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**U. S. ARMY GARRISON HAWAII
OAHU TRAINING AREAS
NATURAL RESOURCE MANAGEMENT**

FINAL REPORT

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For the U. S. Army Garrison, Hawaii

Contract: Scopes of Work for the Ecosystem Management Activities at Makua Military Reservation, Island of Oahu and Ecosystem Management Activities at Various Training Areas, Island of Oahu.

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INTRODUCTION

The Natural Resource Staff (NRS), employed by the Pacific Cooperative Studies Unit (PCSU), were charged with managing rare plants and animals and the ecosystems upon which they depend under the contract scopes of work entitled: Scope of Work for Ecosystem Management Activities at Makua Military Reservation, Island of Oahu and Scope of Work for Ecosystem Management Activities at Various Training Areas, Island of Oahu. The legal requirement driving the Army's ecosystem management program is the Endangered Species Act (ESA) Sections 7(a)(1) and 7(a)(2). These sections of the ESA require that Federal agencies use their authorities to carry out programs for the conservation of federally listed species and to ensure that their actions are not likely to jeopardize the continued existence of any federally listed species.

O'ahu training areas include Makua Military Reservation, Schofield Barracks Military Reservation, Kawaihoa Training Area, Kahuku Training Area and Dillingham Military Reservation (See Figure A). A total of sixty-eight endangered species, fifty-six plants and fifteen animals, have been reported from O'ahu Army Training Areas since 1970.

O'ahu training areas encompass 46,000 acres and range from intact native forests to completely alien dominated areas. To prioritize management, NRS have delineated management units (MUs) within each training area. These units are chosen based on two criteria, the density of rare species and the degree to which the native ecosystem is intact. NRS implement ecosystem level management, which includes ungulate, and weed control in these areas. Two areas in Mākua have been designated as ungulate control areas because the forest in these regions is degraded in nature and does not warrant widespread weed control attention. The only threat control performed in these areas is ungulate control. Outside the MUs and ungulate control areas, NRS conduct primarily single species level management.

On O'ahu, the Army has two primary means of impacting threatened and endangered species, fires caused by live ammunition training, and weeds spread by training maneuvers. NRS assist in minimizing training impacts to threatened and endangered species by conducting road and landing zone surveys and addressing any weed problems that arise. NRS conduct post fire surveys to determine impacts to threatened and endangered species and make recommendations to improve training protocols. The aforementioned actions are a part of the minimization actions set out in the Section 7 Biological Opinion for Makua Military Reservation dated July 23, 1999.

Through the work performed under the Ecosystem Management Program contract, the Army has become a major player in conservation on the island of O'ahu. NRS have established cooperative relationships with neighboring land managers and landowners and have successfully promoted ecosystem project partnerships. This report summarizes the natural resource protection work conducted in this contract period (August 2000 to August 2001). The Chapters are as follows, Feral Ungulate Management (Chapter 1) and Weed Management (Chapter 2), Rare Plant Management (Chapter 3), Rare Vertebrate Management (Chapter 4), Invertebrate Management (Chapter 5), and Stream Management (Chapter 6). This report comes at the completion of the fourth year that PCSU contractors have been conducting natural resource management on Army training lands on O'ahu. NRS have used this report to critically analyze management approaches and efforts and to make recommendations for next year's work.

**Table A: PCSU Line Items
Makua Military Reservation**

| Line Item | Chapter | | | | | |
|-----------|---------|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 1(a) | X | | | | | |
| 1(b) | X | | | | | |
| 1(c) | X | | | | | |
| 1(d) | X | | | | | |
| 1(e) | | X | | | | |
| 1(f) | | X | | | | |
| 1(g) | | | X | | | |
| 1(h) | | | X | | | |
| 1(i) | | | | X | | |
| 1(j) | | | | X | | |
| 1(k) | | | | | X | |
| 1(l) | | X | | | | |
| 1(m) | | X | | | | |
| 1(n) | | X | X | X | | |
| 1(o) | | | X | | | |
| 1(p) | | | X | | | |
| 1(q) | | | X | | | |

Various Training Areas

| Line Item | Chapter | | | | | |
|-----------|---------|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 1(a) | X | | | | | |
| 1(b) | X | | | | | |
| 1(c) | X | | | | | |
| 1(d) | X | | | | | |
| 1(e) | | X | | | | |
| 1(f) | | X | | | | |
| 1(g) | | | X | | | |
| 1(h) | | X | | | | |
| 1(i) | | | X | | | |
| 1(j) | | | X | | | |
| 1(k) | | | | X | | |
| 1(l) | | | | | X | |
| 1(m) | | | | | X | |
| 1(n) | | | | | | X |
| 1(o) | | X | X | X | | |
| 1(p) | | | X | | | |
| 1(q) | | | X | | | |

Makua Military Reservation (MMR)

MMR encompasses two valleys, Kahanahāiki and Mākua, which are the northern-most valleys in the Wai`anae Mountains. Encompassing approximately 4,190 acres, MMR is the largest maneuvering/live-fire training area on O`ahu. Elevation within MMR ranges from sea level to just over 3,000 feet. While most of the natural habitats within MMR are highly disturbed there are large pockets of relatively intact dry and mesic forest. The terrain at MMR is extremely steep, exposed and rocky. There are five MUs and two ungulate control areas within MMR (See Figure B, Management Units Makua Military Reservation). There are a total of thirty-three endangered species in Mākua, thirty of which are plants.

Kahanahāiki Management Unit

Kahanahāiki MU is located on the northeast rim of Mākua Valley. At its boundary to the East, is the State of Hawaii's Pahole Natural Area Reserve. Kahanahāiki has an elevational range of 1,500 feet to 2,300 feet and an annual rainfall of 1,200 mm-3,800 mm. Kahanahāiki MU is approximately 110 acres in size and is characterized as being a diverse mesic forest. Ridges and drainage's that feed into the northern half of MMR (Kahanahāiki Valley) dissect the Kahanahāiki MU. A feral pig exclosure fence surrounds 90 acres of the Kahanahāiki MU. This fence was completed in December of 1996. Kahanahāiki contains twelve endangered plant species and two endangered animal species and is the site of the first endangered species outplanting on military lands in Hawaii. Because there is good road access and native resources are abundant, Kahanahāiki has been a focal point for volunteer projects.

ʻŌhikilolo Management Unit

ʻŌhikilolo MU is located on ʻŌhikilolo Ridge, which is the southern boundary of Mākua Valley. It encompasses approximately forty acres. The terrain is extremely steep and rocky and access to the upper portion of this management unit is by helicopter only. Large patches of ʻŌhikilolo Ridge lack vegetation and erosion by wind and rain is severe. A large population of goats once exacerbated this problem by consuming most of the vegetation on the ridge. With intensive goat control measures and a perimeter fence installed, this MU is now very close to being ungulate free. ʻŌhikilolo MU harbors a great deal of intact vertical cliff habitat and small patches of intact mesic forest. There is a goat-proof exclosure of approximately two and a half acres at the plateau where ʻŌhikilolo ridge meets Kea`au ridge from the south. ʻŌhikilolo contains thirteen endangered plant species and two endangered animal species. ʻŌhikilolo is also home to the largest population of *Achatinella mustelina* known to NRS.

Kaluakauila Management Unit

Kaluakauila MU is approximately forty-five acres and is located in and around Kaluakauila drainage, just north of Mākua Valley. The area around this drainage is referred to as Keawa`ula. This MU is made up primarily of dry forest on steep slopes and contains some intact native cliff habitat. Kaluakauila MU is very susceptible to fires because the habitat surrounding the intact native forest patches is comprised of introduced grasses and shrubs, which have very high fire potentials. There are a total of six endangered plants in Kaluakauila MU.

Lower Mākua Management Unit

The Lower Mākua MU is located at the base of the cliffs on the southern side of Mākua Valley. Portions of the lower valley contain extensive intact stands of dry forest that become intermixed

with mesic forest as elevation increases. The Lower Mākua MU ranges from 800 feet to 2,200 feet in elevation and encompasses an area of 270 acres. NRS believe that the stands of dry and mesic forest found in this MU are the most intact on O`ahu. The Lower Mākua MU contains eight endangered plant species and two endangered animal species.

C-Ridge Management Unit

The C-ridge MU is located on the north exposure of the large ridge, which separates Mākua and Kahanahāiki Valleys. It is a small four-acre patch of native dry forest surrounded on the lower side by introduced grasslands and on the upper side by sheer cliffs between 800 and 1,200 feet. The hike to C-ridge is lengthy which limits the amount of time spent and number of trips made to the area. This MU is susceptible to fires from military live-fire training. There are a total of three endangered plant species known from this MU.

East Rim Ungulate Control Area

The East Rim Ungulate Control Area is situated at the headwall of the southern side of Mākua Valley, opposite Pahole Natural Area Reserve. It contains small native mesic forest patches but is dominated by non-native canopy and understory species. Christmas berry (*Schinus terebenthifolius*) dominates large portions of this area. The substrate character of this Ungulate Control Area varies from loose rocky soil to rocky cliff. This unit extends from 1,800 ft to 2,600 ft and is approximately one hundred acres in area. There are a total of three endangered plant species in the East Rim Ungulate Control Area.

Ko`iahi Ungulate Control Area

Ko`iahi Ungulate Control Area is centered on Ko`iahi gulch, which is the southernmost subgulch of MMR. The southern boundary ridge of Mākua, `Ōhikilolo, and a spur ridge off of `Ōhikilolo form Ko`iahi gulch. Alien scrubby vegetation and kukui (*Aleurites moluccana*) overstory dominate this area. The substrate character of Ko`iahi ranges from rocky talus, to rocky cliff and gulch substrates. This area extends from 400 ft to 2,200 ft in elevation and is approximately two hundred and thirty acres in area. There are a total of eight endangered plant species in Ko`iahi Ungulate Control Area.

Schofield Barracks Military Reservation (SBMR)

SBMR is located in central O'ahu on the west and east side of Wahiawā town. SBMR is approximately 9,676 acres and encompasses lands that stretch from the summit of the Ko'olau Mountains in the east to the summit of the Wai'anae Mountains in the west. The Army uses Schofield Barracks for live-fire and maneuver training. Vegetation types at SBMR include dry, mesic and wet forests. SBMR is broken up into three ranges, West (SBW), East (SBE) and South (SBS) Ranges (See Figure C, Management Units and Training Ranges Schofield Barracks Military Reservation). Hazards associated with unexploded ordnance (UXO) restrict ecosystem management possibilities in SBW. NRS will focus surveys this year in SBW to better identify MUs. The impacts of these limitations are discussed within each chapter. In both SBS and SBE, management units, which encompass the most intact portions of the training areas, have been designated. SBW, on the other hand, has not been adequately surveyed for areas that meet MU standards because of the UXO limitations. At present, management work is limited to the single species level. There are a total of three MUs within SBMR (See Figure C, Management Units and Training Ranges of Schofield Barracks Military Reservation). There is presently only one MU within SBW at Mt. Ka'ala. There are a total of forty endangered species in SBMR, eight of which are animals.

Ka'ala Management Unit

The Ka'ala MU encompasses approximately one half of the wetland atop the summit of Mt. Ka'ala at 4,100 ft. It also extends down the slopes of Mt. Ka'ala to approximately 3,200 feet in elevation. The total area within this MU is approximately eighty acres. The flat summit forest portion of the MU is characterized by drenched, mossy soils and is considered to be an immature bog. The sloped region of the MU contains both wet forests with very organic soils and native plant-dominated cliff habitat. There are three endangered plants within the Ka'ala MU. NRS have also detected 'i'iwi on several occasions in the Ka'ala MU.

Pu'u Hāpapa Management Unit

The Pu'u Hāpapa MU is located at the top of Pu'u Hāpapa, the first peak to the south of Kolekole Pass. The MU is approximately nine acres. The elevation ranges from 2,400 ft to 2,900 ft. The forest within this MU is wet-mesic and extends down the north-facing slopes of Pu'u Hāpapa. This area is the only native forest patch deemed worthy of intensive ecosystem management in SBS. The habitat in the lower mesic portion of SBS is very degraded thus single species management is the focus. The Pu'u Hāpapa MU is home to a large population of *Achatinella mustelina* and a population of rare terrestrial snails, *Laminella sanguinea* and *Amastra micans*. There are also three endangered plants located within the MU.

Schofield-Waikāne Management Unit

This MU encompasses 780 acres between 1,600 feet and 2,600 feet in elevation of the southernmost portion of the KLOA and the summit portion of SBE. The forest types within the Schofield-Waikāne MU include short stature wet forest near the Ko'olau summit region, and at lower elevations, taller-stature wet forest. The terrain is dissected by deep ravines characteristic of the Ko'olau mountains. The Army leases the portion of this MU, between the Poamoho and Schofield-Waikāne Trails from the State of Hawaii. The State of Hawaii, Division of Forestry and Wildlife, has primary management responsibility and authority for this portion of the MU. The Schofield-Waikāne MU is home to thirteen endangered plants and five endangered animal species.

Kahuku Training Area (KTA)

The KTA is approximately 9,400 acres of land, which has been leased for years by the Army from Campbell Estate and was recently purchased by the Army. Elevation within KTA ranges from eighty feet to approximately 2,100 feet above sea level (See Figure E, Kahuku Training Area). The Army uses KTA for pyrotechnic training and foot maneuver training. Habitat within KTA is highly disturbed with some small, predominantly native pockets in upper elevations. The terrain consists of rolling hills dissected by broad drainages in lower elevations and relatively steep and windswept ridges in upper elevations. There are no MUs designated in KTA because surveys have not identified areas that meet the biological criteria. NRS will continue to search for areas that meet MU designation criteria. There are five endangered plants and two endangered animals found at KTA.

Dillingham Military Reservation (DMR)

DMR is approximately 665 acres. It is located near the northern tip of O`ahu, between Mokulē`ia and Ka`ena Point (See Figure F, Dillingham Military Reservation). The Army uses DMR for para-drop and night-vision goggle exercises. The elevation at DMR ranges from sea level to 400 feet. Habitat within DMR is highly disturbed with very little native flora surviving. However, small stands of native forest and shrub land can still be found on the cliffs and talus slopes in the southwest portion of the reservation. Most of the management at DMR is conducted within the small stands of native forest dominated by the native soapberry, *Sapindus oahuensis* or *Lonomea*. This area could be classified as a MU but in this document is not treated as such. This area does not fulfill the necessary biological criteria to be considered a MU.

DMR also harbors a perennial spring seep habitat that begins at the uppermost portions of the reservation and has running water to about sixty feet in elevation. There are four endangered plants known from DMR.