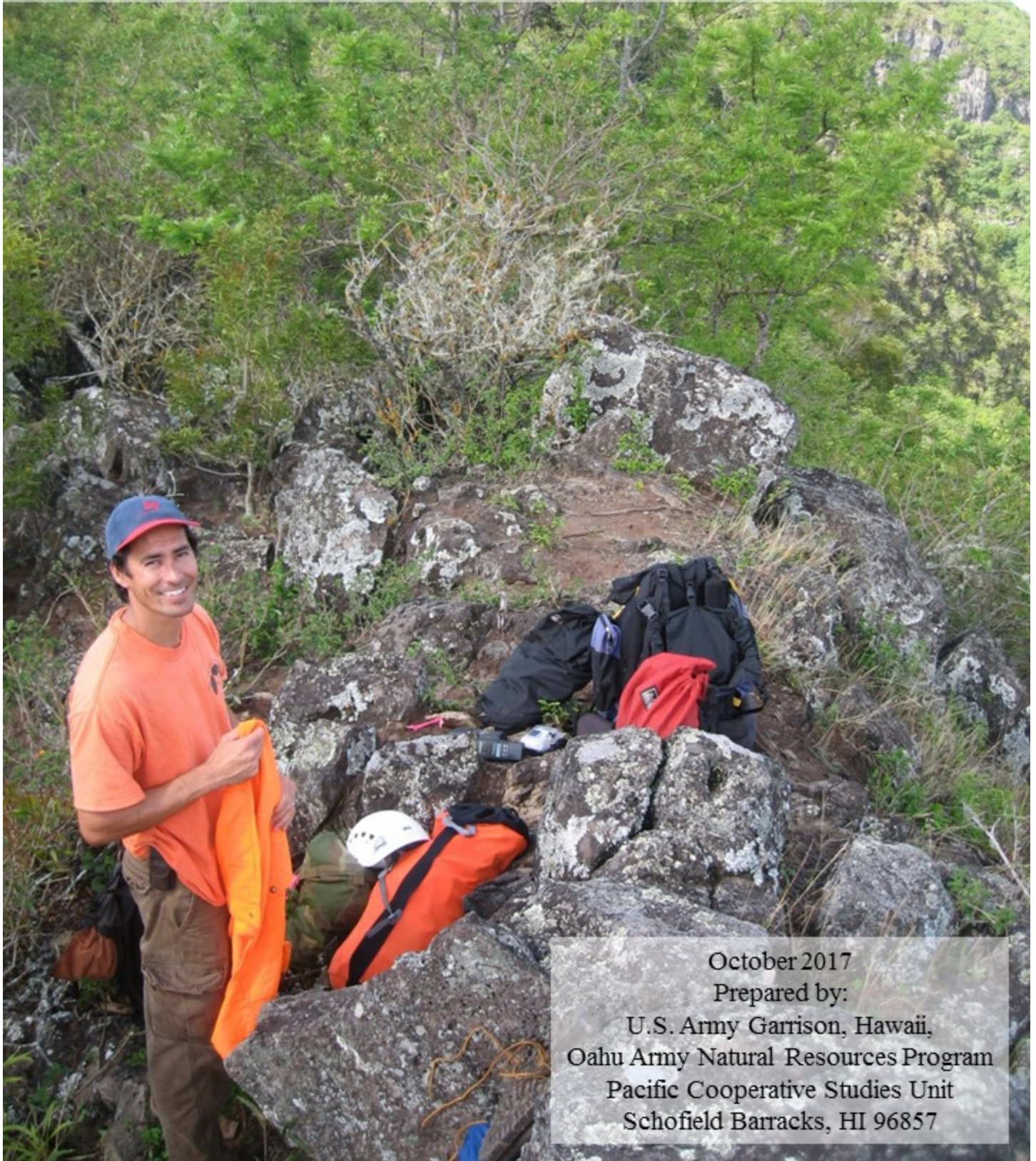


2017 Status Report for the Makua and Oahu Implementation Plans



October 2017

Prepared by:

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*Cover photo: Daniel Sailer, Senior Natural Resources Management Coordinator preparing for a rappel to monitor and collect endangered plants in Makaha.

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EXECUTIVE SUMMARY

The Oahu Army Natural Resources Program (OANRP) has nearly 60 personnel on staff, comprised of management and administrative support staff, an ecosystem restoration crew, an ungulate management crew, three resource management crews, and a nursery/seed bank crew. Most of these staff are employed via a Cooperative Agreement funded by the Army through the Pacific International Center for High Technology Research (PICHTR) and administered by the Research Corporation of the University of Hawaii - Pacific Cooperative Studies Unit (PCSU). Staff levels in Fiscal Year (FY) 2017 were slightly lower than those in FY 2016. For FY 2017, OANRP received a total of \$5,746,173 to implement Makua Implementation Plan projects and Tier 1 projects from the Oahu Implementation Plan. This included funding for ongoing research initiatives, contracted snail predator fence construction projects, plant propagation services, ongoing rat control services and document preparation. As in FY 2016, for FY 2017, OANRP did not receive funding for OIP Tier 2 and Tier 3 projects as there was no training conducted that could impact the species at the Tier 2 and 3 levels, as specified in the 2003 Oahu Biological Opinion.

This status report (report) serves as the annual report for participating landowners, the U.S. Fish and Wildlife Service (USFWS), and the Implementation Team (IT) overseeing the Makua Implementation Plan (MIP) and Oahu Implementation Plan (OIP). The period covered in this report is July 1, 2016 to June 30, 2017. This report covers Year 13 of the MIP and Year 10 of the OIP.

Hawaiian diacriticals are not used in this document except in some appendices in order to simplify formatting. Please refer to Appendix ES-1, Spelling of Hawaiian Names.

OANRP completes thousands of actions each year to implement the MIP and OIP (IPs); the results of those myriad activities are summarized in this report. The report presents summary tables analyzing changes to population units of plants and snails over the last year and since the IPs were completed, as well as updates on new projects and technologies. More detailed information for all IP taxa is available via the program database supplied on CD (see Appendix ES-2 for a tutorial of how to use this database).

OANRP is reporting on the thirteenth year of the MIP Addendum (Addendum completed in 2005, original finalized in 2003) and the tenth year of the OIP (finalized in 2008). The MIP Addendum emphasized management for stability of three Population Units (PUs) per plant taxon in the most intact habitat and 300 individuals of *Achatinella mustelina* in each Evolutionarily Significant Unit (ESU). The original Makua Biological Opinion (BO) in 2007 and amended BO in 2008, both issued by the USFWS, require that the Army provide threat control for all Oahu Elepaio (*Chasiempis ibidis*) pairs in the Makua Action Area, stabilize 28 plant taxa and *Achatinella mustelina*, and take significant precautions to control the threat and spread of fire as a result of the 2007 Waialua fire that destroyed individuals and habitat of *Hibiscus brackenridgei* subsp. *mokuleianus*. The OIP outlines stabilization measures for 23 additional plant taxa, the Oahu Elepaio, and six extant Koolau *Achatinella* species. Since the OIP was finalized, two additional species were added requiring stabilization, *Drosophila montgomeryi* and *Drosophila substenoptera*. Of the OIP plants, management activities are conducted with eleven taxa that are present in the Schofield Barracks West Range Action Area and in the Kahuku Training Area. In 2017, OANRP did not receive funding to support the remaining 12 OIP plant taxa and the six Koolau *Achatinella* species because of the lack of Army training impacts to these taxa in the Kawaihoa Training Area. The MIP and OIP also requires surveys of Army Landing Zones for weeds and the prevention and control of weeds on training areas.

The Army contracted the Center for Environmental Management of Military lands based at Colorado State University to prepare an updated biological assessment for the Army to enter into formal consultation for Oahu training ranges (including Makua Military Reservation). This document will

include an analysis of the potential impacts from Army training (including weed spread) on the plant and animal taxa given federal status in August 2012 and September 2016. The decision was made to include Makua Military Reservation in this Biological Assessment (BA), while in previous consultations, Oahu and Makua had been kept separate. This approach allows the Army to present a combined analysis of impacts to Oahu's endangered species. The draft BA is expected in October 2017 and a Biological Opinion from the USFWS is anticipated in the summer of 2018. Management requirements will be determined through the consultation process and outlined in the Biological Opinion to be issued upon completion of this process.

Infrastructure

During this reporting period there have been a handful of infrastructure projects supporting the natural resources program beyond ongoing routine maintenance. The program re-established a working shadehouse at our east range baseyard for growing common native plants, established a living collection and seed production site at a former landfill near the west range baseyard (Kahua) and completed a covered structure over gear storage units.

Landowner/Agency Cooperative Agreements and Partnerships

OANRP could not meet stabilization goals without the cooperation of public and private landowners and agencies. OANRP continues to operate under a 20-year license agreement with Kamehameha Schools (KS) (expiring November 2030). A three-year license agreement with Hawaii Reserves, Inc. expired in March 2017 and the four-year license agreement with the Honolulu Board of Water Supply expired in November 2014; however, the Army and BWS real estate staff are actively working on a renewal. The Army also continues to work cooperatively under an MOU with the U.S. Navy for work in Lualualei Naval Magazine. Lastly, the Army renewed its right of entry permit to protect Oahu Elepaio on Gill and Olson properties at Palehua.

In July 2011, an MOU was signed between the Army and the State of Hawaii (State), Department of Land and Natural Resources (DLNR). Currently, the Army holds six State of Hawaii permits, including a Natural Area Reserves Special Use Permit, a Threatened and Endangered Plant Species Permit, an Invertebrate Permit, a Forest Reserve Access Permit, a Conservation District Use Permit, and a Protected Wildlife Permit. The Army and the State are working on finalization of a rental agreement for OANRP's use of the NIKE site mid-elevation greenhouse and associated facilities. A signed lease is expected before the end of the 2017 calendar year.

OANRP continues to provide and receive support from partner agencies including the Oahu Invasive Species Committee, the Honolulu Board of Water Supply, Oahu Plant Extinction Prevention Program (OPEPP), Snail Extinction Prevention Program (SEPP), the Koolau and Waianae Mountains Watershed Partnerships and the Hawaii Department of Agriculture. The Army is also an official member of the Koolau Mountains Watershed Partnership, the Waianae Mountains Watershed Partnership, the Coordinating Group on Alien Pest Species, the Hawaii Rare Plant Restoration Group, the Pacific Island Climate Change Cooperative and the Hawaii Conservation Alliance. Highlights of our partnership work over the last fiscal year include fence gear sling loads using Army heavy lift helicopters for State watershed fences in the Kaluanui and Poamoho areas, staff exchanges for high priority incipient invasive weed control in the Koolau Mountains, aerial surveys for highly invasive species, rare snail enclosure construction and maintenance, and numerous habitat improvements for endangered plant and invertebrate OPEPP and SEPP species.

Management Unit (MU) Protection

Management Unit protection continued on several fronts during this reporting period through 1) ungulate control/fencing efforts, 2) aggressive weed control including control of incipient invasives, 3) an expanded effort at active habitat restoration through outplanting of common natives, and 4) rodent control technique development for MU application.

During this reporting period, OANRP worked to retrofit some existing MU fences with chicken wire mesh to prevent ingress of smaller ungulates into ungulate-free fences. In addition, management crews constructed water bars to prevent water driven erosion along steep sections. Maintenance and repair of fences is ongoing and includes replacing any fence fabric or posts that are rusting or rotten, repairing gulch crossings following flooding and controlling animals that breach the fence perimeter. Also, ungulate control efforts continue within the sizeable Makua Valley and Lihue fences.

Last year, OANRP secured funding for two small fences at Makaleha West and Kaala MUs. The Makaleha West fence will be an expansion of our existing 3-Points enclosure to secure additional rare plant and snail habitat. The Kaala fence will also be an extension of an existing fenced area to better secure the plateau area from pig incursion via the headwaters of Waianae Kai Valley. Completion of those two small fences has been delayed due to contracting constraints, nonetheless, completion of these fences is anticipated before the summer of 2018. For more details about OANRP ungulate control see Chapter 1.

Native Habitat Restoration

As reported previously, OANRP transitioned ecosystem management efforts to more intensive MU weed control and restoration.

In this reporting period, OANRP spent 9,309 hours controlling weeds across 594 ha. Incipient Control Area (ICA) efforts accounted for 467 ha of this total which is 79% of the total area over which weeds were controlled. Staff spent 2,573 hours on ICA management and conducted 662 visits to 233 ICAs. There were 16 ICAs declared eradicated during this reporting period. The ICA totals represent an increase from previous reporting periods. Some of this increase is due to aerial treatment of *Chromolaena odoratum* using helicopters. Weed Control Area (WCA) efforts covered 127 ha which is a decrease from last year's effort. OANRP conducted control in WCAs for a total of 6,736 hours over 727 visits at 123 WCAs. Although the area covered in WCAs decreased, the number of hours spent increased. This is likely a result of the more intensive weed control and restoration being conducted by the Ecosystem Restoration Crew. See Chapter 3 for a comparison to last year's control figures.

OANRP conducted 105 road, landing zone, and weed transect surveys in order to detect and prevent the spread of any newly introduced invasive species. OANRP submitted 21 non-native plant samples to the Oahu Early Detection Program at Bishop Museum collected both during these surveys and during the course of regular work activities. Of these, two were new state records. Highlights are covered in Chapter 3.

OANRP has completed a total of 22 Ecosystem Restoration Management Unit Plans (ERMUPs) for the highest priority and largest MUs. Six ERMUPs updates are included in this year's report. These are Ekahanui, Kaena, Kaluakauila, Koloa, Ohikilolo (Lower Makua), Palikea and Pualii MUs.

Complementary to our other threat control programs, our additive restoration work expanded during this past reporting period. In six MUs, and across nearly three acres, 1,951 common native plants were planted to enhance recovery of native habitat, provide additional host plants for rare snails, and rare *Drosophila*

sp. flies, and to help stabilize the habitat for rare plants. Three MUs received the bulk of common outplants, Kaluaa and Waieli, Makaha, and Kahanahaiki. The area over which seeds sows, divisions and transplants occurred increased three fold from last year, as the use of these techniques expanded by the Program. See Chapter 3 for more information on habitat restoration efforts.

Rodent Control Program

OANRP directed rat and mice control in our MUs in small trap grids used for seasonal and year round localized rodent control around rare plant and snail populations and in large trap grids used for seasonal and year round rodent control across MUs for native habitat, rare plant, snail, and elepaio protection. In addition, OANRP continues to be on the leading edge of research and development for new rodent control tools to increase efficiency and effectiveness. We are partnering with the U.S. Department of Agriculture, National Wildlife Research Center to plan and vet the aerial application of rodenticide in the Lihue MU. If approved the application will occur in the Fall of 2017. This MU is inaccessible for much of the year due to intensive training utilization and creative tools to achieve rodent control are needed. In addition, planning has begun for a pilot study to deploy rat birth control and monitor the effectiveness. See Chapter 8 Rodent Control for details on these pilot projects.

OANRP continues to use Goodnature® automatic traps to reduce labor and increase trapping effectiveness. During this reporting period, citric acid was tested as an additive to the bait mixture in order to reduce secondary consumption by invasive slugs and it was highly successful. In addition, Goodnature released the auto pump lure which pushes out a small amount of fresh bait on a regular interval. These two developments combined have changed the effectiveness of the automatic traps and substantially reduced the labor required to effect quality control of rats at remote management sites. For more details about the OANRP rodent control program see Chapter 8 as well as Chapter 9 for a slug repellent/rat bait study using citric acid.

Monitoring Program

Our OANRP monitoring program consisted of a number of projects: baseline and follow-up vegetative community monitoring, weed control analysis, rare plant recruitment following *in situ* seed sowing, rare plant laboratory seed germination trials and bird gut passage treatments.

Near the end of this reporting period, OANRP monitored the Palikea MU, which will be reported on in the 2018 annual report.

Regarding remote sensing and weed control efforts, OANRP supported a University of Hawaii research project which compared satellite imagery, aerial imagery and gigapan robotic technology (Gigapan) for collecting vegetation monitoring data. This project was concluded during this reporting period the Master's Thesis for this project is included as Appendix ES-3. OANRP continues to use a Gigapan System in-house to guide management of target weed taxa at various sites, and is working towards in-house use of UAS in areas where ground based or Gigapan monitoring is impractical.

Regarding native habitat and rare plant stabilization monitoring efforts, staff:

- Completed analysis of ongoing vegetation changes at the Ohikilolo (monitored near the end of the last reporting year)(Appendix 3-9)
- Monitored vegetation change associated with a restoration project in Makaha (Appendix 3-11)
- Analyzed the effect of *Morella faya* control on surrounding vegetation at the Palikea MU, one year after control (Appendix 3-10).

- Conducted a laboratory trial to assess the effect of fruit senescence on *Cyanea grimesiana* subsp. *obatae* seed viability (Appendix 4-3).
- Conducted a laboratory investigation of seed germination from fresh versus senescing *Delissea waianaensis* fruit (Appendix 4-2).
- Established a field seed sow trial of *Cyanea superba* subsp. *superba* to examine environmental influences on germination at existing and potential manage for stability sites (Appendix 4-4).
- Installed and monitored a trial for establishing new populations of *Tetramolopium filiforme* var. *polyphyllum* using seed sowing and to test seed application techniques (Appendix 4-5).

Fire Management

During this reporting period, no fires occurred on Army training areas that impacted endangered species or critical habitat. One large fire occurred off Army training areas, caused by a vehicle fire, which threatened the Kapuna MU. Details regarding this fire are summarized in the Memorandum for Record included as Appendix ES-4. A total of ~500 acres burned and Army air support was critical in controlling and extinguishing the wildfire. The Army was mobilized under a mutual aid agreement between the State of Hawaii and the Army. Close coordination with State and City and County Partners was critical during the response.

In May of 2017, the Army conducted another successful prescribed burn at Schofield Barracks. The burn reduced fuel within the impact area as planned. No fires have occurred outside the Schofield Barracks firebreak road from training nor have any fires occurred at Makua Military Reservation.

Outreach Program

The OANRP outreach program is focused on training military members on environmental requirements and natural resource management issues, as well as community outreach through volunteer work trips, educational exhibits at community events, internships, and the production of publications and other media materials.

In 2017, 1,591 military members were trained during the Environmental Compliance for Officers course, were educated on Natural Resource Issues at Makua during 15-minute presentations and/or received a 20-minute brief on natural resource considerations on training lands.

During this reporting period, volunteers contributed 3,398 hours on 61 field work trips and 489 hours volunteering at our baseyard. In addition, the program hosted 8 interns in the spring and summer. Many former interns return to work for OANRP after college graduation. See Chapter 2 for more details on our Outreach Program.

Rare Plant Program

The Executive Summary tables on the following pages for the MIP and OIP plant taxa include current status (with totals not including seedlings), last year's population numbers, and the number of plants in the original IPs for comparison for each population unit. Genetic storage and ungulate protection status is also summarized for each PU. The number of PUs that have reached numeric stabilization goals are included.

As of the end of this reporting period, 46 of 101 MIP PUs (46%) and 14 of 31 (45%) PUs for OIP Tier 1 plant species are at or above the stabilization goal for minimum number of reproducing plants. All data tables are included on the CDs distributed to IT members. During this reporting period, OANRP

outplanted a grand total of 1,755 individuals of 11 species of MIP and OIP taxa. In the last year, OANRP made 469 observations at in situ and outplanting sites.

Genetic storage of at least 50 seeds each from 50 individuals, or at least three clones each in propagation from 50 individuals, is required for each PU. If there are fewer than 50 founders for a PU, genetic storage is required from all available founders. For example, if there are at least 50 seeds from five individuals, or at least three clones in propagation from five individuals, then the “% Completed of Genetic Storage Requirement” listed in the tables is 10%. Genetic storage for reintroduced populations is not required because those populations originate from other populations with their own genetic storage requirement. PUs with population sizes of zero and a genetic storage requirement of “n/a (reintroduction)” denote reintroductions that are planned but have yet to be conducted. The number of seeds in genetic storage approximates the number of viable seeds initially received for stored collections. Viability rates for most collections were estimated or calculated at the time of storage. For untested collections, seed viability was averaged from other collections within the same PU or taxon.

One rare plant research project is ongoing but still at the preliminary stages. It involves inoculating *Phyllostegia kaalaensis* with beneficial fungi. *Phyllostegia kaalaensis* is overwhelmed by a pathogenic leaf fungus, or powdery mildew. Beneficial fungal associates can provide plants with natural protection and thus improve survivorship. Thus far, there has been 100% mortality of planted *P. kaalensis* at reintroduction sites. Fungal inoculum has been isolated from field sites and clones have been grown for use in experiments. Planting of inoculated plants will occur during the winter season and OANRP is optimistic. For an update on the status of this research see Appendix ES-5.

A second study was concluded during this reporting period, An Assessment of the Short and Long-Term Stability Goals for Endangered Hawaiian Flora Managed by the Oahu Army Natural Resources Program: Orou Gaoue and Kasey Barton, Principal Investigators, Lalasia Bialic-Murphy, Graduate Assistant, Dept. of Botany, University of Hawaii at Manoa. Two papers regarding *Delissea waianaensis* population stability are under review for publication and are included as Appendix ES-6 and Appendix ES-7. In addition, an article published in the Journal of Applied Ecology regarding *Cyrtandra dentata* is also included in Appendix ES-8.

Table 1. MIP Plants Executive Summary

Makua Implementation Plan - Executive Summary - Plants


of Stable IP Population Units: 47 of 101



















■ = Ungulate Threat to Taxon within Population Unit
 No Shading = Absence of Ungulate threat to Taxon within Population Unit

Plant Taxon	Target # Matures	Population Unit Name	Total Current Mat.+Imm.	Total Current Mature	Total Current Immature	Total Current Seedling	# Plants In 2016	# Plant In Original Report	% Completed Genetic Storage Requirement	% of Plants Protected from Ungulates	PU Met Goal?	# PU Met Goal
Alectryon macrococcus var. macrococcus	50	Central Kaluaa to Central Waieli	4	3	1	0	8	53	0%	0%	No	
		Kahanahaiki to Keawapilau	2	1	1	0	2	8	0%	100%	No	
		Makaha	29	29	0	0	29	75	30%	100%	No	
		Makua	4	4	0	0	6	15	33%	100%	No	
		Alectryon macrococcus var. macrococcus Total:	39	37	2	0	45	151				
Cenchrus agrimonioides var. agrimonioides	50	Central Ekahanui	302	184	118	54	319	20	60%	100%	Yes	
		Kahanahaiki and Pahole	276	200	76	20	292	276	28%	100%	Yes	
		Makaha and Waianae Kai	289	161	128	5	289	12	17%	97%	Yes	
		Cenchrus agrimonioides var. agrimonioides Total:	867	545	322	79	900	308				
Cyanea grimesiana subsp. obatae	100	Kaluaa	141	124	17	0	141	0	75%	100%	Yes	
		North branch of South Ekahanui	147	82	65	0	147	5	100%	100%	No	
		Pahole to West Makaleha	106	70	36	0	111	46	52%	100%	No	
		Palikea (South Palawai)	921	911	10	0	139	63	65%	100%	Yes	
Cyanea grimesiana subsp. obatae Total:	1315	1187	128	0	538	114					2 of 4	
Cyanea longiflora	75	Kapuna to West Makaleha	257	61	196	2	259	66	44%	100%	No	
		Makaha and Waianae Kai	246	116	130	0	306	4	33%	100%	Yes	
		Pahole	74	59	15	2	78	114	98%	100%	No	
		Cyanea longiflora Total:	577	236	341	4	643	184				
Cyanea superba subsp. superba	50	Kahanahaiki	226	48	178	1	226	152	100%	100%	No	
		Makaha	199	27	172	246	199	0	N/A	100%	No	
		Manuwai	79	0	79	0	108	0	N/A	100%	No	
		Pahole to Kapuna	166	95	71	4	166	170	N/A	100%	Yes	
Cyanea superba subsp. superba Total:	670	170	500	251	699	322					1 of 4	

Makua Implementation Plan - Executive Summary - Plants

of Stable IP Population Units: 47 of 101

 = Ungulate Threat to Taxon within Population Unit
 No Shading = Absence of Ungulate threat to Taxon within Population Unit

Plant Taxon	Target # Matures	Population Unit Name	Total Current Mat.+Imm.	Total Current Mature	Total Current Immature	Total Current Seeding	# Plants In 2016	# Plant In Original Report	% Completed Genetic Storage Requirement	% of Plants Protected from Ungulates	PU Met Goal?	# PU Met Goal
Cyrtrandra dentata	50	Kahanahaiki	175	33	142	9	175	97	32%	 100%	No	
		Kawaiiki (Koolaus)	21	2	19	1	92	50	0%	 0%	No	
		Opaeuia (Koolaus)	196	35	161	2	196	26	4%	 100%	No	
		Pahole to West Makaleha	814	330	484	97	1502	300	90%	 100%	Yes	
		Cyrtrandra dentata Total:			1206	400	806	109	1965	473		
Delissea waianaensis	100	Ekahanui	219	196	23	0	219	58	86%	 100%	Yes	
		Kahanahaiki to Keawapilau	194	185	9	0	257	34	88%	 100%	Yes	
		Kaluaa	538	499	39	0	661	44	80%	 100%	Yes	
		Manuwai	168	132	36	0	132	0	N/A	 100%	Yes	
Delissea waianaensis Total:			1119	1012	107	0	1269	136				4 of 4
Dubautia herbstobatae	50	Makaha	54	52	2	0	81	0	48%	 0%	Yes	
		Ohikilolo Makai	137	133	4	0	91	700	0%	 100%	Yes	
		Ohikilolo Mauka	400	373	27	0	424	1300	0%	 100%	Yes	
Dubautia herbstobatae Total:			591	558	33	0	596	2000				3 of 3
Euphorbia celastroides var. kaenana	25	East of Alau	22	20	2	66	22	26	64%	 0%	No	
		Kaena	1154	880	274	0	1154	300	90%	 0%	Yes	
		Makua	85	85	0	0	85	40	90%	 100%	Yes	
		Puaakanoa	150	135	15	0	131	157	56%	 0%	Yes	
Euphorbia celastroides var. kaenana Total:			1411	1120	291	66	1392	523				3 of 4
Euphorbia herbstii	25	Kaluaa	20	0	20	0	0	0	N/A	 100%	No	
		Kapuna to Pahole	97	54	43	1	98	170	36%	 100%	Yes	
		Manuwai	0	0	0	0	0	0	N/A	 100%	No	
Euphorbia herbstii Total:			117	54	63	1	98	170				1 of 3

Makua Implementation Plan - Executive Summary - Plants

of Stable IP Population Units: 47 of 101


■ = Ungulate Threat to Taxon within Population Unit























No Shading = Absence of Ungulate threat to Taxon within Population Unit

Plant Taxon	Target # Matures	Population Unit Name	Total Current Mat.+Imm.	Total Current Mature	Total Current Immature	Total Current Seedling	# Plants In 2016	# Plant In Original Report	% Completed Genetic Storage Requirement	% of Plants Protected from Ungulates	PU Met Goal?	# PU Met Goal
Flueggea neowawraea	50	Kahanahaiki to Kapuna	143	5	138	0	136	32	29%	100%	No	
		Makaha	64	9	55	0	64	4	36%	44%	No	
		Manuwai	16	0	16	0	45	0	N/A	100%	No	
		Ohikilolo	1	1	0	0	1	3	50%	100%	No	
		Flueggea neowawraea Total:	224	15	209	0	246	39				
Gouania vitifolia	50	Keaau	51	51	0	0	51	0	66%	0%	Yes	
		Makaha (Future Introduction)	0	0	0	0	0	0	N/A	100%	No	
		Manuwai (Future Introduction)	0	0	0	0	0	0	N/A	100%	No	
		Gouania vitifolia Total:	51	51	0	0	51	0				
Hesperomannia oahuensis	75	Haleaauu	5	1	4	0	1	0	0%	100%	No	
		Makaha	45	11	34	0	46	13	0%	100%	No	
		Pahole NAR	24	3	21	0	34	8	N/A	100%	No	
		Pualii	72	14	58	1	68	0	N/A	100%	No	
Hesperomannia oahuensis Total:	146	29	117	1	149	21					0 of 4	
Hibiscus brackenridgei subsp. mokuleianus	50	Hali to Kawaiu	122	117	5	0	66	4	43%	0%	Yes	
		Keaau	86	82	4	0	58	0	10%	100%	Yes	
		Makua	144	124	20	0	144	7	73%	100%	Yes	
		Manuwai	110	102	8	20	151	0	N/A	100%	Yes	
Hibiscus brackenridgei subsp. mokuleianus Total:	462	425	37	20	419	11					4 of 4	
Kadua degeneri subsp. degeneri	50	Alaihehe and Manuwai	161	77	84	4	145	60	60%	96%	Yes	
		Central Makaleha and West Branch of East Makaleha	32	22	10	22	32	47	62%	0%	No	
		Kahanahaiki to Pahole	202	102	100	150	202	161	100%	100%	Yes	
		Outplanting site to be determined	0	0	0	0	0	0	N/A		No	
Kadua degeneri subsp. degeneri Total:	395	201	194	176	379	268					2 of 4	

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
















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Plant Taxon	Target # Matures	Population Unit Name	Total Current Mat. +Imm.	Total Current Mature	Total Current Immature	Total Current Seedling	# Plants In 2016	# Plant In Original Report	% Completed Genetic Storage Requirement	% of Plants Protected from Ungulates	PU Met Goal?	# PU Met Goal	
Kadua parvula	50	Ekahanui	87	58	29	0	45	0	N/A		Yes		
		Halona	35	31	4	0	35	64	40%		No		
		Ohikilolo	230	129	101	0	215	66	74%		Yes		
		Kadua parvula Total:	352	218	134	0	295	130					2 of 3
		<hr/>											
Melanthera tenuifolia	50	Kamaileunu and Waianae Kai	1061	815	246	274	1061	880	0%		Yes		
		Mt. Kaala NAR	155	131	24	0	155	250	0%		Yes		
		Ohikilolo	582	571	11	0	1099	2009	12%		Yes		
		Melanthera tenuifolia Total:	1798	1517	281	274	2315	3139					3 of 3
<hr/>													
Neraudia angulata	100	Kaluakauila	124	100	24	1	124	0	N/A		Yes		
		Makua	78	67	11	0	75	29	46%		No		
		Manuwai	161	97	64	10	207	12	67%		No		
		Waianae Kai Mauka	13	11	2	0	13	46	56%		No		
		Neraudia angulata Total:	376	275	101	11	419	87					1 of 4
<hr/>													
Nototrichium humile	25	Kaluakauila	188	140	48	0	208	200	2%		Yes		
		Makua (south side)	53	50	3	0	53	138	0%		Yes		
		Manuwai	111	111	0	0	112	0	N/A		Yes		
		Waianae Kai	305	204	101	0	290	200	0%		Yes		
		Nototrichium humile Total:	657	505	152	0	663	538					4 of 4
<hr/>													
Phyllostegia kaalaensis	50	Keawapilau to Kapuna	0	0	0	0	0	0	100%		No		
		Makaha	0	0	0	0	0	0	N/A		No		
		Manuwai	0	0	0	0	0	0	N/A		No		
		Pahole	0	0	0	0	0	10	100%		No		
		Phyllostegia kaalaensis Total:	0	0	0	0	0	10					0 of 4
<hr/>													
Plantago princeps var. princeps	50	Ekahanui	57	5	52	0	83	33	84%		No		
		Halona	15	6	9	0	15	50	49%		No		
		North Mohiakea	51	39	12	0	51	30	38%		No		
		Ohikilolo	50	28	22	0	8	14	82%		No		
		Plantago princeps var. princeps Total:	173	78	95	0	157	127					0 of 4

Makua Implementation Plan - Executive Summary - Plants


of Stable IP Population Units: 47 of 101

 = Ungulate Threat to Taxon within Population Unit
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Pritchardia kaalae	25	Makaleha to Manuwai	134	123	11	0	134	141	0%		Yes		
		Ohikilolo	1675	85	1590	0	1675	473	0%		Yes		
		Ohikilolo East and West Makaleha	334	6	328	0	334	75	N/A		No		
		Pritchardia kaalae Total:	2143	214	1929	0	2143	689					2 of 3
		Sanicula mariversa	100										
Sanicula mariversa		Kamaileunu	213	31	182	1	267	26	92%		No		
		Keaau	28	0	28	34	13	141	8%		No		
		Ohikilolo	229	0	229	0	180	162	32%		No		
		Sanicula mariversa Total:	470	31	439	35	440	329					0 of 3
Schiedea kaalae	50	Kaluaa and Waielei	168	164	4	0	168	55	100%		Yes		
		Maakua (Koolaus)	10	10	0	0	10	4	50%	0%	No		
		Pahole	84	45	39	3	125	3	100%		No		
		South Ekahanui	268	172	96	1	297	85	79%		Yes		
		Schiedea kaalae Total:	530	391	139	4	600	147					2 of 4
Schiedea nuttallii	50	Kahanahaiki to Pahole	123	88	35	317	123	65	87%		Yes		
		Kapuna-Keawapilau Ridge	57	55	2	0	57	4	100%		Yes		
		Makaha	96	91	5	0	96	0	N/A		Yes		
		Schiedea nuttallii Total:	276	234	42	317	276	69					3 of 3
Schiedea obovata	100	Kahanahaiki to Pahole	351	229	122	23	448	90	100%		Yes		
		Keawapilau to West Makaleha	405	42	363	16	494	36	100%		No		
		Makaha	90	76	14	0	90	0	N/A		No		
		Schiedea obovata Total:	846	347	499	39	1032	126					1 of 3
Tetramolopium filiforme	50	Kalena	117	24	93	0	117	0	16%	100%	No		
		Ohikilolo	3367	1903	1464	20	3366	2500	12%		Yes		
		Puhawai	6	3	3	1	6	12	80%	0%	No		
		Waianae Kai	20	20	0	0	20	22	0%		No		
		Tetramolopium filiforme Total:	3510	1950	1560	21	3509	2534					1 of 4

Makua Implementation Plan - Executive Summary - Plants

of Stable IP Population Units: 47 of 101

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



Plant Taxon	Target # Matures	Population Unit Name	Total Current Mat.+Imm.	Total Current Mature	Total Current Immature	Total Current Seedling	# Plants In 2016	# Plant In Original Report	% Completed Genetic Storage Requirement	% of Plants Protected from Ungulates	PU Met Goal?	# PU Met Goal
<i>Viola chamissoniana</i> subsp. <i>chamissoniana</i>	50											
		Halona	21	16	5	0	20	3	7%	 0%	No	
		Makaha	79	68	11	0	79	50	0%	 100%	Yes	
		Ohikilolo	243	191	52	0	263	0	0%	 100%	Yes	
		Puu Kumakalii	44	44	0	0	44	20	16%	 0%	No	
Viola chamissoniana subsp. chamissoniana Total:			387	319	68	0	406	73				2 of 4

Table 2. OIP Executive Summary Plants

Oahu Implementation Plan - Executive Summary - Plants

of Stable IP Population Units: 14 of 31

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Plant Taxon	Target # Matures	Population Unit Name	Total Current Mat.+Imm.	Total Current Mature	Total Current Immature	Total Current Seedling	# Plants In 2016	# Plant In Original Report	% Completed Genetic Storage Requirement	% of Plants Protected from Ungulates	PU Met Goal?	# PU Met Goal
Abutilon sandwicense	50	Ekahanui and Huliwai	175	57	118	0	175	44	12%	100%	Yes	
		Kaawa to Puulu	203	27	176	1	79	124	2%	52%	No	
		Kahanaikaiki	74	69	5	0	78	0	100%	100%	Yes	
		Makaha Makai	225	92	133	0	225	100	100%	75%	Yes	
		Abutilon sandwicense Total:	677	245	432	1	557	268				
Cyanea acuminata	50	Helemano-Punaluu Summit Ridge to North Kaukonahua	205	96	109	9	272	72	16%	0%	Yes	
		Kaluanui and Maakua	249	123	126	50	249	0	0%	0%	Yes	
		Makaleha to Mohiakea	284	195	89	0	279	118	18%	95%	Yes	
		Cyanea acuminata Total:	738	414	324	59	800	190				
Cyanea koolauensis	50	Kaipapau, Koloa and Kawainui	125	113	12	0	109	76	2%	85%	Yes	
		Opaeula to Helemano	28	21	7	0	24	13	0%	48%	No	
		Poamoho	39	20	19	0	39	12	3%	0%	No	
		Cyanea koolauensis Total:	192	154	38	0	172	101				
Eugenia koolauensis	50	Kaunala	59	20	39	27	59	141	28%	95%	No	
		Oio	8	6	2	0	8	74	35%	83%	No	
		Pahipahialua	28	22	6	141	28	291	31%	100%	No	
		Eugenia koolauensis Total:	95	48	47	168	95	506				
Gardenia mannii	50	Haleauau	74	74	0	0	77	2	33%	100%	Yes	
		Helemano and Poamoho	23	22	1	0	22	18	52%	5%	No	
		Lower Peahinaia	22	10	12	0	30	46	50%	60%	No	
		Gardenia mannii Total:	119	106	13	0	129	66				
Hesperomannia swezeyi	25	Kamananui to Kaluanui	246	134	112	45	246	99	0%	4%	Yes	
		Kaukonahua	109	55	54	2	109	127	0%	0%	Yes	
		Lower Opaeula	26	11	15	6	38	24	0%	0%	No	
		Hesperomannia swezeyi Total:	381	200	181	53	393	250				

Oahu Implementation Plan - Executive Summary - Plants

of Stable IP Population Units: 14 of 31

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Labordia cyrtandrae	50											
		East Makaleha to North Mohiaka	343	294	49	0	349	100	22%	89%	Yes	
		Koloa	31	9	22	0	14	0	N/A	100%	No	
		Labordia cyrtandrae Total:	374	303	71	0	363	100				1 of 2
Phyllostegia hirsuta	100											
		Haleauau to Mohiaka	98	96	2	0	98	18	53%	100%	No	
		Koloa	149	111	38	1	153	0	117%	98%	Yes	
		Puu Palikea	142	87	55	0	142	0	N/A	100%	No	
Phyllostegia hirsuta Total:	389	294	95	1	393	18				1 of 3		
Phyllostegia mollis	100											
		Ekahanui	1	1	0	0	1	35	100%	100%	No	
		Kaluaa	97	72	25	0	137	49	100%	100%	No	
		Pualii	11	11	0	0	11	0	100%	100%	No	
Phyllostegia mollis Total:	109	84	25	0	149	84				0 of 3		
Schiedea trinervis	50											
		Kalena to East Makaleha	647	296	351	377	647	376	100%	89%	Yes	
Schiedea trinervis Total:	647	296	351	377	647	376				1 of 1		
Stenogyne kanehoana	100											
		Haleauau	230	230	0	0	281	1	100%	100%	Yes	
		Kaluaa	204	26	178	0	204	79	100%	100%	No	
		Makaha	60	0	60	0	60	0	N/A	100%	No	
Stenogyne kanehoana Total:	494	256	238	0	545	80				1 of 3		

Achatinella mustelina Management

During this reporting period, OANRP continued: 1) Monitoring wild snail populations; 2) Controlling rats around wild snail populations; 3) Improving rare snail habitat through weed control and host tree outplantings; 4) Maintaining existing snail enclosures; 5) Constructing one new snail enclosure; 6) Translocating snails into snail enclosures; and 7) Collecting Ekahanui *A. mustelina* to establish a lab population at the new SEPP facility in order to secure snails from *Euglandina rosea* predation. The table below presents the status summary for the Waianae *A. mustelina* in the MIP. There is no OIP snail table as all Koolau snail taxa are Tier 2 or 3. Populations of *A. mustelina* in the MIP have been genetically assigned to one of six evolutionarily significant units (ESU). The MIP goal is to achieve 300 total snails across all age classes in each of eight managed populations within the six ESUs. Consistent with last year, six of the eight managed field populations have over 300 snails. Ekahanui snails (ESU-E) were largely collected into the laboratory for safe keeping thus reducing the number of wild snails remaining. See summary table below.

Table 3. Summary of *A. mustelina* Management

ESU	Population	Number of Snails in MFS Pop. Reference Sites (PRS)	Number of Snails in No Mgmt. PRS	Number of Snails in PRS with Rat Control	Number of Snails in Enclosures (observed)	Planned Enclosure for Additional Snails Not Currently in Enclosures
A	Kahanahaiki	243	0	243	215 (Kahanahaiki) 28 (Pahole)	Kahanahaiki/Pahole
B1	Ohikilolo	330	7	330	0	West Makaleha
B2	East Makaleha	467	192	467	0	West Makaleha
C	Lower Kaala NAR & Schofield Barracks West Range	333	10	333	0	Kaala
D1	Central Kaluaa to Schofield Barracks South Range	805	10	805	805 (Hapapa)	Hapapa
D2	Makaha	313	0	131	0	None designated
D*	South Range to Lihue	0	335	0	0	Kaala and Hapapa
E	Ekahanui**	7	28	0	0	Palikea North
F	Puu Palikea	628	9	628	163 (Palikea)	Palikea

*Snails from this portion of the ESU are not managed for stability in the MIP

**100 additional snails protected in SEPP laboratory (from 71 collected snails)

During this reporting period, OANRP continued to maintain the Kahanahaiki and Puu Hapapa predator enclosures and cooperated with SEPP to maintain the Puu Palikea enclosure. OANRP nearly completed construction on the new Palikea North enclosure which will be the home for Ekahanui (ESU-E) *A. mustelina* in the future. OANRP and partners continued to monitor population trends for *A. mustelina* within the Kahanahaiki, Puu Hapapa, and Palikea predator enclosures using timed-count monitoring. Snails from fragmented subpopulations at Palikea ESU-F continued to be translocated into the existing Palikea enclosure. Also, the State continues to prepare for the replacement of the Pahole snail enclosure which should occur before the next annual report.

Sites for permanent snail enclosures were also selected at 3-Points Makaleha west and at Kaala for ESU-B2 and ESU-C respectively. Funding for these snail enclosures has been secured. Lessons learned during the construction of the Palikea North enclosure should make construction of these two additional enclosures more streamlined and efficient. For more information on rare snail management, see Chapter 5.

In addition, one OANRP-funded research project investigating the Adaptive Genetics of Hawaiian Tree Snails and Climate Change (Appendix ES-9). Results of this study helped to adjust management plans for *Achatinella mustelina* given the limited enclosure siting options.

Rare Vertebrate Management

Currently, OANRP manages three species of rare vertebrates, the Oahu Elepaio (*Chasiempis ibidis*), Nene geese (*Branta sandvicensis*), and the Opeapea, or Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). Management consists of active predator control for the Elepaio, monitoring during Nene sightings at Schofield Barracks and Wheeler Army Airfield, and monitoring for Opeapea at Army installations across Oahu, as well as spot monitoring for bat roosting in trees requiring removal at Schofield Barracks during the bat pupping season.

In 2017, OANRP controlled rats to protect 89 pairs of Oahu Elepaio at four management sites. The BO requires the protection of 75 pairs, therefore, OANRP met this requirement. In addition, during annual monitoring, two male elepaio were observed at the Makua Military Reservation for the second year in a row.

The number of managed pairs and reproductive efforts in 2017 are summarized below.

Table 4. Summary of Elepaio Management

Year	Managed Pairs	Success Active Nests	Family Groups	Fledglings	Fledglings/Managed Pair
2017	89	26	36	73	0.79

The number of documented fledglings from managed pairs this year was 73, which is up from last year’s number. Four more pairs were managed in 2017 than 2016 which may account for the small increase in management statistics.

The total number of rats caught and the ratio of rats caught per trap decreased in 2016 across all four sites. Reasons for the lower catch rates might be attributed to higher rainfall (which washes off bait) or for other undetermined reasons. OANRP will continue to adapt rodent control approaches in order to maximize protection in a cost-effective manner. The total required access dates in Schofield Barracks West Range were met during the calendar year, but were not ideally distributed for Elepaio management. For more information, see the Rodent Management Chapter 8

Over the past year, Nene geese (*Branta sandvicensis*) were not observed at Army Installations on Oahu and therefore are not further covered in this report. OANRP will continue to track nene visitation via airfield operations staff and U.S. Department of Agriculture Staff conducting airstrike hazard management.

The U.S. Geological Survey acoustic monitoring project for the Hawaiian hoary bat concluded last year and results are pending, a report summarizing findings is expected before the end of the 2017 calendar year and will be published as a PCSU Technical Report and will be included in next year’s report. A new bat study funded through windfarms is beginning and includes deployment of 100 total long term monitoring stations on Oahu. Army installations are included in their project and OANRP is working to secure access for detector installation and monitoring. In early September 2015, an official Garrison policy was signed that formalizes a tree cutting moratorium during the bat pupping season each year. OANRP was tasked to survey trees for roosting bats that required cutting, pruning or de-nutting because of safety issues. OANRP conducted eight bat survey to clear trees for removal or pruning, and ~14 hours

were spent by OANRP conducting the surveys (including travel time). Zero roosting bats were found. For more information, see the Rare Vertebrate Management Chapter 6.

Rare Insect Management

During this reporting period, OANRP continued to conduct regular monitoring of known *Drosophila* populations designated as ‘manage for stability’ and host tree outplanting efforts. This monitoring allows OANRP to track fluctuations and attempt to determine abundance patterns. *Drosophila* population numbers were reduced during this reporting period, likely due to extended dry weather conditions. Results of the surveys and management conducted during this reporting period are summarized in Chapter 7. An additional 48 *Urera glabra* were outplanted into the Palikea *Drosophila montgomeryi* site. Also, 122 *Cheirodendron trigynum* saplings were planted for habitat restoration and as host plants for *Drosophila substenoptera*. Many more *Drosophila* host plants are slated for outplanting in the upcoming planting season.

Surveys of suitable hosts continue at training ranges to obtain a thorough picture of endangered *Drosophila* distribution on Army training ranges for use in the upcoming Biological Assessment. Also, surveys for endangered *Hylaeus* bees are ongoing.

In addition, OANRP funded a study on the effect of the invasive ant, *Solenopsis papuana* on arthropods, including picture-wing *Drosophila*. An update on this study is included as Appendix ES-10. In summary, this ant taxon reduces successful *Drosophila* breeding. This result is relevant to the Army’s ongoing stabilization efforts for two *Drosophila* species. The Researchers are planning to publish their results which will be included in next year’s report.

Alien Invertebrate Control Program

The Alien Invertebrate Control Program continued to focus on slug control, Coconut Rhinoceros Beetle (CRB) detection and invasive ant detection during this past reporting period. OANRP has expanded its slug control program every year since 2010 for the protection of rare plants and rare plant habitat, and this year was no exception. We now protect 42 PU’s from slugs (up from 32). In 2016-2017, OANRP controlled slugs within ten Management Units (MUs) across 11 acres, a 57% increase in area from the previous year (7 acres). OANRP is a cooperator in control and detection efforts for CRB and the little fire ant (LFA) on Oahu. There are no known breeding populations of CRB on Army controlled lands and the LFA has not been detected during OANRP surveillance of new plantings and Army plant holding facilities. The Army established an official Garrison policy for preventing the LFA from establishing at Army controlled lands in FY 2015. This policy requires that landscaping plants be sourced from LFA free nurseries and that the responsibility for eradication of LFA, if introduced, is with contractors. During this reporting period, OANRP conducted coconut palm surveys on Wheeler to complement CRB crew surveys.

Research Projects

During this reporting period, OANRP funded numerous outside research projects related to management of MIP and OIP taxa, these are referenced within related chapters or subject areas of this report. Direct funding available to support outside research has decreased with budget decrements. Nonetheless, our in-house research projects continue as management related questions arise which require attention. Current in-house research includes decreasing rat bait palatability to slugs, pollination biology, seed viability, germination, and storage. As mentioned above regarding our rodent control program, OANRP also partnered with the U.S. Dept. of Agriculture, Wildlife Services to hand broadcast rodenticide in one of our MUs as an experimental pilot project.

In addition, OANRP supported various research projects by providing access or guidance during study plan development. The following are ongoing projects supported by OANRP during this reporting period:

- Vertebrate Introductions and Novel Ecosystems (VINE) project which is investigating the role of non-native birds in dispersing native and non-native fruit at various forested locations on Oahu. This is a multi-year study funded by the Department of Defense's Strategic Environmental Research and Development Program (SERDP).
- Seed Dispersal by non-native birds and potential application of con-specific attraction using playbacks to encourage dispersal of rare native plant taxa which was funded as a sub-project through the SERDP. Appendix ES-11 is a poster presented at the Hawaii Conservation Conference reporting on some of the research results.
- Pollination Biology of Hawaiian *Lysimachia*.
- Applying climate change modelling to select sites for reintroduction of *Hibiscus brackenridgei* subsp. *mokuleianus*.
- Investigation of Native Hawaiian Orchid fungal associations.

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Appendix 6-7 Hawaiian Hoary Bat Thermal IR and Acoustic Monitoring Project, McCarthy Flats Mohiaka Gulch, for Powerline Maintenance Tree Clearing on 24 August 2017

Appendix for Chapter 8

Appendix 8-1 Experimental Protocol for ContraPest Trial in Forest Areas

**Starred appendices are printed at the end of Chapter 9. All appendices are included in electronic format on a CD enclosed with this document. Also, they can be found online through the PCSU website at http://manoa.hawaii.edu/hpicesu/dpw_mit.htm.*