begin with the greenhouse collection of clones from the Wai‘anae Kai and Kea‘au PUs.
- Determine the fenceline and work with DOFAW to complete the Environmental Assessment for the Management Unit fence around the Kea‘au PU.

Table 2.23 Taxon Status Summary

Action Area: In															
TaxonName: Gouania vitifolia								TaxonCode: GouVit							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Keaau	Manage for stability	60	1	0	0	0	0	60	0	0	60	1	0	One immature plant was observed in the known site	
Total for Taxon:		60	1	0	0	0	0	60	0	0	60	1	0		
Action Area: Out															
TaxonName: Gouania vitifolia								TaxonCode: GouVit							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Makaha	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	Reintroduction will begin when site is determined	
Makaleha or Manuwai	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	NRS will revisit historic sites in Makaleha in the next year and reintroduction will begin once the fence is complete	
Waianae Kai	Genetic Storage	2	0	0	0	0	0	2	0	0	2	0	0	Monitoring showed no change in the last year	
Total for Taxon:		2	0	0	0	0	0	2	0	0	2	0	0		

Table 2.24 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num/Wild Dead	# Plants >= 10 in Seedbank	# Plants >=1 Microprop	# Plants >=1 Army Nursery	# Plants that Met Goal
Gouania vitifolia							
Keaau	60	1	0	46	12	0	35
Waiānae Kai	2	0	0	0	0	0	0
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				46	12	0	35

2.13 *Hedyotis degeneri* var. *degeneri*

Requirements for Stability:

- 3 Population Units (PUs)
- 50 reproducing individuals in each PU (short-lived perennial)
- Threats controlled
- Stable population structure
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- Stability goal of 50 reproducing individuals met for the Kahanahāiki to Pahole PU.
- Seed collections for genetic storage and propagation continued from all extant PUs.
- After thorough monitoring of the Pahole section of the Kahanahāiki to Pahole PU, NRS revised the population estimates to include many more younger plants.

Plans for Year 5

- NRS will survey for new locations in the East branch of East Makaleha PU.
- Genetic storage collection efforts will continue at all PUs.
- A large management unit ungulate fence is planned to be completed around the Manuwai portion of the Alaiheihe to Manuwai PU in the next two years.
- Determine the need to protect the Central Makaleha and West branch of East Makaleha PU from ungulates.

Table 2.25 Taxon Status Summary

Action Area: In														
TaxonName: Hedyotis degeneri var. degeneri								TaxonCode: HedDegDeg						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kahanahaiki to Pahole	Manage for stability	186	205	101	0	0	0	243	9	8	186	205	101	Population estimates were revised after thorough monitoring in the last year
Total for Taxon:		186	205	101	0	0	0	243	9	8	186	205	101	

Action Area: Out														
TaxonName: Hedyotis degeneri var. degeneri								TaxonCode: HedDegDeg						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Alaihehe and Manuwai	Manage for stability	31	6	1	0	0	0	31	6	1	31	6	1	Monitoring showed no change in the last year
Central Makaleha and West Branch of East Makaleha	Manage for stability	21	39	0	0	0	0	25	10	17	21	39	0	Population estimates were revised after thorough monitoring in the last year
East branch of East Makaleha	Genetic Storage	0	0	0	0	0	0	0	0	0	0	0	0	No monitoring in the last year
Total for Taxon:		52	45	1	0	0	0	56	16	18	52	45	1	

Table 2.26 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num/Wild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Hedyotis degeneri</i> var. <i>degeneri</i>							
Alaihehe and Manuwai	31	6	2	25	1	0	23
Central Makaleha and West Branch of East Makaleha	21	39	19	28	0	1	25
East branch of East Makaleha	0	0	0	0	0	0	0
Kahanahaiki to Pahole	186	205	9	40	0	4	30
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				93	1	5	78

2.14 *Hedyotis parvula*

Requirements for Stability:

- 3 Population Units (PUs)
- 50 reproducing individuals in each PU (short-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation in storage of all PUs

Major Highlights/Issues Year 4

- Both extant PUs have met the stability goal of having more than 50 reproducing plants
- Genetic storage goals have been met for both extant PUs.

Plans for Year 5

- Conduct a thorough monitoring of the ‘Ōhikilolo PU focusing on locating juvenile plants.

Table 2.27 Taxon Status Summary

Action Area: In															
TaxonName: Hedyotis parvula								TaxonCode: HedPar							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Ohikilolo	Manage for stability	120	28	40	0	0	0	120	28	40	120	28	40	No monitoring in the last year	
Total for Taxon:		120	28	40	0	0	0	120	28	40	120	28	40		

Action Area: Out															
TaxonName: Hedyotis parvula								TaxonCode: HedPar							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
East Makaleha	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	Reintroduction will begin once the fence is complete	
Halona	Manage for stability	97	35	19	0	0	0	97	19	0	97	35	19	No monitoring in the last year	
Total for Taxon:		97	35	19	0	0	0	97	19	0	97	35	19		

Table 2.28 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num/Wild Dead	# Plants >= 10 in Seedbank	# Plants >=1 Microprop	# Plants >=1 Army Nursery	# Plants that Met Goal
<i>Hedyotis parvula</i>							
East Makaleha	0	0	0	0	0	0	0
Halona	97	35	0	70	0	2	62
Ohikilolo	120	28	5	108	0	0	102
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				178	0	2	164

2.15 *Hesperomannia arbuscula*

Requirements for Stability:

- 4 Population Units (PUs)
- 75 reproducing individuals in each PU (long-lived perennial but with low seed set, tendency for large declines or fluctuations in population size, and recent severe population declines)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- Two new PUs were discovered during surveys by NRS in the last year. A single plant was found in Hale‘au‘au Gulch in Schofield Barracks West Range and a new site with four immature plants was discovered in Nāpepeiau‘ōlelo Gulch in Honouliuli. Since this taxon now occurs in two Action Areas, the Hale‘au‘au PU was added as the fourth Manage for Stability PU.
- Hand pollinations were conducted again this year on all mature founders. 52 pollinations were made, consisting of 13 different mother:father combinations. Seed set was 16% and germination was 73%. Crosses resulted in a total of 198 seedlings to be propagated for reintroduction.
- After another significant decline in the North Pālāwai PU there is only one mature plant remaining.
- A small fence was built around the new Hale‘au‘au PU.
- A large scale management unit fence was completed by O‘ahu NARS around the historic site in the Kapuna PU.

Plans for Year 5

- Continue surveys for additional populations (SBMR, Wai‘anae Kai, Mākaha, Honouliuli).
- Pollinations will be conducted next year to target under-represented crosses.
- Clone greenhouse plants with air layers.
- Determine reintroduction/augmentation strategy for all four MFS PUs and prepare stock for outplanting.
- Complete a fence around the new Nāpepeiau‘ōlelo PU.

Table 2.29 Taxon Status Summary

Action Area: In														
TaxonName: <i>Hesperomannia arbuscula</i>								TaxonCode: HesArbu						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kapuna	Genetic Storage	0	0	0	0	0	0	0	0	0	0	0	0	No monitoring in the last year
Total for Taxon:		0	0	0	0	0	0	0	0	0	0	0	0	

Action Area: Out														
TaxonName: <i>Hesperomannia arbuscula</i>								TaxonCode: HesArbu						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Haleauau	Manage for stability	0	1	0	0	0	0				0	1	0	This new PU with one plant was discovered by NRS
Makaha	Manage for stability	3	3	0	0	0	0	4	8	0	3	3	0	Thorough monitoring showed a decline in the last year
Napepeiauelelo	Genetic Storage	0	4	0	0	0	0				0	4	0	This new PU with four plants was discovered by NRS
North Palawai	Manage for stability	1	0	0	0	0	0	3	0	0	1	0	0	Two mature plants in the known site have died
Waiānae Kai	Manage for stability	2	1	0	0	0	0	2	1	0	2	1	0	Monitoring showed no change
Total for Taxon:		6	9	0	0	0	0	9	9	0	6	9	0	

Table 2.30 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num/VWild Dead	# Plants >= 10 in Seedbank	# Plants >=1 Microprop	# Plants >=1 Army Nursery	# Plants that Met Goal
Hesperomannia arbuscula							
Haleauau	0	1	0	0	0	0	0
Kaaikukai	0	0	0	0	0	0	0
Kapuna	0	0	0	0	0	0	0
Makaha	3	3	1	0	0	1	0
Napepeiauelelo	0	4	0	0	0	0	0
North Palawai	1	0	16	0	2	8	3
Waianae Kai	2	1	8	0	1	2	2
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				0	3	11	5

2.16 *Hibiscus brackenridgei* subsp. *mokuleianus*

Requirements for Stability

- 4 Population Units (PU)
- 50 reproducing individuals in each PU (short-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- New seedlings were observed in the Mākua PU and 23 plants grown from clones of the wild plants were used to augment the wild site. All these augmented plants have survived.
- The genetic storage goal has been met for the Mākua PU. All available founders are kept in a living collection in the greenhouse and at a site near Mākua Range Control. In addition, seed collections from the clones at Mākua Range Control have been made for genetic storage.
- The reintroduction of stock from the Haili to Kawaiū PU was expanded at Dillingham Military Reservation (DMR), but the survivorship at the site has been low at 42% (13/31).
- Many new immature plants were observed during monitoring of sites burned in August 2007 in the Kaimuhole and Palikea Gulch, Kihakapu and Kaumoku Nui PUs.

Plans for Year 5

- Continue to augment the Mākua PU with plants grown from clones of all the wild plants.
- Continue expansion of the DMR reintroduction of the Haili to Kawaiū PU stock.
- Collect from additional founders in the Haili to Kawaiū PU for reintroduction and genetic storage.
- Determine management unit boundaries and strategy for managing the Kaimuhole and Palikea PU.
- Monitor the burned sites in the Kaimuhole and Palikea Gulch, Kihakapu and Kaumoku Nui PUs to revise population estimates and collect from new founders for genetic storage.
- Expand the living collection of the Mākua PU at MMR Range Control and continue to collect seed for genetic storage from the Range Control planting.
- Begin the Environmental Assessment for fence construction and begin management and reintroduction of the proposed Kea‘au PU.

Table 2.31 Taxon Status Summary

Action Area: In															
TaxonName: Hibiscus brackenridgei subsp. mokuleianus								TaxonCode: HibBraMok							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Keaau	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	Reintroduction will begin once the management unit fence is complete	
Makua	Manage for stability	11	2	68	23	0	0	10	14	18	34	2	68	The wild site was augmented with 23 new outplantings. Two older wild plants died and many new seedlings plants were observed.	
Total for Taxon:		11	2	68	23	0	0	10	14	18	34	2	68		
Action Area: Out															
TaxonName: Hibiscus brackenridgei subsp. mokuleianus								TaxonCode: HibBraMok							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Hali to Kawaiu	Manage for stability	6	3	9	15	1	0	34	6	9	21	4	9	Thorough monitoring found a few plants at the know wild sites have died and many of the reintroductions have not survived	
Kaimuhole and Palikea Gulch	Manage for stability	6	1012	0	0	0	0	1	8	0	6	1012	0	Monitoring found many new young plants in the known sites	
Kaumoku Nui	Genetic Storage	0	250	300	0	0	0	0	0	0	0	250	300	Monitoring found many new young plants in the known site	
Kihakapu	Genetic Storage	1	0	0	0	0	0	1	0	0	1	0	0	No monitoring in the last year	
Total for Taxon:		13	1265	309	15	1	0	36	14	9	28	1266	309		

Table 2.32 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num Wild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Hibiscus brackenridgei</i> subsp. <i>mokuleianus</i>							
Haili to Kavaui	6	3	5	0	0	9	2
Kaimuhole and Palikea Gulch	6	1012	7	1	0	11	11
Kaumoku Nui	0	250	7	0	0	0	0
Kihakapu	1	0	3	3	0	10	11
Makua	11	2	18	20	0	29	28
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				24	0	59	52

2.17 *Melanthera tenuifolia*

Requirements for Stability

- 3 Population Units (PUs)
- 50 genetically unique individuals in each PU (short-lived perennial with tendency to reproduce vegetatively)*
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

* It is difficult to distinguish genetic individuals, since vegetative reproduction creates identical adjacent plants. Genetic studies suggest that plant material separated by >2 m is genetically distinct.

Major Highlights/Issues Year 4

- Stability goal of 50 reproducing individuals met at all 3 Manage for Stability PUs.
- NRS continue to maintain a collection of clones from 40 founders from Kahanahāiki and 18 from the makai end of the 'Ōhikilolo PU for genetic storage.
- Temperature data loggers have been placed at wild sites in the 'Ōhikilolo and Kamaile'unu and Wai'anae Kai PUs to help determine what temperature fluctuations may stimulate germination in situ.
- NRS monitored the makai end of the 'Ōhikilolo PU in May 2008 and saw only 3 mature plants. This is a decline from the previous estimate made after a thorough observation in September 2004. There have been two fires in this area since 2004.
- A decline in the Kahanahāiki PU was observed during monitoring in the last year. A thorough search of the area found fewer plants than are currently represented by clones in the greenhouse from previous collections.

Plans for Year 5

- NRS will revisit the PUs that are highly threatened by fire from training at Mākua Military Reservation to collect clones from new founders to expand the greenhouse genetic storage collections.
- Seeds from the greenhouse collection of clones from the 'Ōhikilolo and Kahanahāiki stock will be collected for genetic storage and to continue studies to investigate dormancy-breaking mechanisms in order to determine the storage potential of seeds collected for genetic storage goals.
- Construct a large scale management unit fence in Manuwai that will protect all the known plants in the Mt Ka'ala PU.
- Deploy additional data loggers at higher elevation sites in the 'Ōhikilolo PU.
- Conduct thorough monitoring of the Kahanahāiki PU and the makai end of the 'Ōhikilolo PU and collect from any new founders to expand the greenhouse collection.
- Determine the need to protect the Kamaile'unu and Wa'anae Kai PUs from ungulate threats.

Table 2.33 Taxon Status Summary

Action Area: In														
TaxonName: <i>Melanthera tenuifolia</i>								TaxonCode: MelTen						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kahanahaiki	Genetic Storage	11	2	2	0	0	0	54	23	4	11	2	2	Thorough monitoring showed a significant decline
Kaluakauila	Genetic Storage	64	20	40	0	0	0	64	20	40	64	20	40	No monitoring in the last year
Keawaula	Genetic Storage	45	15	0	0	0	0	45	15	0	45	15	0	No monitoring in the last year
Ohikilolo	Manage for stability	1235	0	0	0	0	0	1242	1	0	1235	0	0	Monitoring of the makai end of this PU showed a decline in that area.
Total for Taxon:		1355	37	42	0	0	0	1405	59	44	1355	37	42	

Action Area: Out														
TaxonName: <i>Melanthera tenuifolia</i>								TaxonCode: MelTen						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kamaileumu and Waianae Kai	Manage for stability	880	269	297	0	0	0	880	269	297	880	269	297	No monitoring in the last year
Mt. Kaala NAR	Manage for stability	300	0	0	0	0	0	300	0	0	300	0	0	No monitoring in the last year
Total for Taxon:		1180	269	297	0	0	0	1180	269	297	1180	269	297	

Table 2.34 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num Wild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Melanthera tenuifolia</i>							
Kahanahaiki	11	2	25	11	0	40	20
Kaluakauila	64	20	0	9	0	11	4
Kamaileunu and Waianae Kai	880	269	0	0	0	0	0
Keawaula	45	15	0	0	0	0	0
Mt. Kaala NAR	300	0	0	0	0	0	0
Ohikilolo	1235	0	31	16	0	20	18
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				36	0	71	42

2.18 *Neraudia angulata*

Requirements for Stability

- 4 Population Units (PUs)
- 100 reproducing individuals in each Manage for Stability PU (short-lived perennial, mostly dioecious, prone to large declines or fluctuations in population size)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- A small fence to protect the Wai‘anae Kai Makai PU from ungulate threats was begun in cooperation with DOFAW.
- Genetic storage goals have been met for all available founders in the Punapōhaku, Kapuna and Manuwai PUs. Collections from all other PUs have begun and clones are being kept as a living collection in the greenhouse.
- Continued to plant clones of var. *dentata* stock from the Manuwai PU at the reintroduction site in lower Kaluakauila and clones of the Punapōhaku and Kapuna PUs into the upper site.

Plans for Year 5

- Continue to collect clones from new founders at wild populations in order to meet genetic storage goals with living collections in the greenhouse.
- Continue monitoring wild and outplanted plants to guide reintroduction plans and gather further information about life histories, reproductive strategies, and habitat requirements.
- Continue to supplement the Kaluakauila PU with var. *dentata* stock from Punapōhaku Manuwai, and Kapuna PUs at two separate sites.
- Continue to augment the Mākua PU with stock established from clones to meet stabilization goal.
- Construct a large scale management unit fence in Manuwai that will protect the historic site and provide secure habitat for reintroduction.
- Work with DOFAW to complete the small ungulate fence around the Wai‘anae Kai mauka PU.
- Determine need to augment the Wai‘anae Kai Mauka PU in order to reach the stability goal of 100 reproducing plants after the fence is complete.

Table 2.34 Taxon Status Summary

Action Area: In															
TaxonName: <i>Neraudia angulata</i>								TaxonCode: NerAng							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Kaluakauila	Manage reintroduction for stability	0	0	0	46	0	0	44	9	0	46	0	0	Additional plants were added to the existing reintroduction sites	
Kapuna	Genetic Storage	2	0	0	0	0	0	2	0	0	2	0	0	No monitoring in the last year	
Makua	Manage for stability	21	77	0	17	2	0	37	5	6	38	79	0	Monitoring showed an increase at the wild site	
Punapohaku	Genetic Storage	1	0	0	0	0	0	1	0	0	1	0	0	Monitoring showed no change in the last year	
Total for Taxon:		24	77	0	63	2	0	84	14	6	87	79	0		

Action Area: Out															
TaxonName: <i>Neraudia angulata</i>								TaxonCode: NerAng							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Halona	Genetic Storage	30	4	0	0	0	0	30	4	0	30	4	0	No monitoring in the last year	
Leeward Puu Kaua	Genetic Storage	9	0	0	0	0	0	9	0	0	9	0	0	No monitoring in the last year	
Makaha	Genetic Storage	10	0	0	0	0	0	10	0	0	10	0	0	No monitoring in the last year	
Manuwai	Manage for stability	0	0	0	0	0	0	0	0	0	0	0	0	Monitoring did not detect any new plants	
Waianae Kai Makai	Genetic Storage	46	35	25	0	0	0	46	35	25	46	35	25	Monitoring showed no change in the last year	
Waianae Kai Mauka	Manage for stability	57	29	54	0	0	0	57	29	54	57	29	54	Monitoring showed no change in the last year	
Total for Taxon:		152	68	79	0	0	0	152	68	79	152	68	79		

Table 2.35 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Neraudia angulata</i>							
Halona	30	4	0	0	0	12	8
Kapuna	2	0	0	2	0	2	2
Leeward Puu Kaua	9	0	0	0	0	1	1
Makaha	10	0	7	2	0	8	4
Makua	21	77	61	0	0	31	12
Manuwai	0	0	6	0	0	2	2
Punapohaku	1	0	0	0	0	1	1
Waianae Kai Makai	46	35	0	0	0	0	0
Waianae Kai Mauka	57	29	1	0	0	4	3
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				4	0	61	33

2.19 *Nototrichium humile*

Requirements for Stability

- 4 Population Units (PUs)
- 25 reproducing individuals in each PU (long-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation in storage of all PUs

Major Highlights/Issues Year 4

- A small fence to protect the Wai‘anae Kai PU from ungulate threats was begun in cooperation with DOFAW.
- All four Manage for Stability PUs have met the goal of more than 25 reproducing plants
- The augmentation of the Mākua (south side) PU continues to have good survivorship (14/18) after five years.
- NRS has continued to work with David Orr at Waimea Botanical Garden to maintain the living collection of clones from 27 plants in the Kahanahāiki PU.

Plans for Year 5

- Prepare the living collection stock for pollination and breeding system studies .
- Prioritize monitoring and collection of the Kea‘au, Nānākuli, Mākua (East Rim) & Mākaha PUs. These have not been observed recently and have had few or no collections for genetic storage. NRS will also continue to collect from the remaining founders in the Kaimuhole and Palikea Gulch (Kihakapu) and Kolekole (east side) PUs.
- Continue to maintain the living collection of clones from the smallest and most fire-threatened PUs in the greenhouse and at Waimea Botanical Garden.
- Determine management unit boundaries and strategy for managing the Kaimuhole and Palikea Gulch (Kihakapu) PU.
- Monitor the Kaluakauila and Wai‘anae Kai PUs for juvenile plants.

Table 2.37 Taxon Status Summary

Action Area: In														
TaxonName: <i>Nototrichium humile</i>								TaxonCode: NotHum						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kahanahaiki	Genetic Storage	67	10	0	0	0	0	67	10	0	67	10	0	No monitoring in the last year
Kaluakaula	Manage for stability	198	35	0	0	0	0	198	35	0	198	35	0	No monitoring in the last year
Keaau	Genetic Storage	21	31	0	0	0	0	21	31	0	21	31	0	No monitoring in the last year
Keawaula	Genetic Storage	138	5	0	0	0	0	138	5	0	138	5	0	No monitoring in the last year
Makua (East rim)	Genetic Storage	1	0	0	0	0	0	0	0	0	1	0	0	No monitoring in the last year
Makua (south side)	Manage for stability	56	1	0	13	1	0	72	1	0	69	2	0	A few plants in the reintroduction from 2003 were observed to have died in the last year
Punapohaku	Genetic Storage	302	14	7	0	0	0	302	14	7	302	14	7	No monitoring in the last year
Total for Taxon:		783	96	7	13	1	0	798	96	7	796	97	7	

Action Area: Out														
TaxonName: <i>Nototrichium humile</i>								TaxonCode: NotHum						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kaimuhole and Palikea Gulch (Kihakapu)	Manage for stability	51	4	0	0	0	0	51	4	0	51	4	0	No monitoring in the last year
Keawapilau	Genetic Storage	5	0	0	0	0	0	5	0	0	5	0	0	No monitoring in the last year
Kolekole (east side)	Genetic Storage	12	0	0	0	0	0	12	0	0	12	0	0	No monitoring in the last year
Makaha	Genetic Storage	15	3	0	0	0	0	15	3	0	15	3	0	No monitoring in the last year
Nanakuli	Genetic Storage	5	0	0	0	0	0	5	0	0	5	0	0	No monitoring in the last year
Puu Kaua (Leeward side)	Genetic Storage	2	0	0	0	0	0	12	0	0	2	0	0	A thorough census showed a decline
Waianae Kai	Manage for stability	224	5	0	0	0	0	224	5	0	224	5	0	No monitoring in the last year
Total for Taxon:		314	12	0	0	0	0	324	12	0	314	12	0	

Table 2.38 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Nototrichium humile</i>							
Kahanahaiki	67	10	1	5	0	17	10
Kaimuhole and Palikea Gulch (Kihakapu)	51	4	0	0	0	13	11
Kaluakauila	198	35	0	5	0	0	4
Keaau	21	31	0	0	0	0	0
Keawapilau	5	0	0	0	0	5	2
Keawaula	138	5	0	0	0	9	0
Kolekole (east side)	12	0	0	0	0	9	2
Makaha	15	3	0	0	0	0	0
Makua (East rim)	1	0	0	0	0	0	0
Makua (south side)	56	1	0	0	0	0	0
Nanakuli	5	0	0	0	0	0	0
Punapohaku	302	14	1	0	0	11	1
Puu Kaua (Leeward side)	2	0	0	0	0	0	0
Waianae Kai	224	5	0	0	0	4	2
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				10	0	68	32

2.20 *Phyllostegia kaalaensis*

Requirements for Stability

- 4 Population Units (PUs)
- 50 genetically unique, reproducing individuals in each PU (short-lived perennial, seems to be primarily a vegetative reproducing taxon)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- This taxon has been extinct in the wild since 2003.
- The genetic storage goals have been met for all eight existing founders from three of the historic PUs. All eight founders are represented both in the greenhouse living collection and at the Lyon Arboretum Micropropagation Lab.
- In Mākaha, there have been no survivors from the 83 plants reintroduced in the 2006-2007 season and only 29 of the 108 planted in January 2008 are still alive.
- In the Keawapilau to Kapuna PU, there have been no survivors from the 25 plants reintroduced in the 2006-2007 season and only 2 of the 12 planted in January 2008 are still alive.
- In the Pahole PU, there are no plants remaining from the 46 planted in December 2004, but there are 7 left of the 57 planted in 2006-2007.
- A large scale management unit fence was completed by O‘ahu NARS around the Keawapilau to Kapuna PU. It includes more habitat for use in additional reintroductions.
- Two HOBO ® weather stations were deployed at reintroduction sites in the Pahole and Keawapilau to Kapuna PUs. The stations were installed to look at the environmental differences between the sites that might influence outplanting success. However, the reintroductions at both sites have not been successful.

Plans for Year 5

- NRS will collect and analyze data from the two HOBO® stations
- NRS will continue to develop new horticulture methods to produce plants that may be better able to become established and survive.
- NRS will work with NARS staff to develop an outplanting site that is easy to visit to facilitate more frequent monitoring and management of reintroduced plants. Plants reintroduced into this site will be monitored closely to better understand what is causing such high mortality in outplanting sites. NRS may also establish experimental plots to test different treatments that may aid in establishment of plants at this site.
- Pollination and breeding system studies will be conducted on living collection stock during next flowering period.

Table 2.39 Taxon Status Summary

Action Area: In															
TaxonName: Phyllostegia kaalaensis								TaxonCode: PhyKaa							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Keawapilau to Kapuna	Manage for stability	0	0	0	2	0	0	17	0	0	2	0	0	Most of the reintroduced plants were observed dead	
Pahole	Manage for stability	0	0	0	0	7	0	0	30	0	0	7	0	These plants remain from the 2007 outplanting season, but are in poor health	
Palikea Gulch	Genetic Storage	0	0	0	0	0	0	0	0	0	0	0	0	No monitoring in the last year	
Total for Taxon:		0	0	0	2	7	0	17	30	0	2	7	0		
Action Area: Out															
TaxonName: Phyllostegia kaalaensis								TaxonCode: PhyKaa							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Makaha	Manage reintroduction for stability	0	0	0	29	0	0	4	20	0	29	0	0	Most of the 191 plants reintroduced have died	
Manuwai	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	Reintroductions will begin when the MU fence is complete	
Waianae Kai	Genetic Storage	0	0	0	0	0	0	0	0	0	0	0	0	No monitoring in the last year	
Total for Taxon:		0	0	0	29	0	0	4	20	0	29	0	0		

Table 2.40 Status of Genetic Storage

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Phyllostegia kaalaensis</i>							
Keawapilau to Kapuna	0	0	1	1	1	1	1
Pahole	0	0	4	0	2	2	2
Palikea Gulch	0	0	5	0	3	3	3
Waianae Kai	0	0	4	1	2	2	2
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				2	8	8	8

2.21 Plantago princeps var. princeps

Requirements for Stability

- 4 Population Units (PUs)
- 50 reproducing individuals in each PU (short-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- A large scale management unit fence was completed in ‘Ēkahanui that protects all of the known sites from ungulates was completed.
- Genetic storage collections of seeds has begun from every know PU. Nearly 100 plants from all the PUs are represented in this collection, which is more than the total of all the currently known plants.
- Plants in the Wai‘eli reintroduction site since January 2008 have survived, matured and have begun to flower.
- Collections of mature seeds for genetic storage from additional founders at all PUs continued in the last year.

Plans for Year 5

- Continue efforts to secure genetic storage collections from all populations of this taxon and complete the ‘Ēkahanui PU collections for 50 plants.
- NRS will determine if fencing is needed to protect the plants at the recently rediscovered south branch of north Pālāwai population in order to collect for genetic storage.
- NRS will determine a new reintroduction site within the new larger ‘Ēkahanui management unit and continue to augment the Wai‘eli site.

Table 2.41 Taxon Status Summary

Action Area: In														
TaxonName: Plantago princeps var. princeps								TaxonCode: PlaPriPri						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
North Mohiakea	Manage for stability	10	16	2	0	0	0	10	16	2	10	16	2	No monitoring in the last year
Ohikilolo	Manage for stability	11	0	0	0	0	0	12	14	0	11	0	0	No immature plants were observed during monitoring this year
Pahole	Genetic Storage	2	6	6	0	0	0	2	6	6	2	6	6	Monitoring showed no change
Total for Taxon:		23	22	8	0	0	0	24	36	8	23	22	8	

Action Area: Out														
TaxonName: Plantago princeps var. princeps								TaxonCode: PlaPriPri						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Ekahanui	Manage for stability	29	37	7	0	0	0	29	39	7	29	37	7	Monitoring showed no change
Halona	Manage for stability	29	43	0	0	0	0	10	17	11	29	43	0	A thorough monitoring found more plants in the known site
North Palawai	Genetic Storage	2	2	0	0	0	0	2	5	0	2	2	0	A few of the immature plants in the wild site have died
Waielei	Manage reintroduction for storage	0	0	0	10	0	0	9	7	0	10	0	0	All reintroduced plants have matured and a few more have died
Total for Taxon:		60	82	7	10	0	0	50	68	18	70	82	7	

Table 2.42 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Plantago princeps</i> var. <i>princeps</i>							
E kahanui	29	37	19	46	0	4	42
Halona	29	43	1	18	0	1	18
North Mohiakea	10	16	11	13	0	4	12
North Palawai	2	2	1	1	0	0	1
Ohikilolo	11	0	14	18	0	0	11
Pahole	2	6	1	2	1	0	2
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				98	1	9	86

2.22 *Pritchardia kaalae*

Requirements for Stability

- 3 Population Units (PU)
- 25 reproducing individuals in each PU (long-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- The stability goal of 25 reproducing plants has been met for the ‘Ōhikilolo and Makaleha to Manuwai PUs.
- Rat control continues to be successful in allowing the development of mature fruit and the establishment of seedlings within the ‘Ōhikilolo and Makaleha to Manuwai PUs.
- Collections of seed for genetic storage began from the ‘Ōhikilolo PU. The seeds will be dried and kept frozen at the Army seedbank.
- Continued expansion of the reintroduction sites in the ‘Ōhikilolo and East ‘Ōhikilolo to West Makaleha PUs

Plans for Year 5

- NRS will continue to collect from unrepresented founders from the ‘Ōhikilolo and Makaleha to Manuwai PUs for reintroduction and genetic storage.
- Continue to expand the reintroduction sites in the ‘Ōhikilolo and East ‘Ōhikilolo to West Makaleha PUs with stock from additional founders.
- Complete a large scale management unit fence in Manuwai which will protect the known plants in that gulch.
- Monitor for seedlings in East Makaleha and determine the need to construct small fences.
- Survey the Makaleha to Manuwai PU to revise population estimates.
- Monitor the Wai‘anae Kai PU and assess the need for rat control in order to collect for genetic storage
- Determine feasibility of accessing the plant in the Mākaha PU.

Table 2.43 Taxon Status Summary

Action Area: In															
TaxonName: Pritchardia kaalae								TaxonCode: PriKaa							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Ohikilolo	Manage for stability	75	644	20	0	358	0	75	1006	19	75	1002	20	Small changes were observed in the known wild sites	
Ohikilolo East and West Makaleha	Manage reintroduction for stability	0	0	0	0	84	0	0	75	0	0	84	0	Additional plants were added to the existing reintroduction	
Total for Taxon:		75	644	20	0	442	0	75	1081	19	75	1086	20		

Action Area: Out															
TaxonName: Pritchardia kaalae								TaxonCode: PriKaa							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Makaha	Genetic Storage	4	0	0	0	0	0	4	0	0	4	0	0	No monitoring in the last year	
Makaleha to Manuwai	Manage for stability	70	4	0	0	0	0	68	3	0	70	4	0	A few more plants were observed at known sites	
Waianae Kai	Genetic Storage	4	5	0	0	0	0	4	5	0	4	5	0	No monitoring in the last year	
Total for Taxon:		78	9	0	0	0	0	76	8	0	78	9	0		

Table 2.44 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Pritchardia kaalae</i>							
Makaha	4	0	0	0	0	0	0
Makaleha to Manuwai	70	4	0	0	0	18	13
Ohikilolo	75	644	0	5	13	26	18
Waianae Kai	4	5	0	0	1	0	0
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				5	14	44	31

2.23 *Sanicula mariversa*

Requirements for Stability

- 3 Population Units (PUs)
- 100 reproducing individuals in each PU (short-lived perennial with infrequent, inconsistent flowering)
- Stable population structure
- Threats controlled
- Complete genetic representation in storage of all PUs

Major Highlights/Issues for Year 4

- NRS conducted thorough monitoring of all individuals at the Kea'au PU.
- A small fence protecting the Kamaile'unu PU was completed this year.
- Temperature data loggers have been placed at all wild sites to collect *insitu* temperature fluctuations to help determine how they might affect germination in situ.
- NRS continued to collect seeds for genetic storage from all PUs. The genetic storage goals are almost complete for both the Kamaile'unu and Kea'au PUs.
- At the Kamaile'unu PU, an in situ germination study was conducted. This study attempts to determine what percentage of seeds produced in a given year will become seedlings the following year. This study coincides with the population structure monitoring over the past two years. These efforts attempt to assess the stability of the population for this PU.

Plans for Year 5

- NRS will fence the Kea'au PU in the coming year.
- NRS will collect mature seed for dormancy and germination studies.
- Monitor the germination study at the Kamaile'unu PU.

Table 2.45 Taxon Status Summary

Action Area: In															
TaxonName: <i>Sanicula mariversa</i>								TaxonCode: SanMar							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Keaau	Manage for stability	11	300	40	0	0	0	11	359	5	11	300	40	Small changes were noted during monitoring in the last year	
Ohikilolo	Manage for stability	3	112	0	0	0	0	3	112	0	3	112	0	Small changes were noted during monitoring in the last year	
Total for Taxon:		14	412	40	0	0	0	14	471	5	14	412	40		

Action Area: Out															
TaxonName: <i>Sanicula mariversa</i>								TaxonCode: SanMar							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Kamailaunu	Manage for stability	10	178	13	0	0	0	5	188	13	10	178	13	Monitoring showed no change	
Puu Kawiwi	Genetic Storage	2	11	0	0	0	0	1	21	1	2	11	0	Small changes were noted during monitoring in the last year	
Total for Taxon:		12	189	13	0	0	0	6	209	14	12	189	13		

Table 2.46 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num Wild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Sanicula maritima</i>							
Kamaileunu	10	178	41	56	0	0	49
Keaau	11	300	42	65	0	0	48
Ohikilolo	3	112	92	67	0	0	34
Puu Kawili	2	11	1	3	0	0	3
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				191	0	0	134

2.24 *Schiedea kaalae*

Requirements for Stability

- 4 Population Units (PUs)
- 50 reproducing individuals in each PU (short-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues for Year 4

- The stability goal of 50 reproducing plants has been met for the South ‘Ēkahanui and the Kalua‘ā and Wai‘eli PU.
- The genetic storage goal is met for the all available founders from the Kalua‘ā and Wai‘eli, North Pālāwai and Pahole PUs.
- A large scale management unit fence was completed in ‘Ēkahanui protecting all known sites in the South ‘Ēkahanui PU.
- Clones from additional founders in the ‘Ēkahanui, Ma‘akua and Kahana PUs were collected for the greenhouse collection. These will be used as a source for producing propagules for storage and reintroduction.
- All greenhouse stock has been hand-crossed and seeds have been collected as part of a study by UH graduate student Lauren Weisenberger to determine the effects of inbreeding and outbreeding.
- The last wild plant in the North Pālāwai PU has died.
- A large scale management unit fence was completed by O‘ahu NARS in Kapuna and Keawapilau. It includes more habitat for use in additional reintroductions of the Pahole PU stock.

Plans for Year 5

- Balance founders at existing reintroduction and/or augmentation sites.
- Collect seed for storage from the reintroductions in Kalua‘ā and Wai‘eli, South ‘Ēkahanui, Pahole and Makaua.
- Continue slug control research with Sluggo® in the field.
- Expand the greenhouse collections of clones when available and continue to use the plants to produce propagules for storage and reintroduction.
- Continue to support research by UH Botany graduate student Lauren Weisenberger to determine the effects of inbreeding and outbreeding on *S. kaalae*.

Table 2.47 Taxon Status Summary

Action Area: In															
TaxonName: Schiedea kaalae								TaxonCode: SchKaa							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Pahole	Manage for stability	2	0	0	39	11	0	41	9	0	41	11	0	More plants were added to the reintroduction sites	
Total for Taxon:		2	0	0	39	11	0	41	9	0	41	11	0		

Action Area: Out															
TaxonName: Schiedea kaalae								TaxonCode: SchKaa							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Kahana	Genetic Storage	6	2	0	3	0	0	10	0	0	9	2	0	Monitoring showed a small change in the known wild site	
Kaluaa and Waieli	Manage for stability	0	0	0	116	19	0	72	44	0	116	19	0	More of the plants in the reintroduction have matured in the last year	
Maakua (Koolau)	Manage for stability	10	0	0	0	0	0	16	0	0	10	0	0	Monitoring showed a small change in the known wild site	
Makua (Koolau)	Genetic Storage	1	0	0	8	0	0	9	0	0	9	0	0	No monitoring in the last year	
North Palawai	Genetic Storage	0	0	0	0	0	0	1	0	0	0	0	0	The last wild plant died in the last year	
South Ekahanui	Manage for stability	13	7	0	38	0	0	69	0	0	51	7	0	More plants were added to the reintroduction sites, but some older outplantings have died	
Total for Taxon:		30	9	0	165	19	0	177	44	0	195	28	0		

Table 2.48 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num Wild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Schiedea kaalae</i>							
Kahana	6	2	2	3	6	0	7
Kaluaa and Waieli	0	0	1	1	1	1	1
Maakua (Koolaus)	10	0	1	2	4	0	4
Makaua (Koolaus)	1	0	0	0	1	0	0
North Palawai	0	0	1	1	0	1	1
Pahole	2	0	0	2	1	2	2
South Ekahanui	13	7	3	15	2	13	12
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				24	15	17	27

2.25 *Schiedea nuttallii*

Requirements for Stability

- 3 Population Units (PUs)
- 50 reproducing individuals in each PU (short-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- The stability goal of 50 reproducing individuals has been met for the Kahanahāiki to Pahole PU.
- The genetic storage goals have been met by holding clones of plants from the Kahanahāiki to Pahole PU in the greenhouse.
- A large management unit fence contracted by O‘ahu NARS has been completed around the known sites in the Kapuna-Keawapilau Ridge PU.
- The Mākaha reintroduction begun two years ago has had good survivorship: 6:8 plants survived for two years.
- NRS continued to collect clones from new founders in the Kahanahāiki to Pahole PU.
- Survivorship at the Pu‘u 2210 reintroduction of Pahole stock remains high at 89% (35:39).
- Survivorship at the Switchbacks reintroduction of Kahanahāiki stock is moderate at 42% (34/81).
- All greenhouse stock has been hand-crossed and seeds have been collected as part of a study by UH graduate student Lauren Weisenberger to determine the effects of inbreeding and outbreeding.

Plans for Year 5

- Continue to supplement the reintroduction sites of Kahanahāiki stock into Mākaha and at the Switchbacks site in Pahole.
- Continue the reintroduction site of Pahole stock at the Pu‘u 2210 site.
- Determine reintroduction/augmentation strategy for the Kapuna to Keawapilau PU and prepare stock for outplanting.
- Collect from the reintroduction sites in both PUs for genetic storage.
- Continue to support research by UH Botany graduate student Lauren Weisenberger to determine the effects of inbreeding and outbreeding on *S. nuttallii*.

Table 2.49 Taxon Status Summary

Action Area: In															
TaxonName: Schiedea nuttallii								TaxonCode: SchNut							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Kahanahaiki to Pahole	Manage for stability	13	2	0	80	2	0	61	7	4	93	4	0	The wild sites continue to decline and more plants were added to the reintroductions	
Kapuna-Keawapilau Ridge	Manage for stability	0	0	0	0	0	0	0	0	0	0	0	0	No monitoring in the last year	
Total for Taxon:		13	2	0	80	2	0	61	7	4	93	4	0		

Action Area: Out															
TaxonName: Schiedea nuttallii								TaxonCode: SchNut							
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes	
Makaha	Manage reintroduction for stability	0	0	0	6	0	0	7	0	0	6	0	0	One of the reintroduced plants died in the last year	
Total for Taxon:		0	0	0	6	0	0	7	0	0	6	0	0		

Table 2.50 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num Wild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Arm Nurse	# Plants that Met Goal
<i>Schiedea nuttallii</i>							
Kahanahaiki to Pahole	13	2	41	23	2	37	29
Kapuna-Keavapilau Ridge	0	0	4	0	0	0	0
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants >= 1 Arm Nurse	Total # Plants that Met Goal
				23	2	37	29

2.26 *Schiedea obovata*

Requirements for Stability

- 3 Population Units (PUs)
- 100 reproducing individuals in each PU (short-lived perennial which is prone to large fluctuations)
- Stable population structure
- Threats controlled

Major Highlights/Issues Year 4

- The stability goal of 100 reproducing plants has been met for the Kahanahāiki to Pahole and Keawapilau to West Makaleha PUs.
- The genetic storage goal has been met for the all available founders from the Kahanahāiki to Pahole PU and the Keawapilau to West Makaleha PU.
- An additional collection from a new founder at a historic site in the Kahanahāiki to Pahole PU was received from the National Tropical Botanic Garden. The collection was germinated and will be used to supplement the existing reintroductions.
- All greenhouse stock has been hand-crossed and seeds have been collected as part of a study by UH graduate student Lauren Weisenberger to determine the effects of inbreeding and outbreeding.
- Construction of the large scale management unit fence in Keawapilau has been completed by O‘ahu NARS.

Plans for Year 5

- Continue to balance founders at existing reintroduction sites in both PUs.
- NRS will determine a strategy and locate sites for the Mākaha reintroduction.
- Continue slug control research with Sluggo® in the field.
- Continue to support research by UH Botany graduate student Lauren Weisenberger to determine the effects of inbreeding and outbreeding on *S. obovata*.
- The progeny from cross pollinated plants will be propagated for the Mākaha reintroduction.
- Collect seeds for genetic storage from the reintroductions in Pahole.

Table 2.51 Taxon Status Summary

Action Area: In														
TaxonName: Schiedea obovata								TaxonCode: SchObo						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kahanahāiki to Pahole	Manage for stability	0	0	0	151	130	0	177	119	7	151	130	0	Additional plants were added to existing reintroduction sites in the last year. There are new juvenile plants and some of the oldest mature plants have died.
Keawapilau to West Makaleha	Manage for stability	48	10	20	75	9	0	63	64	11	123	19	20	
Total for Taxon:		48	10	20	226	139	0	240	183	18	274	149	20	

Action Area: Out														
TaxonName: Schiedea obovata								TaxonCode: SchObo						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Makaha	Manage reintroduction for stability	0	0	0	0	0	0	0	0	0	0	0	0	The reintroduction will begin once the MU fence is complete
Total for Taxon:		0	0	0	0	0	0	0	0	0	0	0	0	

Table 2.52 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num Wild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Schiedea obovata</i>							
Kahanahaiki to Pahole	0	0	5	6	1	5	6
Keawapilau to West Makaleha	48	10	21	71	1	18	70
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				77	2	23	76

2.27 Tetramolopium filiforme

Requirements for Stability

- 4 Population Units (PUs)
- 50 reproducing individuals in each PU (short-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- The stability goal of 50 reproducing individuals has been met for the ‘Ōhikilolo PU
- The genetic storage goals have been met for the Kahanahāiki PU.
- A greenhouse living collection from plants in the Kalena and Pūhāwai PUs continues to be maintained for collecting seeds for genetic storage and outplanting.
- The wild site in the Pūhāwai PU was observed to have declined to only one mature plant in the last year.

Plans for Year 5

- Continue to maintain the Kalena and Pūhāwai PU stock separate from stock from other PUs in order to secure seeds for genetic storage.
- Collect cuttings from Wai‘anae Kai PU stock to establish in the nursery as a seed source.
- Produce plants grown from both the Kalena and Pūhāwai PUs to show Botanist, Joel Lau in order to determine if there are any characteristics unique to one or the other. This may be used to guide augmentation strategy at these two PUs.
- Continue to augment the Pūhāwai PU outplanting site with stock from the greenhouse living collection.
- Complete the genetic storage collections for the ‘Ōhikilolo PU.

Table 2.53 Taxon Status Summary

Action Area: In														
TaxonName: Tetramolopium filiforme								TaxonCode: TetFil						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Kahanahaiki	Genetic Storage	45	0	0	0	0	0	45	0	0	45	0	0	No monitoring in the last year
Kalena	Manage for stability	9	0	6	0	0	0	9	0	6	9	0	6	No monitoring in the last year
Keaau	Genetic Storage	30	41	17	0	0	0	30	41	17	30	41	17	No monitoring in the last year
Makaha/Ohikilolo Ridge	Genetic Storage	300	0	0	0	0	0	300	0	0	300	0	0	No monitoring in the last year
Ohikilolo	Manage for stability	2542	582	21	0	0	0	2442	552	1	2542	582	21	Population counts were revised after updating old observations in the last year
Total for Taxon:		2926	623	44	0	0	0	2826	593	24	2926	623	44	

Action Area: Out														
TaxonName: Tetramolopium filiforme								TaxonCode: TetFil						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Puhawai	Manage for stability	1	0	0	0	2	0	7	2	3	1	2	0	The wild site has declined to one mature plant and no juvenile plants were observed. The reintroduction was not monitored in the last year.
Waianae Kai	Manage for stability	30	8	1	0	0	0	30	8	1	30	8	1	No monitoring in the last year
Total for Taxon:		31	8	1	0	2	0	37	10	4	31	10	1	

Table 2.54 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >= 1 Microprop	# Plants >= 1 Army Nursery	# Plants that Met Goal
<i>Tetramolopium filiforme</i>							
Kahanahaiki	45	0	36	99	0	0	60
Kalena	9	0	0	9	0	7	7
Keaau	30	41	0	17	0	0	2
Makaha/Ohikilolo Ridge	300	0	0	0	0	0	0
Ohikilolo	2542	582	1	134	0	0	48
Puhawai	1	0	9	5	0	2	5
Waianae Kai	30	8	0	1	0	0	0
				Total # Plants w/ >= 10 Seeds in Seedbank	Total # Plants w/ >= 1 Microprop	Total # Plants w/ >= 1 Army Nursery	Total # Plants that Met Goal
				265	0	9	122

2.28 Viola chamissoniana subsp. chamissoniana

Requirements for Stability

- 4 Population Units (PUs)
- 50 reproducing individuals in each PU (short-lived perennial)
- Stable population structure
- Threats controlled
- Complete genetic representation of all PUs in storage

Major Highlights/Issues Year 4

- The stability goal of 50 reproducing individuals met for the ‘Ōhikilolo PU
- A thorough monitoring of the Makaleha PU revealed many more plants at the known site.
- Results were inconclusive for the crossing study of greenhouse collection stock, but do not contradict the decision to collect open-pollinated fruit from plants of one isolated PU at a time. Further crosses would be necessary to determine if there are differences in seed set among different parent combinations (selfed, within PU cross, among PU cross).
- Mature seeds were collected for genetic storage from the greenhouse living collection of clones from the Pu‘u Hāpapa PU. The genetic storage goals were met for 5 of the founders represented in the greenhouse.

Plans for Year 5

- Continue to collect seeds for genetic storage from the greenhouse collections of plants from the Pu‘u Hāpapa, Pu‘u Kūmakali‘i and Makaleha PUs.
- Search historic sites within the Kamaile‘unu PU.
- Investigate areas in the Mākaha PU for augmentation and begin to collect clones for the greenhouse living collection.
- Continue to collect clones from new founders in the Pu‘u Hāpapa PU.

Table 2.55 Taxon Status Summary

Action Area: In														
TaxonName: <i>Viola chamissoniana</i> subsp. <i>chamissoniana</i>								TaxonCode: VioChaCha						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Keaau	Genetic Storage	40	10	0	0	0	0	40	10	0	40	10	0	No monitoring in the last year
Makaha/Ohikilolo Ridge	Genetic Storage	7	0	0	0	0	0	7	0	0	7	0	0	No monitoring in the last year
Ohikilolo	Manage for stability	435	10	0	0	0	0	433	10	0	435	10	0	No monitoring in the last year
Puu Kumakalii	Manage for stability	44	0	0	0	0	0	44	0	0	44	0	0	No monitoring in the last year
Total for Taxon:		526	20	0	0	0	0	524	20	0	526	20	0	

Action Area: Out														
TaxonName: <i>Viola chamissoniana</i> subsp. <i>chamissoniana</i>								TaxonCode: VioChaCha						
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2007	NRS Immature 2007	NRS Seedling 2007	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Halona	Manage for stability	41	3	0	0	0	0	41	3	0	41	3	0	No monitoring in the last year
Kamaileunu	Genetic Storage	35	0	0	0	0	0	35	0	0	35	0	0	No monitoring in the last year
Makaha	Manage for stability	17	2	0	0	0	0	17	2	0	17	2	0	No monitoring in the last year
Makaleha	Genetic Storage	34	1	0	0	0	0	1	0	0	34	1	0	A thorough census of the area found many more plants
Puu Hapapa	Genetic Storage	13	5	0	0	0	0	13	0	0	13	5	0	A few more plants were observed in the last year
Total for Taxon:		140	11	0	0	0	0	107	5	0	140	11	0	

Table 2.56 Genetic Storage Summary

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	NumWild Dead	# Plants >= 10 in Seedbank	# Plants >=1 Microprop	# Plants >=1 Army Nursery	# Plants that Met Goal
<i>Viola chamissoniana</i> subsp. <i>chamissoniana</i>							
Halona	41	3	0	2	0	2	1
Kamaileunu	35	0	0	0	0	0	0
Keaau	40	10	0	0	0	0	0
Makaha	17	2	0	0	0	0	0
Makaha/Ohikilolo Ridge	7	0	0	0	0	0	0
Makaleha	34	1	0	0	0	10	0
Ohikilolo	435	10	0	1	0	4	2
Puu Hapapa	13	5	1	5	0	11	5
Puu Kumakalii	44	0	0	11	0	18	11
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				19	0	45	19

Chapter 3.0: *Achatinella mustelina* Management

The MIP stabilization plan for *Achatinella mustelina* outlines protection measures for each Evolutionarily Significant Unit (ESU). Each ESU is considered a genetically distinct group and thus important to conserve in stabilizing the taxon. In order to reach stability for *A. mustelina*, NRS must work towards attaining the goals below.

***Achatinella mustelina* Stabilization Plan Summary**

Long Term Goals:

- Manage snail populations at eight field locations to encompass the extant range of the species and all six genetically defined ESUs.
- Achieve at least 300 snails per population.
- Maintain captive populations for each of the six recognized ESUs.
- Control all threats at each managed field location.

Summary of Stabilization for *A. mustelina*

Overall, stabilization measures for *A. mustelina* are progressing well. Threat control is underway at seven of the eight populations designated for management and at the eighth, monitoring is underway in order to direct management action. Seven of the eight are protected within MU ungulate fences. Rat control is underway at seven of the eight sites designated for management. Weed control is ongoing at seven of the eight manage for stability populations. All eight sites are represented in captive propagation at the UH Snail Laboratory. Research regarding *A. mustelina* dispersal and habitat utilization is ongoing and research about *Euglandina rosea* habitat utilization and feeding patterns is complete. In addition, rat density and home range research is underway in ESU-A and ESU-D2. The top priority management work recommended in last year's report was to expand the management of ESU-C because snail numbers are incredibly reduced here. Rat baiting grid expansion around Schofield Barracks West Range (SBW) sites was accomplished last year by adding more bait boxes and snap traps. Habitat protection fences at these sites were completed in 2007. The ESU-F fence was completed in 2008. In addition, NRS will work with researchers at the UH Snail Laboratory to pursue important *Achatinella* genetics work.

Grouping of *A. mustelina* sites into ESUs

The ESU areas have been updated based on additional genetic sampling conducted last year (Figure 3.1). More details on the results of this sampling will be discussed within the specific ESU sections. Note that the exact shape and extent of each ESU is unknown and therefore the contours depicted are partially theoretical.

**Map removed,
available upon request**

Figure 3.1 Grouping of *Achatinella mustelina* sampling sites into six ESUs

Captive Propagation

One of the requirements outlined in the MIP stabilization plan is to represent, in captive propagation, snails from each of the six ESUs and from two extra sites in ESU-B and ESU-D. ESU-B and ESU-D are very large therefore two sites were selected from each in order to represent the geographic extent of the ESUs. All sites are represented at the UH Snail Lab. Detailed snail captive propagation data is shown in Table 3.1.1.

Table 3.1 Captive Snail Propagation Summary for *Achatinella mustelina*

Population	ESU	Date	# juv	# sub	# adult	# Individuals
Peacock Flats	A	1995	0	0	6	6
		2003	--	--	--	21
		4/2004	8	11	4	23
		9/2005	3	15	2	20
		8/2006	1	12	3	16
		7/2007	0	9	2	11
		8/2008	0	3	3	6
‘Ōhikilolo – Makai	B1	2003	0	0	10	10
		4/2004	27	0	4	31
		9/2005	15	8	0	23
		8/2006	3	9	0	12
		7/2007	1	9	1	11
		8/2008	0	9	0	9
‘Ōhikilolo – Mauka	B1	2003	0	0	8	8
		4/2004	20	5	0	25
		9/2005	18	7	0	25
		8/2006	0	21	2	23
		7/2007	0	12	1	13
		8/2008	0	11	1	12
Ka‘ala S-ridge	B2	2003	0	0	10	10
		4/2004	23	0	6	29
		9/2005	19	5	0	24
		8/2006	4	11	0	15
		7/2007	0	4	1	5
		8/2008	0	3	1	4
Alaiheihe Gulch	C	2003	0	0	10	10
		4/2004	14	4	4	22
		9/2005	17	5	0	22
		8/2006	2	20	0	22
		7/2007	2	21	0	23
		8/2008	1	20	0	21

Population	ESU	Date	# juv	# sub	# adult	# Individuals
Palikea Gulch	C	2003	0	0	10	10
		4/2004	20	1	8	29
		9/2005	22	3	2	27
		8/2006	12	13	0	25
		7/2007	0	22	2	24
		8/2008	0	20	1	21
Schofield Barracks West Range	C	2003	0	0	10	10
		4/2004	15	1	9	25
		9/2005	27	1	2	30
		8/2006	8	22	0	30
		7/2007	2	28	0	30
		8/2008	0	26	1	27
10,000 snails	D1	2001	0	0	9	9
		2003	--	--	--	29
		4/2004	8	22	0	30
		9/2005	3	24	3	30
		8/2006	1	24	3	28
		7/2007	7	14	4	25
		8/2008	8	13	0	21
Schofield South Range	D1	2003	0	0	10	10
		4/2004	18	7	3	28
		9/2005	24	2	0	26
		8/2006	11	12	0	23
		7/2007	0	21	0	21
		8/2008	0	15	3	18
Mākaha	D2	2003	0	0	10	10
		4/2004	16	0	8	24
		9/2005	23	0	3	26
		8/2006	10	14	0	24
		7/2007	5	17	0	22
		8/2008	0	20	0	20
‘Ēkahanui - Honouliuli	E	2003	0	0	10	10
		4/2004	24	2	3	29
		9/2005	22	2	0	24
		8/2006	7	9	0	16
		7/2007	2	9	1	12
		8/2008	0	8	0	8

Population	ESU	Date	# juv	# sub	# adult	# Individuals
Palikea Lunch / former Pālehua	F	1997	1	0	0	1
		4/2004	4	0	4	8
		9/2005	20	0	2	22
		8/2006	5	14	0	19
		7/2007	1	15	0	16
		8/2008	0	13	0	13
TOTAL		2003	--	--	--	138
TOTAL		4/2004	--	--	--	303
TOTAL		9/2005	--	--	--	299
TOTAL		8/2006	--	--	--	255
TOTAL		7/2007	--	--	--	213
TOTAL		8/2008	--	--	--	180

Juvenile=<10mm, Subadult=>10mm no thickened lip, Adult=thickened lip

Table 3.2 below shows an alarming trend of many more deaths than births within the captive laboratory population. UH Tree Snail Laboratory Staff are working on determining the factors involved in these trends. NRS will work with the UH Snail Laboratory Staff to determine steps for revitalizing lab populations.

Table 3.2 *Achatinella mustelina* Laboratory Population Deaths 2004-2008

ARMY POPULATION DEATHS 2004-2008	jan- jun0 4	jul- dec0 4	jan- jun05	jul- dec05	jan- jun06	jul- sept06	oct06- jul07	aug- dec07	jan- jun08
Cage and location	j/s/a	j/s/a	j/s/a	j/s/a	j/s/a	j/s/a	j/s/a	j/s/a	j/s/a
Ka'ala S- ridge chamber 4 bottom	0/1/2	1/0/4	3/1/2	6/2/0	2/1/0	2/2/0	2/6/0	0/0/0	0/0/0
Ala'ihe'ihe Gulch chamber 5 top	1/0/3	2/0/3	1/0/1	0/0/0	0/0/0	0/0/0	0/0/0	0/0/0	0/3/0
Palikea Gulch chamber 5 top	0/0/2	2/0/4	6/0/3	1/0/1	0/0/1	0/0/0	0/2/1	0/1/0	0/0/0
'Ōhikilolo Mauka chamber 5 top	0/0/3	0/0/0	0/0/0	0/0/0	0/1/0	0/0/1	0/9/1	0/0/0	0/0/0
Schofield West chamber 5 top	1/0/1	1/0/3	1/0/2	2/1/2	0/0/2	0/0/0	0/0/0	0/1/0	0/1/0
Mākaha chamber 5 top	1/0/3	2/0/2	2/0/1	1/0/2	1/0/1	0/1/1	0/2/0	0/0/0	0/2/0
'Ēkahanui Gulch chamber 5 bottom	3/0/4	1/0/2	0/0/0	1/2/0	0/4/0	0/2/0	1/3/0	0/1/0	0/2/0
'Ōhikilolo Makai chamber 5 bottom	3/0/2	3/1/4	4/0/0	8/4/0	0/0/0	0/0/0	0/1/0	0/1/1	0/0/0
Schofield South chamber 5 bottom	1/0/0	6/0/1	4/0/6	1/0/1	0/0/2	0/0/0	0/2/0	0/1/0	0/0/0
Schofield chamber 5 bottom	2/0/0	0/0/0	0/0/1	4/0/1	5/0/1	0/0/0	1/0/2	0/0/0	0/0/0
Palehua chamber 1	1/0/0	1/0/0	1/0/1	3/0/2	1/0/0	0/0/0	0/3/0	0/0/0	0/7/0
Peacock Flats chamber 1	1/0/1	1/0/0	2/0/2	0/0/0	0/3/1	0/0/1	0/5/1	0/1/0	0/2/1
10,000 snails chamber 1	1/0/0	0/0/0	0/0/0	0/1/0	1/1/1	0/0/0	9/8/1	4/2/0	1/2/4
Total	37	44	44	46	29	10	60	13	25

mortality									
Mortality by age class Totals	15/1/21	20/1/23	24/1/19	27/10/9	10/10/9	2/5/3	13/41/6	4/8/1	1/19/5
Births during period	72	50	33	10	8	2	15	7	4
Total live <i>A. mustelina</i> at end of period	321	327	316	280	259	251	206	200	179
Population totals at beginning of period by age	188/57/41 286	192/72/57 321	213/75/39 327	220/71/25 316	189/73/18 280	121/124/14 259	55/183/13 251	19/176/11 206	10/180/10 200
Percent mortality by age class	8/1.8/51.2	10.4/1.4/40	11/1.3/48.7	12.3/14/36	5.2/13.7/50	1.7/4/21	23.6/22.4/46	21/4.5/9	10/10.6/50

Genetic Issues

Genetic analyses using microsatellite techniques have been conducted for ESU-B2 in order to determine intra-population variation. These data will be used to guide management decisions related to mixing snails in captive propagation from the same ESU but from different ridges. DNA was extracted from 40 tissue samples that were collected from four separate geographic populations in ESU-B2. Snails from culvert 39 and culvert 45 showed close similarities with each other. This is not surprising since these two ridges are only separated by one ridge. But culvert 56 and culvert 73 are separated by three ridges and they showed much more variation. Thus, DNA analyses found three distinct genetic populations. It can be inferred that there is gene flow or was gene flow in the relatively recent past between snails around culverts 39 and 45. More discussion still needs to take place between the UH lab and NRS before final plans can be determined as to how and which populations of snails might be mixed in the future. More samples also need to be collected from culvert 69 since this ridge will also be included in the fence (Hadfield 2008, unpublished).

Monitoring

- A total of 13 Ground Shell Plots (GSPs) continue to be read quarterly where no rat control is underway and annually where rat control is ongoing.

Reintroduction

- Over the next year finalize draft of rare snail reintroduction protocols with USFWS. Conduct a small-scale trial reintroduction with S-Ridge stock returning to the wild.

Threat Control Development

- Continue coordinating with Working Dogs for Conservation in Montana to train and use dogs to detect *Euglandina rosea* in the field.

Research

- Initiated capture/mark/recapture at two sites in both the Ko‘olau and Wai‘anae mountain ranges to better predict how many snails comprise known populations.
- Aaron Shiels, a PhD student from U.H, has initiated rat home range and rat density studies within the Mākaha fence now that it is complete. He has already established protocols for his research in Kahanahāiki MU over the last year. He will be implementing these same protocols in Mākaha. What he learns at Mākaha will aid in designing the best rat control program for the MU. NRS funded his research almost exclusively.

ESU Updates

The tables used in this section are in a new format. They are developed through queries from the newly completed Microsoft Access database for snail data tracking.

Population Reference Site

The first column lists the population reference code for each field site. This consists of a three-letter abbreviation for the gulch or area name. For example, MMR stands for Mākua Military Reservation. Next, a letter code is applied in alphabetic order according to the order of population discovery. This coding system allows NRS to track each field site as a unique entity. This code is also linked to the Army Natural Resource geodatabase. In addition, the “common name” for the site is listed as this name is often easier to remember than the population reference code.

Management Designation

In the next column, the management designation is listed for each field site. The tables used in this report only display the sites chosen for Manage for Stability (MFS), where NRS is actively conducting management. These sites are generally the most robust sites in terms of snail numbers, habitat quality, and manageability. Other field sites where NRS has observed snails are tracked in the database but under the designation ‘no management.’ In general, these sites include only a few snails in degraded habitat where management is logistically challenging. The combined total for sites designated as MFS should be a minimum of 300 total snails in order to meet stability requirements.

Population Numbers

The most current and most accurate monitoring data from each field site are used to populate the ‘total snails’ observed column and the numbers reported by ‘size class’ columns. In some cases, complete monitoring has not been conducted within this reporting period because of staff time constraints, therefore, older data are used. Some snail monitoring forms do not divide numbers of snails counted into size classes, therefore, size class is recorded as ‘unknown.’

Threat Control

It is assumed that ungulate, weed, rat and *Euglandina* threats are problems at all the managed sites. If this is not true of a site, special discussion in the text will be included. If a threat is being managed in the vicinity of *A. mustelina* or affecting the habitat occupied by *A. mustelina*, a “Yes” designation is assigned. The “No” designation is assigned when there is no ongoing threat control at the field site.

ESU-A Pahole to Kahanahāiki**Table 3.3 *Achatinella mustelina* in ESU-A Manage for Stability Sites**

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
Achatinella mustelina											
MMR-E Ohikilolo Mauka	Manage for stability	77	2004-08-11	62	8	7	0	Yes	Yes	Yes	No
MMR-F Ohikilolo Makai	Manage for stability	240	2004-08-10	190	25	25	0	Yes	Yes	Yes	No
MMR-G Ohikilolo Alemac Site	Manage for stability	28	2002-06-04	24	0	4	0	Yes	Yes	No	No
MMR-H Ohikilolo Koiahi Prikaa Reintro Site	Manage for stability	17	2004-06-16	10	7	0	0	Yes	Yes	No	No
AchMus Total :		362		286	40	36	0				

Size Class Definitions

Size Class	DefSizeClass
Large	>18 mm
Medium	8-18 mm
Small	< 8 mm

Table shows the number of snails, size classes, and threats to the snails in the Population Reference sites. Yes=indicate that the threat is being controlled.

Major Highlights/Issues Year 4

- The number of snails found during mark/recapture work in the MMR-C portion of ESU-A is more than on all previous counts.
- A *Euglandina rosea* exclosure site was surveyed at Kapuna Gulch.
- Significant upgrade and maintenance was conducted at the Pahole Snail Exclosure. Rat bait stations and snap traps have been deployed there.
- A total of 10 *A. mustelina* were collected from outside of the study area in Kahanahāiki and given to the UH lab for captive rearing.

Plans for Year 5

- Outplant common native host trees at the Pahole exclosure site to increase canopy closure.
- Pursue construction of the *Euglandina* exclosure proposed for the Kapuna Gulch site with the State of Hawaii.
- Perform thorough surveys and obtain current snail numbers.
 1. Survey within managed parts of ESUs with <300 total snails
 2. Survey Army training land populations that have not been visited in 3+ years.

ESU-B Ohikilolo to Makaleha

ESU-B is a very large ESU. For management purposes it has been split into two portions. ESU-B1 includes snail occurrences on ‘Ōhikilolo Ridge and B2 includes occurrences in Central and

East Makaleha. Each is discussed separately. The current status of snails at each MFS population reference code in ESU-B1 is shown in Table 3.1.4 and ESU-B2 status in Table 3.1.5.

ESU-B1 ‘Ōhikilolo

Table 3.4 *Achatinella mustelina* in ESU-B1 Manage for Stability Sites

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
Achatinella mustelina											
MMR-E Ohikilolo Mauka	Manage for stability	77	2004-08-11	62	8	7	0	Yes	Yes	Yes	No
MMR-F Ohikilolo Makai	Manage for stability	240	2004-08-10	190	25	25	0	Yes	Yes	No	No
MMR-G Ohikilolo Alemac Site	Manage for stability	28	2002-06-04	24	0	4	0	Yes	Yes	No	No
MMR-H Ohikilolo Koiahi Prikaa Reintro Site	Manage for stability	17	2004-06-16	10	7	0	0	Yes	Yes	No	No
ESU Total :		362		286	40	36	0				

Size Class Definitions

SizeClass	DefSizeClass
Large	>18 mm
Medium	8-18 mm
Small	< 8 mm

Table shows the number of snails, size classes, and threats to the snails in the ESU sites. Yes = threat is being controlled; In some cases the threat may be present but not actively preying on *A. mustelina*.

Major Highlights/Issues Year 4

- Ground Shell plots were monitored showing no signs of rat or *Euglandina* predation.

Plans for Year 5

- Conduct a survey at MMR-H and establish a baiting grid if necessary.
- Perform thorough surveys and obtain current snail numbers.

ESU-B2 East and Central Makaleha**Table 3.5 *Achatinella mustelina* in ESU-B2 Manage for Stability Sites**

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
Achatinella mustelina											
LEH-C	Manage for stability	423	2006-05-23	241	119	63	0	No	No	No	No
East Branch of East Makaleha (culvert 69)											
LEH-D	Manage for stability	39	2006-05-01	20	16	3	0	No	No	No	No
East Branch of East Makaleha (culvert 73)											
LEH-J	Manage for stability	2	2006-11-16	2	0	0	0	No	No	No	No
East Makaleha (culvert 69 - lower down)											
ESU Total :		464		263	135	66	0				

Size Class Definitions

<u>SizeClass</u>	<u>DefSizeClass</u>
Large	>18 mm
Medium	8-18 mm
Small	< 8 mm

Table shows the number of snails, size classes, and threats to the snails in the ESU sites. Yes = threat is being controlled; In some cases the threat may be present but not actively preying on *A. mustelina*.

Major Highlights/Issues Year 4

- Two ground shell plots have been monitored quarterly.
- Collected additional genetics samples for determining intra-ESU genetic variation (see discussion above).

Plans for Year 5

- Collect from the East Makaleha portion of this ESU for representation in the UH Tree Snail Lab.
- Control incipient canopy weeds in the ESU, such as: *Falcataria moluccana*, *Heliocarpus popayanensis*, and *Trema orientalis*.
- Determine best destination for S-Ridge (LEH-A) laboratory stock.
- Perform thorough surveys and obtain current snail numbers.

ESU-C Schofield Barracks West Range (SBW), Alaiheihē and Palikea Gulches**Table 3.6 *Achatinella mustelina* in ESU-C Manage for Stability Sites**

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
Achatinella mustelina											
ALI-A	Manage for stability	0	2004-09-01	0	0	0	0	No	No	No	No
Palikea gulch											
ALI-B	Manage for stability	6	2005-03-23	4	1	1	0	No	No	No	No
Palikea gulch west. Just east of AlaiheihēPalikea dividing ridge.											
AIU-A	Manage for stability	1	2004-06-02	0	1	0	0	No	No	No	No
Manuwai gulch											
IHE-A	Manage for stability	0	2005-03-22	0	0	0	0	No	No	No	No
Alaiheihē Gulch Western Most Site											
IHE-B	Manage for stability	27	2003-02-05	23	4	0	0	No	No	No	No
Alaiheihē middle site "Ptemac Site"											
IHE-C	Manage for stability	0	2005-03-22	0	0	0	0	No	No	No	No
Alaiheihē below Haku's LZ, TT's spot											
SBW-A	Manage for stability	28	2007-08-22	18	6	4	0	Yes	No	Yes	No
North Haleauau Hame Ridge											
SBW-B	Manage for stability	0	2007-08-20	0	0	0	0	Yes	No	No	No
North Haleauau one ridge north of Hame											
SBW-C	Manage for stability	7	2007-08-21	4	3	0	0	No	No	Yes	No
North Haleauau just above Pouteria pair territory											
AchMus Total :		69		49	15	5	0				

Size Class Definitions

Size Class	Def Size Class
Large	> 18 mm
Medium	8-18 mm
Small	< 8 mm

Table shows the number of snails, size classes, and threats to the snails in the Population Reference sites. Yes= indicate that the threat is being controlled.

Major Highlights/Issues Year 4

- Rat control grids were installed within SBW-A and SBW-C where *A. mustelina* are still extant.
- Fences have been constructed in SBW-A and SBW-B.
- Surveys last year revealed more snails than had been observed in recent years at SBW-A.

Plans for Year 5

- Resurvey sites within Ka‘ala NAR that have not been visited recently.
- Secure additional collections to bolster lab population as necessary.
- Continue rat control.
- Perform thorough surveys in all known areas and obtain current snail numbers.
- Pursue permission to move snails from SBW-C to SBW-B site before extirpation.

ESU-D North Kalua‘ā, Wai‘eli, Pu‘u Hāpapa, SBS, and Mākaha**ESU D1 North Kalua‘ā, Wai‘eli, Pu‘u Hāpapa and SBS****Table 3.7 *Achatinella mustelina* in ESU-D1 Manage for Stability Sites**

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
Achatinella mustelina											
KAL-A	Manage for stability	430	2006-11-28	207	160	63	0	Yes	Yes	Yes	No
Land of 10,000 snails											
SBS-B	Manage for stability	196	2004-07-06	131	44	21	0	No	Yes	Yes	No
Puu Hapapa											
ESU Total :		626		338	204	84	0				

Size Class Definitions

<u>SizeClass</u>	<u>DefSizeClass</u>
Large	>18 mm
Medium	8-18 mm
Small	< 8 mm

Table shows the number of snails, size classes, and threats to the snails in the ESU sites. Yes = threat is being controlled; In some cases the threat may be present but not actively preying on *A. mustelina*.

Major Highlights/Issues Year 4

- Determined the best route for a predator fence for the KAL-A site with Island Conservation.
- Surveys have been conducted near Pu‘u Kalena ESU-D over the last year. During these surveys, over 139 new *A. mustelina* were discovered.
- NRS may propose shifting management to the Pu‘u Kalena area if the numbers of snails observed in Mākaha does not increase.
- A new site was discovered on the slopes of Ka‘ala (SBW-R) but genetic sampling proved that the samples fell within ESU-D (which already has >300 snails) and not ESU-C. (which has <300 snails).

Plans for Year 5

- Continue rat grid maintenance and ground shell plot monitoring
- Continue to investigate predator fence construction at KAL-A
- Perform thorough surveys and obtain current snail numbers.

ESU D2 Mākaha**Table 3.8 *Achatinella mustelina* in ESU-D2 Manage for Stability Sites**

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
Achatinella mustelina											
MAK-A Isolau ridge	Manage for stability	31	2006-12-13	18	6	7	0	Yes	Yes	No	No
MAK-B Kumaipo ridge crest	Manage for stability	32	2000-05-03	0	0	0	32	Yes	No	No	No
MAK-C Near pinnacle rocks. Includes Hesarb ridge.	Manage for stability	3	2007-03-07	3	0	0	0	Yes	No	No	No
MAK-D On ledge below ridge crest above MAK-A site.	Manage for stability	27	2005-06-29	21	3	3	0	Yes	No	No	No
AchMus Total :		93		42	9	10	32				

Size Class Definitions

<u>SizeClass</u>	<u>DefSizeClass</u>
Large	>18 mm
Medium	8-18 mm
Small	< 8 mm

Table shows the number of snails, size classes, and threats to the snails in the Population Reference sites. Yes=indicate that the threat is being controlled.

Major Highlights/Issues Year 4

- Completed Mākaha Subunit I MU fence and are removing pigs within it.
- Conducted weed control in areas where *A. mustelina* are known.

Plans for Year 5

- Continue surveys along crestline and Makai Ridge fenceline.
- Install rat control grids at high density *A. mustelina* sites within the new fence. Restock bait every six weeks.
- Install two ground shell plots at these sites.
- Coordinate with Aaron Shiels from UH regarding rat studies within the fence unit.
- Perform thorough surveys and obtain current snail numbers. Expand survey coverage in Mākaha Subunit I fence.

ESU-E Pu‘u Kaua/‘Ēkahanui**Table 3.9 *Achatinella mustelina* in ESU-E Manage for Stability Sites**

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
Achatinella mustelina											
EKA-A Mamane Ridge and Near Plapripi EKA-A	Manage for stability	183	2004-10-13	93	30	60	0	No	Yes	Yes	No
EKA-B Below north population of Tetlep. Between Plapri EKA-A and EKA-C	Manage for stability	55	2004-10-14	46	6	3	0	No	Yes	Yes	No
EKA-C At Plapripi EKA-C site	Manage for stability	6	2004-10-14	6	0	0	0	No	Yes	Yes	No
EKA-D Puu Kaua	Manage for stability	202	2004-10-12	158	31	13	0	No	No	No	No
EKA-E Amastra site	Manage for stability	13	2004-10-05	9	3	1	0	Yes	Yes	Yes	No
EKA-F from Plapri-C head along blue trail under cliffs mauka	Manage for stability	3	2006-02-01	2	1	0	0	No	Yes	Yes	No
ESU Total :		462		314	71	77	0				

Size Class Definitions

<u>Size Class</u>	<u>Def Size Class</u>
Large	>18 mm
Medium	8-18 mm
Small	< 8 mm

Table shows the number of snails, size classes, and threats to the snails in the ESU sites. Yes = threat is being controlled; In some cases the threat may be present but not actively preying on *A. mustelina*.

Major Highlights/Issues Year 4

- Cleared the large subunit fence corridor and began fence construction.
- Conducted weed control at sites with *A. mustelina*.
- Continued to restock rat bait grids.
- Monitored ground shell plots.

Plans for Year 5

- Complete construction of the large subunit fence.
- Continue rat control.
- Monitor ground shell plots.
- Perform thorough surveys and obtain current snail numbers.

ESU-F Pu‘u Palikea/Mauna Kapu (Pālehua)**Major Highlights/Issues Year 4**

- Expanded two rat baiting grids to better encompass snail trees.

- Cleared the MU fence corridor and completed construction.
- Added new rat bait grids at PAK-D and L.

Plans for Year 5

- Conduct weed control at all ‘manage for stability’ snail sites.
- Perform thorough surveys and obtain current snail numbers.
- Determine dextral/sinistral separation reinforced by genetics.
- UH grad student collected 10 ten snails to establish a captive population but will return them to the wild in six months.

Table 3.10 *Achatinella mustelina* in ESU-F Manage for Stability Sites

Population Reference Site	Management Designation	Total Snails	Date of Survey	Size Classes				Threat Control			
				Large	Medium	Small	Unk	Ungulate	Weed	Rat	Euglandina
Achatinella mustelina											
MAU-A Mauna Kapu (Palehua)	Manage for stability	12	2005-03-14	4	8	0	0	No	No	Yes	No
PAK-A Puu Palikea-Ohia spot	Manage for stability	29	2008-04-22	26	0	3	0	No	Yes	Yes	No
PAK-B Iele Patch	Manage for stability	13	2004-08-10	11	1	1	0	No	No	Yes	No
PAK-C Steps spot	Manage for stability	33	2008-08-14	19	9	5	0	No	Yes	Yes	No
PAK-D Joel Lau's site	Manage for stability	7	2008-08-20	5	1	1	0	No	No	Yes	No
PAK-E Exogau site	Manage for stability	4	2006-05-22	3	0	1	0	No	Yes	Yes	No
PAK-F Dodonaea site	Manage for stability	5	2008-04-22	5	0	0	0	No	No	Yes	No
PAK-G Hame and Alani site just above Cyagri fence	Manage for stability	30	2006-01-25	13	11	6	0	No	Yes	Yes	No
PAK-H Mike Hadfield's study site at Puu Palikea	Manage for stability	4	2008-04-22	4	0	0	0	No	No	Yes	No
PAK-I One ridge truck side of E and F	Manage for stability	5	2006-01-26	4	0	1	0	No	Yes	Yes	No
PAK-K Pilo site	Manage for stability	8	2008-06-03	7	1	0	0	No	No	No	No
PAK-L Olapa site north of Puu Palikea	Manage for stability	2	2008-04-23	2	0	0	0	Yes	No	Yes	No
AchMus Total :		152		103	31	18	0				

Size Class Definitions

Size Class	Def Size Class
Large	>18 mm
Medium	8-18 mm
Small	< 8 mm

Table shows the number of snails, size classes, and threats to the snails in the Population Reference sites. Yes=indicate that the threat is being controlled.

Chapter 4.0: MIP ‘Elepaio Management

The initial Biological Opinion (BO) that triggered the development of the Mākua Implementation Plan (MIP) was issued in 1999. At that time, the O‘ahu ‘Elepaio (*Chasiempis sandwichensis ibidis*) was not listed as an endangered species. The 1999 BO included recommendations related to ‘Elepaio. These included conducting complete surveys of the Mākua Action Area (AA) for ‘Elepaio presence, monitoring of all known ‘Elepaio within Mākua Military Reservation (MMR) and installing and maintaining predator control grids around nesting pairs within MMR. In 2000, the U.S. Fish and Wildlife Service (USFWS) granted the O‘ahu ‘Elepaio endangered species status under the federal Endangered Species Act and in 2001 designated critical habitat on O‘ahu for the ‘Elepaio. In the *Supplement to the Biological Opinion and Conference Opinion for Proposed Critical Habitat for Routine Military Training at Mākua Military Reservation* issued in 2001, the recommendations from the 1999 BO became requirements. In September 2004, the USFWS issued another BO that covered newly designated critical habitat within the Mākua AA for plants and ‘Elepaio. This BO outlined additional requirements related to this critical habitat. The most recent BO issued in 2007 required the protection of all ‘Elepaio pairs within the Mākua AA. The tables below outline the status of the required actions from MMR Section 7 Consultations since 1999.

Management Actions 2008

- Surveyed additional gulches in lower Mākua and found a new pair at MMR-15.
- Conducted predator control in three territories of which two contained pairs (MMR-03 & MMR-15). MMR-02 turned out to only have a single male during the 2008 breeding season.
- Monitored pairs at MMR-03 & MMR-15 for nesting success.
- Participated in the Rodenticide Working Group to facilitate the use of aerial broadcast of rodenticide for the protection of breeding ‘Elepaio.

Table 4.1 Current Status of ‘Elepaio in Mākua Action Area

MU	Territory	Initial Status	Year Found	Current Status	Last Observed	Last Monitored
Kahanahāiki	MMR-01	P	1995	F	07/2007	01/2008
Mākua No MU	MMR-02	M/P	2000	M	05/2008	05/2008
Mākua No MU	MMR-03	P	2000	P	05/2008	05/2008
Kahanahāiki	MMR-04	M	1995	V	03/2001	02/2002
Kahanahāiki	MMR-05	M	1995	V	12/1999	03/2002
Kahanahāiki	MMR-06	M	1999	V	<2001	<2001
Mākua No MU	MMR-07	M	2005	M	05/2007	06/2008
Mākua No MU	MMR-08	M	1998	U	1999	2000
Mākua No MU	MMR-09	M	2000	V	06/2002	01/2005
Mākua No MU	MMR-10	M	2001	V	2001	01/2005
Mākua No MU	MMR-11	M	2000	V	2000	11/2007
‘Ōhikilolo	MMR-12	M	2000	V	2001	2004
‘Ōhikilolo	MMR-13	M	2000	M	11/2007	4/2008
Kaluakauila	MMR-14	M	1995	V	09/1998	02/2001
Mākua No MU	MMR-15	P	2008	P	05/2008	05/2008
Mākaha No MU	MAK-10	P	2005	M	12/2006	06/2007
Mākaha No MU	MAK-17	M	2002	U	09/2002	09/2002

Mākaha No MU	MAK-18	M	2005	M	12/2006	12/2006
Mākaha No MU	MAK-19	M	2005	V	12/2006	12/2006
Mākaha No MU	MAK-20	M	2005	U	02/2006	02/2006
Mākaha No MU	MAK-21	M	2005	M	06/2006	06/2006
Pahole	PAH-01	P	<1995	V	<1999	2004
Kapuhi No MU	UHI-01	M	2000	V	2000	2000
Ke‘eke‘e No MU	KEE-01	P	2001	V	2003	08/2004

Bold = rodent control during 2008 breeding season. Initial & Current Status: P = Pair, M = single male, F = single female, V = vacant, U = Unknown. Last Visited: month/year or year,

Table 4.2 ‘Elepaio Breeding Success 2008, Mākua Action Area

Territory	Nests Found	Active Nests	# of Fledglings
MMR-03	1	1	0
MMR-15	0	0	0

Table 4.3 ‘Elepaio Banding Data, Mākua Action Area

Bird ¹	Date Banded	Territory	Last Observed	Last Monitored	Disease ²	Mate Observed ³	Sex
ARRB	03/04/96	MMR-04	03/04/01	02/07/02	Y	N	M
GBAR	03/04/96	MMR-01	05/26/04	01/2008	Y	Y	M
BABW	03/04/96	MMR-01	07/2007	01/2008	Y	N	F
BGAW	03/04/96	MMR-05	12/09/99	03/18/02	Y	N	M
ARGB	12/03/02	MMR-02	01/24/04	05/2008	Y	Y	M
ABBB	12/11/01	MMR-03	05/2008	05/2008	N	Y	M
AGWR	05/05/04	MMR-03	05/2008	05/2008	Y	Y	F

¹ = Band combination: A=Aluminum, R=Red, B=Blue, G=Green and W=White color bands.

² = Presence of disease when banded (Yes or No)

³ = Presence of a mate when last observed (Yes or No)

‘Elepaio Management Actions 2009

- Conduct predator control in all territories with pairs.
- Monitor all territories with pairs for nesting success.
- Re-survey all known territories within the Mākua AA.
- Continue to survey for new territories within the Mākua AA.
- Continue to color band birds for survival determination.

Mākua Action Area

**Map removed,
available upon request**

Chapter 4.0: MIP ‘Elepaio Management

The initial Biological Opinion (BO) that triggered the development of the Mākua Implementation Plan (MIP) was issued in 1999. At that time, the O‘ahu ‘Elepaio (*Chasiempis sandwichensis ibidis*) was not listed as an endangered species. The 1999 BO included recommendations related to ‘Elepaio. These included conducting complete surveys of the Mākua Action Area (AA) for ‘Elepaio presence, monitoring of all known ‘Elepaio within Mākua Military Reservation (MMR) and installing and maintaining predator control grids around nesting pairs within MMR. In 2000, the U.S. Fish and Wildlife Service (USFWS) granted the O‘ahu ‘Elepaio endangered species status under the federal Endangered Species Act and in 2001 designated critical habitat on O‘ahu for the ‘Elepaio. In the *Supplement to the Biological Opinion and Conference Opinion for Proposed Critical Habitat for Routine Military Training at Mākua Military Reservation* issued in 2001, the recommendations from the 1999 BO became requirements. In September 2004, the USFWS issued another BO that covered newly designated critical habitat within the Mākua AA for plants and ‘Elepaio. This BO outlined additional requirements related to this critical habitat. The most recent BO issued in 2007 required the protection of all ‘Elepaio pairs within the Mākua AA. The tables below outline the status of the required actions from MMR Section 7 Consultations since 1999.

Management Actions 2008

- Surveyed additional gulches in lower Mākua and found a new pair at MMR-15.
- Conducted predator control in three territories of which two contained pairs (MMR-03 & MMR-15). MMR-02 turned out to only have a single male during the 2008 breeding season.
- Monitored pairs at MMR-03 & MMR-15 for nesting success.
- Participated in the Rodenticide Working Group to facilitate the use of aerial broadcast of rodenticide for the protection of breeding ‘Elepaio.

Table 4.1 Current Status of ‘Elepaio in Mākua Action Area

MU	Territory	Initial Status	Year Found	Current Status	Last Observed	Last Monitored
Kahanahāiki	MMR-01	P	1995	F	07/2007	01/2008
Mākua No MU	MMR-02	M/P	2000	M	05/2008	05/2008
Mākua No MU	MMR-03	P	2000	P	05/2008	05/2008
Kahanahāiki	MMR-04	M	1995	V	03/2001	02/2002
Kahanahāiki	MMR-05	M	1995	V	12/1999	03/2002
Kahanahāiki	MMR-06	M	1999	V	<2001	<2001
Mākua No MU	MMR-07	M	2005	M	05/2007	06/2008
Mākua No MU	MMR-08	M	1998	U	1999	2000
Mākua No MU	MMR-09	M	2000	V	06/2002	01/2005
Mākua No MU	MMR-10	M	2001	V	2001	01/2005
Mākua No MU	MMR-11	M	2000	V	2000	11/2007
‘Ōhikilolo	MMR-12	M	2000	V	2001	2004
‘Ōhikilolo	MMR-13	M	2000	M	11/2007	4/2008
Kaluakauila	MMR-14	M	1995	V	09/1998	02/2001
Mākua No MU	MMR-15	P	2008	P	05/2008	05/2008
Mākaha No MU	MAK-10	P	2005	M	12/2006	06/2007
Mākaha No MU	MAK-17	M	2002	U	09/2002	09/2002

Mākaha No MU	MAK-18	M	2005	M	12/2006	12/2006
Mākaha No MU	MAK-19	M	2005	V	12/2006	12/2006
Mākaha No MU	MAK-20	M	2005	U	02/2006	02/2006
Mākaha No MU	MAK-21	M	2005	M	06/2006	06/2006
Pahole	PAH-01	P	<1995	V	<1999	2004
Kapuhi No MU	UHI-01	M	2000	V	2000	2000
Ke‘eke‘e No MU	KEE-01	P	2001	V	2003	08/2004

Bold = rodent control during 2008 breeding season. Initial & Current Status: P = Pair, M = single male, F = single female, V = vacant, U = Unknown. Last Visited: month/year or year,

Table 4.2 ‘Elepaio Breeding Success 2008, Mākua Action Area

Territory	Nests Found	Active Nests	# of Fledglings
MMR-03	1	1	0
MMR-15	0	0	0

Table 4.3 ‘Elepaio Banding Data, Mākua Action Area

Bird ¹	Date Banded	Territory	Last Observed	Last Monitored	Disease ²	Mate Observed ³	Sex
ARRB	03/04/96	MMR-04	03/04/01	02/07/02	Y	N	M
GBAR	03/04/96	MMR-01	05/26/04	01/2008	Y	Y	M
BABW	03/04/96	MMR-01	07/2007	01/2008	Y	N	F
BGAW	03/04/96	MMR-05	12/09/99	03/18/02	Y	N	M
ARGB	12/03/02	MMR-02	01/24/04	05/2008	Y	Y	M
ABBB	12/11/01	MMR-03	05/2008	05/2008	N	Y	M
AGWR	05/05/04	MMR-03	05/2008	05/2008	Y	Y	F

¹ = Band combination: A=Aluminum, R=Red, B=Blue, G=Green and W=White color bands.

² = Presence of disease when banded (Yes or No)

³ = Presence of a mate when last observed (Yes or No)

‘Elepaio Management Actions 2009

- Conduct predator control in all territories with pairs.
- Monitor all territories with pairs for nesting success.
- Re-survey all known territories within the Mākua AA.
- Continue to survey for new territories within the Mākua AA.
- Continue to color band birds for survival determination.

Mākua Action Area

**Map removed,
available upon request**

Appendix 1

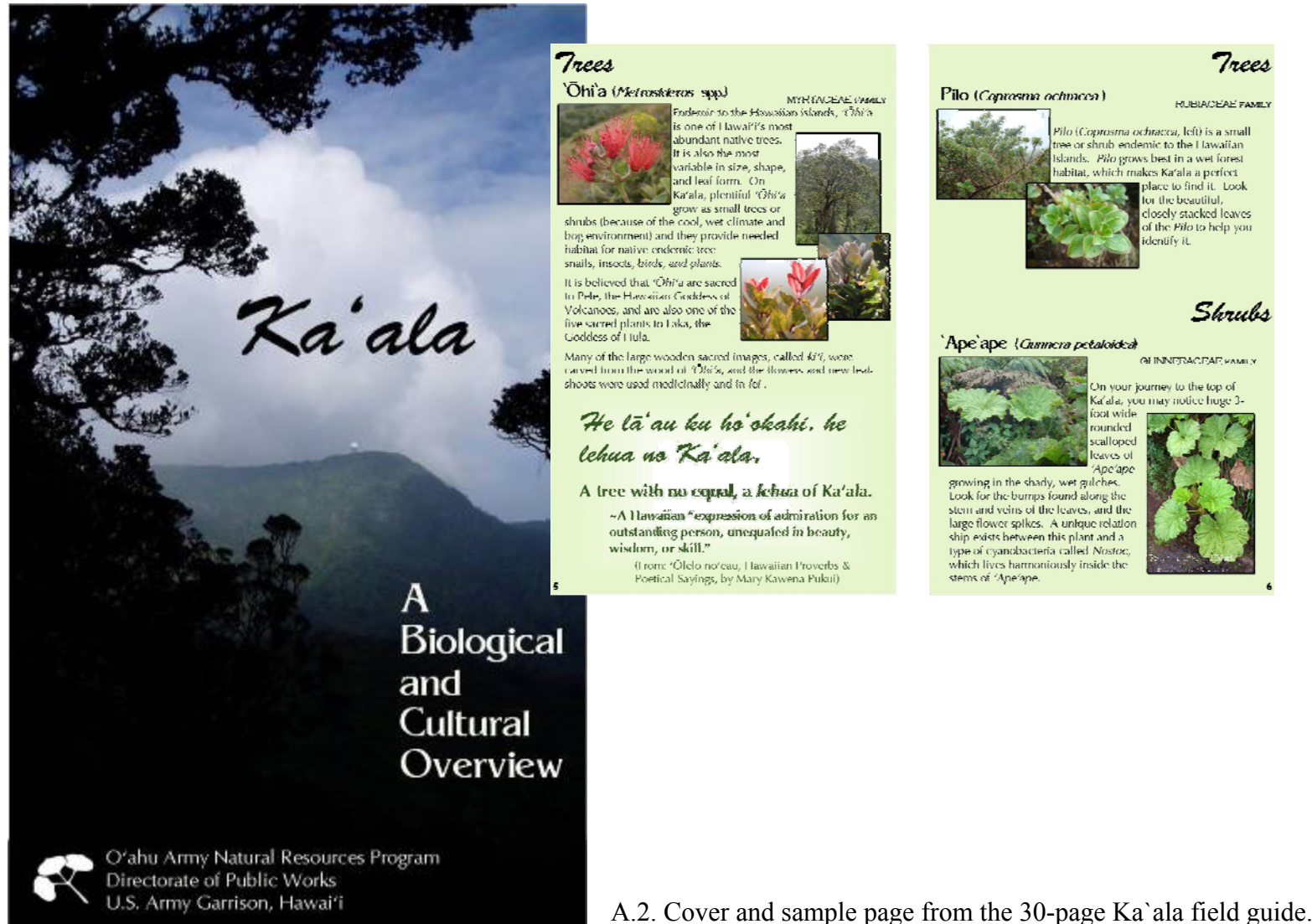
Environmental Outreach

- A. Examples of educational materials developed and produced
- B. Photos from volunteer service trips
- C. Environmental compliance officer training materials
- D. Examples of P.R. articles and publications
- E. Examples of television features

Appendix 1A. Examples of educational materials developed and produced.



A.1. Large (6 x 3 ft.) 3-panel display board highlighting OANRP efforts in Makua Valley.



A.2. Cover and sample page from the 30-page Ka'ala field guide.

O'ahu 'Elepaio



ua 'elepaio 'ia ka wa'a
"The canoe is marked by the 'elepaio"
—Olelo no 'oe, Mary Kawena Pukui

In Hawaiian legend, 'Elepaio helped canoe voyagers judge the quality of low logs to make canoes. Since the 'Elepaio is an insect-eater, its ability to identify insect-infested wood made it a valuable resource to early Hawaiians. If the bird pecked at the tree, the wood was considered poor quality. If it simply landed and sang, the wood was considered sound.

Description

The 'Elepaio is a small flycatcher endemic to the Hawaiian Islands, with distinct subspecies found on Kauai, Hawaii, and O'ahu. 'Elepaio are territorial and may fly close to approaching visitors, announcing their presence with a squeaky "kūp-chup" or a loudly whistled "U-e-pai-e!"

Physical Features: 14 cm long, adult O'ahu 'Elepaio are chocolate-brown above with a white rump, and two white wing bars. The dark-colored tail is white-tipped and is often cocked upward when the bird is perched. Males usually have more black on their throats than females.

Habitat: Moist forests between 200 m and 400 m elevation.

Range: Found only in isolated areas in the Koolau and Waianae mountains.

Food: Insects and other invertebrates.

Nests: 'Elepaio build cup-shaped nests on tree branches, often consisting of mosses and lichen.

*Curious, social,
and in peril...*

- ▶ The O'ahu 'Elepaio is an endangered species. The U.S. Fish and Wildlife Service granted it endangered species status in the year 2000.
- ▶ Kamana Nui and Kamana Iki Valleys are home to the third largest population of the endangered 'Elepaio on O'ahu. The Army monitors this population of 'Elepaio and protects these birds from rodent predation.
- ▶ The Army is protecting more 'Elepaio pairs in Kamana Nui and Kamana Iki Valleys than any other place on O'ahu. Twenty-six mated pairs are currently being protected from rodent predation in these valleys.
- ▶ Last year this population had the highest number of successful fledglings (17) of all populations that are being protected by the Army.

'Elepaio in Kamana Nui and Kamana Iki Valleys



Legend:

- 'Elepaio
- 'Elepaio
- Protected Area
- Military Army Reservation

O'ahu Army Natural Resources Program

A.3. Large (6 x 4 ft.) 3-panel display board describing the O'ahu 'Elepaio, used for the Moanalua Valley dedication ceremony (US Army Garrison, Hawaii helped purchase this valley through their ACUB program).

ALERT! A highly invasive weed has been discovered in the Ko'olau mountains:

CANE TIBOUCHINA (*Tibouchina herbacea*)

Your *kukua* is needed to prevent it's spread and protect our native plants and animals.

How bad is it?

- ▶ Cane tibouchina poses a major threat to Ko'olau forests - it thrives in wet areas and spreads rapidly.
- ▶ It produces hundreds of tiny seeds and can also reproduce from pieces of the plant.

CANE TIBOUCHINA Upright growth

Fluffy stems also can be reddish

Photo courtesy of Hank Oppenheimer

What does it look like?

- ▶ Cane tibouchina is a shrub, reaching up to 4 m (13 ft) tall. Leaves are very hairy, with 5-7 parallel veins, are 3 - 7.5 cm (1.2 - 3 in) long, and 1.3 - 3.5 cm (0.5 - 1.4 in) wide. Flowers are purplish-pink and have 4 petals. Stems are square, and covered with tiny gland-tipped hairs, visible with a hand lens.

What you can do:

- ▶ Please report all sightings to the Oahu Invasive Species Committee (OISC) so it can be identified and removed!
- ▶ Note (with as much detail as possible) where you found it. If possible, please take a close-up photo of the leaves and flowers, and a photo of the whole plant. (GPS point coordinates are also helpful. If you have one.)

Send this information via email to: oisc@hawaii.edu

DO NOT REMOVE THE CANE TIBOUCHINA - It can grow easily from any fallen pieces.

FOR MORE INFORMATION, please contact Julia Parish: oisc@hawaii.edu office: 286-4616

OISC OAHU INVASIVE SPECIES COMMITTEE

Oahu Army Natural Resources Program

Look-a-like plant: **PINKERINGE**

Pinkeringe flowers are 4-petaled but have pink petals. Pinkeringe stems and leaves have only sparse hairs. Pinkeringe tends to fall over, forming large bangles (cane tibouchina grows upright).

A.4. Flyer posted along hiking trails informing the public about a newly discovered incipient weed in the Ko'olau mountains, *Tibouchina herbacea*.

HAWAII'S RARE NATURAL RESOURCES

Protection of the abundant endangered plants and animals found on Army training lands is the primary goal of the Army Natural Resource Program.

"Army personnel at all levels must ensure that they carry out mission requirements in harmony with the requirements of the Endangered Species Act."

-Army Regulation 200-5

THE ARMY NATURAL RESOURCE PROGRAM ACTIONS ARE GUIDED BY MULTI-SPECIES MANAGEMENT PLANS DEVELOPED WITH THE HELP OF EXPERT STATE AND FEDERAL BIOLOGISTS.

MALAMA 'ĀINA HELP PROTECT THE LAND

Volunteers have logged hundreds of hours helping to protect Hawaii's natural resources on Army land.

For more information, please call: (808) 656-7845, on Oahu (808) 369-1886, on the Big Island

US ARMY GARRISON HAWAII

NATURAL RESOURCE PROGRAM

DID YOU KNOW?

- The U.S. Army spends over \$10 million per year protecting more than 100 species of endangered plants and animals at Māhukū and Schofield Barracks on Oahu and at PTI on the Island of Hawaii.
- The U.S. Army employs more than 80 technically-trained civilian and contracted field biologists in their Natural Resource Program.

THREATS TO HAWAII'S NATURAL RESOURCES

- ▶ Invasive, non-native plants (weeds) aggressively compete for nutrients, water, and sunlight with native plants.
- ▶ Introduced, non-native predators such as rats, feral cats, and Indian mongooses eat native birds, bird eggs, plants, seeds, and snails.
- ▶ Feral pigs, goats, and sheep feed on and uproot native plants, and spread weed seeds. Pig wallows can become mosquito breeding grounds, and mongooses spread disease to native forest birds.
- ▶ The introduced Rong Wolf Snail (*Euglandina rosea*) preys on native Kōkoi tree snails.
- ▶ Wildfire destroy native forests and create open areas where invasive weeds quickly become established.

ARMY NATURAL RESOURCE PROTECTION ACTIONS

Endangered plant species are monitored to track their health, select seeds for propagation, and to control threats.

ARMY NATURAL RESOURCE STAFF CURRENTLY MONITOR MORE THAN 500 ENDANGERED PLANT POPULATIONS.

Endangered plants grown from seed or cuttings are cared for in Army Natural Resource Program plant nurseries until they can be planted back into the wild.

THE ARMY SPENDS MORE THAN 3,000 PEOPLE-HOURS CONTROLLING WEEDS ON MORE THAN 55,000 ACRES OF LAND EACH YEAR.

Feral pigs and goats are managed by fence construction and hunting.

THE ARMY CURRENTLY PROTECTS MORE THAN 57,000 ACRES OF NATIVE HABITAT WITH FENCES.

Climb tree trunks (like a koala)

Native bird and snail management entails surveying, monitoring, and controlling predators.

Predator control for these endangered animals includes setting up bait stations and traps for rats.

For information, call: (808) 656-7845, on Oahu (808) 369-1886, on the Big Island

A.5. Front and back of a tri-fold brochure highlighting the Army Natural Resource Program.

Appendix 1B. Photos from volunteer service trips.



B.1 Kahanahaiki –
Volunteers out-plant native
palapalai fern, *Microlepia
strigosa*.



B.2 Palikea - Volunteer assists
with incipient weed control
(*Crocsmia x crocosmiiflora*).



B.3 Ka'ala –
Volunteers
celebrate their
invasive weed
control efforts.



B.4 KTA(O'io) -
OANRP staff out-plant
Carex wahuensis with
large group of
volunteers.




B.5 Ka'ala –
Volunteers brave
the mud to remove
the incipient
Juncus effusus
from the bog.



B.6 Moanalua Valley - OANRP
staff leads a community group on
an interpretive hike to share
information about the endangered
'elepaio.

Appendix 1C. Environmental compliance officer training materials.



Protecting Hawai'i's Natural Resources on Army Training Lands

Many of Hawai'i's native ecosystems are found nowhere else in the world; almost 80% of the endangered plants and animals living in these fragile ecosystems are found on Army Training Lands.

Checklist of what YOU can do:

- ✓ Wash your boots 
- ✓ Wash your equipment 
- ✓ Wash your vehicles 
- ✓ Report ALL snake sightings
Call **643-PEST** 
- ✓ Avoid areas marked by Seibert stakes 

Seibert stakes are placed along roads and within vegetated areas to advise soldiers of unsafe or hazardous range or training conditions and/or environmentally sensitive off-limit areas. Anyone in that area should not proceed past the Seibert stake.

- ✓ Do not smoke on Army training lands
- ✓ Report fires immediately
Call Range Control Operations: **655-1434**

If harmed, endangered plant and animal species may be lost forever, along with countless potential opportunities for new medicines and food crops.

As species diversity declines, so does the health and balance of the ecosystems that provide us with clean water, air, and soil. The Army Natural Resource Program acts to conserve endangered species on Army lands.

Prevent the spread of alien species

Follow the **Checklist!**

Prevent wildfires

FACT: Non-native, invasive weeds spread rapidly and harm Hawai'i's endangered species and ecosystems.

FACT: The Army is required by law to protect endangered species.

FACT: It costs more money to control invasive weeds than it does to implement basic measures (like the ones listed here) to prevent their spread.

FACT: Invasive weeds can interfere with range function, and therefore training operations.

FACT: Uncontrolled fires on Army Training Lands can devastate ecosystems and harm endangered plants and animals.

FACT: Range fires cause interruptions and delays in training and interfere with troop readiness.

C.1. Pages from brochure used for Environmental Compliance Officer (E.C.O.) training on Schofield Barracks.

Appendix 1D. Examples of P.R. articles and publications.

FALL 2008
ENVIRONMENTAL UPDATE
5

‘Conservation Camp’ Interns Clean Up Makua Valley

By Kimberly Welch
Oahu Army Natural Resource Program

In the last morning hours this July, in the fern-filled gully of Kahahaiki, the northern-most gulch of Makua Valley, Hawaii, strange sounds could be heard echoing off the valley walls.

“Height: 2.15 meters.”
“Basal diameter: 23 centimeters.”
“Vigor: healthy.”
“Where’s plant number 75?”

These were the shouts of 10 dedicated interns and their two leaders from the Hawaii Youth Conservation Corps (HYCC), a summer internship program for youth interested in conservation. The interns were calling off measurements to their teammates, who diligently recorded the information.

The group was assisting staff from the Oahu Army Natural Resource Program (OANRP) in locating and monitoring the endangered *Cyanea superba*, a native Hawaiian lobelia plant resembling a cabbage on a stick.

After one day, HYCC interns, working side-by-side with OANRP staff had monitored more than 75 endangered plants, collected more than 150 fruit from a native nettle tree (mamaki), built steps along steep sections of trail, constructed fence crossings, and removed more than 100 invasive plants from the native forest of Kahanahaiki.

This particular group was now on its fourth day with the OANRP staff, actively engaging in natural resource management. The summer at OANRP has been dubbed “Conservation Camp,” an appropriate reference to the multitude of young adults learning about careers in conservation through internships with OANRP. Between June and August, OANRP staff introduced the many aspects of natural resource field work to nearly 40 interns, including 30 one-week interns, two six-week interns, and three three-month interns. This temporary boost in the number of “field technicians” has enabled OANRP staff to accomplish a number of natural resource management tasks in a very short time frame.



Oahu Natural Resource Program staff and Hawaii Youth Conservation Corps volunteers pack in step-building material to improve the trails of Kahanahaiki.

D.1. “Conservation Camp” – article published in the Environmental Update, Fall 2008.

Public Works DIGEST

Volume XX, No. 3,
May/June 2008

This Issue:
**Environment and
Sustainability**

Management	3
Awards	14
Successes	22
Focus on Public Works	36



Oahu Army Natural Resources Program Outreach brings volunteers onto Army lands in Hawaii for hours and to help staff with conservation work like planting native plants. Photo by Kim Welch, Page 28

U.S. ARMY NATURAL RESOURCES PROGRAM
IMCOM



Involving community in Army conservation work

by Candace Russo

What do a hunter, an artist and a high-school student have in common? The Oahu Army Natural Resources Program has learned the answer: they all have a desire to know more about their natural environment and are willing to devote valuable time to this cause. The OANRP also learned that providing educational opportunities to the public is reciprocated by dedicated volunteers providing help to OANRP staff as it works to achieve its mission.

The OANRP, a Directorate of Public Works environmental program, follows a mission to conserve and protect endangered species on Army training lands on the island of Oahu. The work is strenuous,

the goals are impressive, and the staff is small.

Roughly a dozen OANRP staff regularly hike miles of trails across hundreds of acres of land on the island's two mountain ranges. On their back, each person hauls equipment needed for the job: hand saws, pruners, shovels, herbicide and the occasional chain saw.

Hawaii is home to more endangered species than any other state, and 80 percent of Hawaii's endangered species can be found on Army training lands. The OANRP crews spend their days fighting for these plants and animals by controlling invasive weeds, monitoring native plants, building fences or checking rat traps.

The staff considers the work rewarding. Yes, at times, it can also seem over-



The hike into a work site, like this trail into Kahanu Forest, is half the fun. Photo by Will Weaver

Acronyms and Abbreviations

OANRP Oahu Army Natural Resources Program

(continued from previous page)

whelming given the amount of land and the spread of weeds. Taking control, the OANRP employed up two of its valuable techniques in 2007: education and volunteers.

The OANRP created an outreach plan built on the momentum already established by Oahu's conservation community. Not yet a year into development, OANRP Outreach has coordinated more than 30 volunteer service trips to the forests of the Waianae Range on western Oahu.

The program is structured so that volunteers provide several hours of work, and, in return, OANRP staff provides an interpretation of the area's natural history. Because of this reciprocal relationship, what began with a few people has now blossomed into communication with more than 200 regular volunteers.

This volunteer growth can primarily be attributed to one thing — location. The Army owns some of the most pristine habitat on the island of Oahu.

OANRP Outreach offers opportunities for the public to experience one of only two native bogs on Oahu or one of the last remaining mesic forests in Hawaii. Witnessing plants like a rare lobelia hunting with pink flowers on the summit of Mount Ka'ala, or the striped shells of Kahili tree snails decorating the leaves of trees in Kahanu Forest are "lifetime finds" for some volunteers. The OANRP is honored to be able to share these natural wonders with its hard-working volunteers.

Two fiscal volunteer projects have been restoration efforts on the summit of Mount Ka'ala, the highest point on Oahu, and in the mesic Kahanu Forest, located on the north side of Maunaloa Valley.

At Ka'ala, part of a rare bog habitat was overrun with an invasive weed decaying named "soft rush." Eighty volunteers helped remove 35 large garbage bags of

this sharp and tough invasive weed and then transplanted more than 40 native lupine tree ferns.

In Kahanu, OANRP Outreach supervised numerous volunteer service trips to remove weeds and plant more than 500 native trees, shrubs and ferns to help restore this forest to a more native state.

Participants in these and other projects have been as diverse as the habitats. Groups have included intermediate and high school students from various schools, classes from the University of Hawaii and Kapikani Community College, as well as a women's group, local scholarship recipients and a hula hula school.

The general public also participates in several trips a month, bringing families as well as new volunteers. The majority of OANRP Outreach advertising has been word-of-mouth.

In addition to coordinating volunteer service trips, OANRP Outreach is working to increase awareness about natural resource issues in the military community. OANRP Outreach has added new interaction to the monthly Army Environmental Compliance Officer training curriculum. OANRP Outreach is also introducing young people to career opportunities with the OANRP by attending career fairs and giving career-based presentations. To date, specialists have reached more than 100 stu-



In exchange for their work, volunteers at Kahanu Forest are provided an interpretation of critical natural resources found in Maunaloa Valley. Photo by Candace Russo

dents in grades 5-12.

Since October 2007, the OANRP Outreach volunteer efforts have resulted in a total of almost 1,800 volunteer hours on Army training lands. Using the average salary of OANRP field technicians, these volunteer hours translate to roughly \$25,400 worth of free labor.

However, the true value extends beyond a dollar amount. The efforts aid in the restoration of endangered habitats, but they also provide the Oahu community with a rare opportunity to experience areas significant to ancient and current Hawaiian culture and to learn about issues affecting endangered species. This extends knowledge into the community and cultivates a relationship between the public and the Army, the value of which can only be viewed as infinite.

POC is Candace Russo, 858-656-7641, candace.russo@us.army.mil

Candace Russo is an environmental outreach specialist, OANRP, U.S. Army Garrison Hawaii.

D.2. "Involving Community in Army Conservation Work" – article published in the Public Works Digest, May/June 2008.



EMP



Ecosystem Management Program Bulletin

Volume 13

August 2008

Predator-Proof Fencing: Lessons from New Zealand

By Stephen Mosher
Natural Resource Management Coordinator
RCUH/PCBU/O'ahu Army Natural Resources Program

In March, Joby Rohrer and Stephen Mosher of the O'ahu Army Natural Resources Program traveled to New Zealand for two weeks to gain first-hand knowledge of predator control methods and techniques used in New Zealand.

One of the control techniques reviewed during the trip was predator-proof fencing.

Hawaii and New Zealand are both unique in originally having only bats as their sole native



Driving Creek Wildlife Sanctuary Predator-Proof Fence.
(Photo by Stephen Mosher, OANRP)

land mammal and in having large numbers of native and endemic bird species.

Both island groups have had intentional and accidental introductions of small mammals that have led to severe declines or extinctions of native forest birds.

In Hawaii and New Zealand, introduced rats (*Rattus* sp.) are major predators of forest birds.

Predator-proof fencing has been designed in New Zealand to exclude invasive introduced small mammals (three species of rats, mice, stoats, feral cats, ferrets, weasels, brushtailed

Inside this issue:

Predator-Proof Fencing: Lessons from New Zealand, by Stephen Mosher..... 1

DNA Analysis to Better Plant Conservation, by Erin Foley..... 3

Hilo Union Elementary Students Plant the Seeds of Knowledge at Pōhakuoa Training Area, by Tiana Sudduth..... 4

A Helping Hand for *Hesperomannia arbuscula* Pollination, by Lauren Weisenberger..... 5

Cultural Outreach Program at Pōhakuoa Training Area, by Kelly Leialoha Luscomb..... 7

possums, rabbits, hares, hedgehogs, and dogs), for the conservation of rare native forest birds, nesting seabirds, native lizards, and rare native insects.



Stephen Mosher examines one of New Zealand's predator-proof fences.
(Photo by Joby Rohrer, OANRP)

With the construction of fencing and the removal and control of seed eaters, forest health has dramatically improved.

Predator-proof fencing also excludes the many introduced

'Tis the Season...

The Koli'i are blooming! Many tubular-shaped flowers of Koli'i, *Trematolabellia macrostachys*, offer a spectacular display of pink in early summer.

A type of lobelia, Koli'i entices native honey-creepers, like the 'I'iwi, extremely rare on the island of O'ahu, have been known to follow the blooming Koli'i on the summit of Ka'ala to feed on the flowers' nectar.

After flowering, seed-filled capsules are formed. When the wind blows, seeds are released through small pukas in the capsule, much like a salt shaker.



VOLUNTEER OPPORTUNITIES AUGUST 2008

► **Event:** Kahanahāki Volunteer Service Project (O'ahu)
Date: Saturday August 9, 2008
Purpose: To control strawberry guava (an invasive weed) within Kahanahāki, a Mākua Implementation Plan Management Unit.
Participants: Open to the public

► **Event:** Palikea Volunteer Service Project (O'ahu)
Date: Friday August 22, 2008
Purpose: To control *Crocosmia* (an invasive weed) within Palikea, an O'ahu Implementation Plan Management Unit.
Participants: Open to the public

For more information about O'ahu Natural Resources Program volunteer opportunities, please contact
Kim Welch or Candace Russo:
kimwelch@hawaii.edu
candace.russo@us.army.mil

D.3. Sample cover and page from the Ecosystem Management Program Bulletin, August, 2008.

Appendix 1E. Examples of television features.



Posted: June 11, 2008 12:40 PM

Big efforts to save a tiny animal

By Stephanie Lum - [bio](#) | [email](#)



Kapua Kawelo



Dr. Sam Gon



WAIANAE (KHNL) - When you think of endangered species in Hawaii, snails may not be the first thing that comes to mind.

Big efforts are underway to save and preserve the tiny Kahuli Snail.

Biologist Kapua Kawelo and Scientist Dr. Sam Gon with the Oahu Army Natural Resource Program and Nature Conservancy work together every week in the Waianae and Koolau mountains.

Kawelo and Gon monitor the dwindling population of the tree snails and make sure rats, the snail's biggest threat, don't roam the areas the Kahuli snails inhabit.

"Rats love to eat the snails so we set up rat traps and re-bait the rat boxes every couple of weeks," says Kawelo.

At one time, decades ago, there were so many Kahuli snails, some said the snails looked like ornaments on trees. The colorful patterns on their shells gave them the nickname "jewels of the forest" and just as people would snatch up jewels, they were snatched up in numbers by shell collectors.

"People would ride their horses into the forests with empty saddles and come back with their saddles full of Kahuli snails," said Kawelo.

The beloved snail is now on the verge of extinction.

It's not known just how many Kahuli snails are left. Of the 40 species of Oahu tree snails, recent studies say more than half are extinct and most of the others are on the verge of extinction.

Unlike other snails, the Kahuli snails do not lay eggs.

"The snails give live birth to only one baby snail at a time," said Kawelo.

Dr. Gon says this sad reality only makes him work harder to save them.

"It's in song, it's in story, it's in chant. All of those form the foundation of Hawaiian culture. If you lose the physical things of Hawaiian culture, you lose that culture. It would be as if you were singing something and your child asks what is that bird you're singing about and you can't show them because the thing is gone," said Dr. Gon.

Under federal law, anyone caught tampering or harming the Kahuli Snail can face fines of up to fifty thousand dollars.

E.1. Website version of news story produced by KHNL News Channel 8 for their Earth & Sea Project series.



Military Preserves Endangered Plants

Posted: May 28, 2008 03:37 PM



Kapua Kawelo

By [Howard Dashefsky](#)

WAIANAE (KHNL) -- The U.S. military hopes to preserve some of Oahu's most endangered plants. Their goal is to collect seedlings and re-plant them in their native environments.

"This whole group of plants co-evolved from a group of honey creepers with those curved bills and you could imagine those bills fitting in there like a hand to a glove," said Kapua Kawelo of the Army Resource Program.



High above the North Shore, at about 2,000 feet above the ocean sits a brand new, but otherwise ordinary greenhouse. But what's inside is anything but ordinary.

You're looking at some of the rarest plants on earth. And in some cases the only plants of their kind. This is the work of the Army Natural Resource Program.



"This is our conservation green house. We grow endangered plants for their protection and then to plant them back into the wild to bolster their numbers," said Kawelo.

Like all federal agencies, the Army is mandated by the Endangered Species Act to preserve protected species. And here in the 50th state, there are many reasons to make sure that mandate is met.



"Hawaii is the endangered species capitol of the world so the plants we work with, some of them are not represented in the wild anymore, they don't exist there anymore and some of them are just really rare or severely threatened by pigs and goats and other invasive species," said Kawelo.

Everyone within the Army Natural Resource Program shares a common goal. To collect, and nurture the endangered plants from seedlings, to greenhouse, and hopefully one day, back out into their native environments.



"This plant is only known from one individual in the wild anymore," Kewalo said.

And with the gentle touch of the human hand, this fragile gift of nature is flourishing. And the humans couldn't be any happier. "

"I feel for me this was meant to be. I've always loved to hike and look at plants and see native plants and use them for lei making and all those things so it's really great to be able to give back to protecting those resources for future generations," said Kawelo.

E.2. Website version of another news story produced by KHNL News Channel 8 for their Earth & Sea Project series.

Appendix 2

MIP/OIP NATURAL RESOURCES MONITORING PROGRAM

Monitoring Protocol 1.2.1 Belt Plot Sampling for Understory, Weeds, and Canopy

22 September 2008

INTRODUCTION

The U.S. Army is currently involved in a major conservation effort to stabilize populations of endangered plant and animal species within lands they manage on the island of O‘ahu. These actions are conducted by the Army’s Environmental Division (AED) following strategies described in the Makua Implementation Plan (MIP) (Gon et al. 2001, Makua Implementation Team et al. 2003) and the O‘ahu Implementation Plan (OIP) (In Prep.). Both of these plans specify that monitoring will be conducted as part of the species stabilization efforts to evaluate the response of both the target species and their habitats to conservation management actions.

To meet this requirement, monitoring protocols are developed for each management unit (MU) and target species population unit (PU) to assess changes in distribution and abundance of populations of native and alien plant species, as well as changes in distribution, structure, and composition of the dominant plant communities. The monitoring protocol described in this document focuses on monitoring both overstory and understory components of the plant communities within the U.S. Army’s Makua and O‘ahu natural resource management units. This protocol includes collecting data on vegetation structure, species composition, and species cover for both native and alien plant species, which can be used to track changes in these parameters relative to ongoing and future management actions in this area.

Monitoring Objectives

Primary Objectives

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

Secondary Objectives

1. Monitor the status of native plant species within the MU and determine if their cover changes relative to management actions conducted within the unit.
2. Assess the status and changes in bare ground (not vegetated areas) within the MU relative to management actions conducted within the unit.

3. Determine if any ungulates (feral pigs or goats) are detected within the fenced portion of a MU.

Statistical Thresholds

All of the sampling and analysis methods addressed in this protocol are based on the following assumptions:

- The probability of making a Type I error (detecting change or difference when none exists) is <10% (Alpha = .10)
- The probability of making a Type II error (missing change or difference that does exist) is <20%.
- Minimum detected change or difference between two samples being compared is 20% over the sampling period. This threshold may be revised in cases where the resulting needed sample size is too large to be practical.

Sample Size Considerations

An optimal sample size will be calculated following the collection of the initial set of data at a particular MU. Sampling effort will be stratified by the major plant communities within the unit, but may be pooled for analysis. For the first sampling effort within each MU, at least 100 sample plots will be established with no less than 10 plots per each plant community stratum. The results of this baseline survey will be used to assess the total sample size needed to monitor changes in species cover for the unit.

FIELD SAMPLING

Sampling Framework

Vegetation sampling within the MUs is conducted using both transects and rectangular plots that are established throughout the area using a systematic sampling scheme with a random start for the initial point. Since several different vegetation units may be found within each MU, the sample plots will be post-stratified into the different communities for analysis. It was decided that pre-stratification was not practical since the plant communities are closely interdigitated within the MU, (e.g., transects crossing both ridges and gulches), and some of the units may change significantly in plant species distribution, composition, or vegetation structure as a result of management actions within the unit, particularly following removal of ungulates and weeding.

Transect and Plot Layout

Using ArcMap a base line is selected running across the long axis of the MU. Along this base a series of points at 10 m intervals are plotted to serve as potential starting points for the first transect. One of these points is selected using a random numbers table and used to establish the

first transect in the MU, running perpendicular to the base line. Additional transects are then placed at a set intervals parallel to the initial transect, extending to encompass the entire MU with care to ensure that the interval does not favor a particular vegetation zone over another. Transects within a MU are numbered from north to south, with the zero point established at the end with highest elevation on the initial reference transect. All other transects within the MU then follow this numbering orientation. Initial location coordinates and for the start points for each transect are obtained from the GIS and used to locate the sampling points in the field. Compass bearings for transects are also generated using the GIS. When transects and plots are sampled for the first time, location coordinates are taken using a field GPS unit. Both the GIS and GPS should be setup using UTM Zone 4 projection and NAD 83 datum base.

Sampling plots are located along each transect. Each plot is 5 m wide (extending 2.5 m to each side of the transect line), and 10 m long. The distance between the end of a plot and the start of the next plot will be determined based on vegetation strata. The spacing will be set in order to ensure an adequate number of plots in each. However, for small MUs, this distance may be reduced (even down to zero) to allow for the establishment of at least 100 plots within the unit.

The start point for the first plot on each transect within a MU is located using the GIS-generated coordinates. From this point a meter tape or pull-line marked with 5 m intervals is fixed and extended along the GIS-generated azimuth for the transect. The start and end points for each plot are marked using yellow and blue colored flagging tape tied to a woody stem within 30 cm of the actual point. If there is not a suitable place to tie the flagging within this distance, it is tied to a PVC pipe that is pounded into the ground. An aluminum tag with the transect number and distance is also tied to this point.

If it is impossible (due to terrain) or inappropriate (due to sensitivity of the area) to continue the transect along the specified bearing, the compass heading should be changed by 45 degrees away from the impediment. As soon as the terrain permits, complete the sampling plot, then return to the original compass heading prior to delineating a new plot. (NEEDS FIGURE).

Data Collection

Within each plot, data are recorded on cover in several pre-defined plant species associations, as well as the presence and cover of each species by specified vegetation layers, using the Belt Plot Sampling Field Form (Appendix 2.1) or this form loaded onto a field PDA unit or data logger. In addition to recording plant data, information is recorded on when the plot was sampled and observer names, data on the plot location (GPS coordinates), plant community type, if photographs were taken, and other comments on the site or conditions.

Understory vegetation is considered to be all live foliage up to 2 m from the surface of the ground; canopy vegetation is foliage that is greater than 2 m above the ground. Dead foliage on the ground is considered to be litter and is not recorded. Bare ground is defined as areas from 0 – 10 cm above the ground surface that are not directly covered by live foliage. Cover values for both species and species associations are estimated in 10% cover classes, except for values less than 10% cover which are estimated at finer resolution (Table 1). When estimating cover values it is best to have two people independently come up with a value, then discuss the results to arrive at the consensus value that is recorded on the data form.

Species are recorded on the form using the standard 3x3 species field code. For any species that cannot be determined in the field, enter the three letter code for the genus followed by “sp” (e.g., *Melicope* sp. is recorded as MelSp). Indicate in the comments section if a specimen was collected to help with identification. If this is the case, make sure that the determined name is added to the field form as soon as possible. For plants that cannot be determined to genus, enter UNKSP1 (for unknown species 1), and indicate that a collection was made for final determination.

DATA MANAGEMENT

Database Description

A relational database has been designed in MS Access to allow for data entry and management prior to analysis. This database consists of a set of linked tables, queries that are used to join fields together, a data entry form and related subforms, as well as several data report forms. This database is described in Appendix 2.3.

Data Entry and QA/QC

If data were collected using a paper field form, all of the information is entered into the monitoring database using the main data entry form (Belt_Plot_Main) (see Appendix 3). This form allows for several functions including initial data entry and update, creation of new entries for the Observers and Plant Communities fields, as well as running reports used to check the data. If data are entered into the database manually, it is important that a subset (at least 10%) of the entered records is randomly selected and all entries checked for accuracy against the data on the original field sheets. If >10% of these records contain errors in fields other than the Comments field, all records will need to be verified and corrected prior to doing another quality check.

DATA ANALYSIS

Data will be analyzed utilizing both parametric and non-parametric methods, depending on how well they meet the assumptions needed for the various tests. Data analysis for each MU will consist of two steps: baseline analyses following collection of the initial set of data, and analyzing changes in variables over time after the completion of each new sampling effort at the MU.

Baseline Data Analysis

Descriptive statistics will be calculated for all variables following collection of the initial baseline data for each MU and this information will be used to assess current conditions of the variables relative to the monitoring objectives and to help decide what analysis strategies will be appropriate. Additionally, the baseline data will be used to assess the adequacy of sample sizes for the most important variables.

Trend Analysis

After data are collected, following the completion of a new monitoring cycle, analyses will be performed to assess trends of selected variables relative to the thresholds identified in the monitoring objectives for this protocol. These analyses will include paired tests (to compare changes in variables between two specific points in time), trend analysis (e.g., regression analysis), and repeat measures ANOVA.

LITERATURE CITED

- Gon, S. M., III, J. D. Jacobi, K. Kawelo, S. Kim, and J. Rohrer. 2001. The Makua Implementation Plan: a comprehensive species and habitat conservation program. Annual Meeting of the Society for Conservation Biology, Hilo, Hawaii.
- Makua Implementation Team, Will Chee Planning Inc., and Hawaii Natural Heritage Program. 2003. Implementation Plan: Makua Military Reservation, Island of O‘ahu. Report, U.S. Army, Honolulu, HI.

APPENDIX 2.1

Field Data Form

[illegible]

APPENDIX 2.2

Data Entry Form for Database

Microsoft Access - [Belt_Plot_Main]

File Edit View Insert Format Records Tools Window Help Adobe PDF

MS Sans Serif Paste

Makua Monitoring Program

Need to Check Data? ☒

Belt Plot Samples for Understory, Weeds, and Canopy

Entered by: Jim Jacobi Date Entered: 23-May-08 Checked by: Date Checked:

NOTE: Use CTRL + ' [apostrophe] to copy data for a field from the previous record.

Area or MU: Pelikee Date Sampled: 5/14/2008 Observer 1: LBM Observer 2: KK

Transect: 1 Plot Start Distance: 0 Bearing (Mag): 79.5 Observer 3: SLJ Observer 4:

UTM Coordinates X-Coord: 593,300 Y-Coord: 2,368,446 Position Error: 0.0 Datum: NAD83

Ungulate Sign: ☐ Ungulate Sign Description: Photos:

Primary Vegetation Type: Wet Crest Secondary Vegetation Type:

Comments:

SPECIES ASSOCIATIONS

NS: 10 - 20 XS: 1 - 5 Add Observer Add Veg Type

NF: 5 - 10 XF: 0 Add Taxon

NG: 20 - 30 XG: 20 - 30

Total Native Understory: 50 - 60 Total Alien Understory: 0 Total Native Canopy:

Bryophytes: 60 - 70 Not Vegetated (Bare): 10 - 20 Total Alien Canopy:

Total Canopy: 80 - 90

Cover by Species

Layer	SpCode	Cover	Comments
Alien	PsiCat	1 - 5	
Alien	PasCon	5 - 10	
Alien	EhrSti	5 - 10	
Alien	ClitHir	.1	
Alien	MorFay	.1	
Alien	MelMin	.1	
Alien	SchTer	.1	
Alien	EpiObr	.1	
Canopy	CheTri	20 - 30	
Canopy	MorFay	5 - 10	
Canopy	MelClu	.1	
Canopy	AntPla	Not Rec	
Canopy	FreArb	Not Rec	

Record: 14 of 33

Record: 14 of 102

Form View