

Final Report
Resource Management Projects Performed Under the
Ecosystems Management Program at the Pōhakuloa
Training Area, Island of Hawai‘i, Hawai‘i.

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Submitted to:
U.S. Army Garrison, Hawai‘i
U.S. Army Corps of Engineers, Honolulu District
Research Corporation of the University of Hawai‘i

October 1999

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Kipuka Alala Exclosure Project

Introduction

The Federal Highway Administration in cooperation with the State of Hawaii is proposing to improve the Saddle Road (State Route 200), which bisects the island of Hawaii (Figure 1). The route of the current road would be altered in several areas, including Pohakuloa Training Area (PTA). The proposed route through PTA will traverse through an area federally designated as Palila Critical Habitat. The palila (*Loxoides bailleui*) (Figure 2) is an endangered forest bird that inhabits the slopes of Mauna Kea, adjacent to PTA. The Environmental Impact Statement (EIS) calls for mitigation, as the construction of this road will affect the quality of this habitat for the palila. One of the mitigation actions proposed is the construction of a large ungulate exclosure (U.S. DOT, 1999). This exclosure would surround an area in the southwest portion of PTA known as Kipuka Alala (Figure 1). This kipuka offers the only potentially suitable habitat for the palila at PTA besides the area affected by the new road. Once constructed, feral ungulates must be removed to allow regeneration of the native forest. The regenerated forest will provide potential habitat for relocation of the palila.

Planning Process

In August 1998, the Pohakuloa Training Area Environmental Office began the planning process for a fence exclosure around Kipuka Alala. Several options for the fence route were created using Arcview, a Geographic Information System (GIS). Two options were selected as the primary choices (Figure 3). Cost estimates were also written up and provided.

Option 1 was selected for various reasons. It was less costly for three reasons: a shorter overall distance, a larger portion of roadside fencing (less costly than off road) and no boundary survey requirements. Option 2 would have required a boundary survey due to the close proximity to the PTA boundary. Option 1 was also chosen because it encompasses the core area of Kipuka Alala. Although Option 2 would encompass approximately 1,400 additional acres of land, it is of lesser quality than the core area. It contains only small fragments of the native mamane (*Sophora chrysophylla*) forest that is required by the palila.

Aerial Reconnaissance

On December 1, 1998 an aerial reconnaissance of the proposed fence route was conducted. In preparation, points were plotted onto a map using Arcview GIS. These points were then plugged into a hand held GPS unit to provide guidance during the

survey. The survey team consisted of Kathleen Sherry and Jadelyn Moniz Nakamura of the PTA Environmental Office, Howard Hoshide and Allen Ramos of the National Park Service and David Okita of Volcano Helitours. The original route was flown and adjustments were made due to topographic obstacles that were not visible on the map. The new alignment was then plotted with the hand held GPS unit from the helicopter. Later, the new points were analyzed using Pathfinder Office and a map was created using Arcview GIS.

Ground Reconnaissance

A ground reconnaissance of the updated route was conducted from December 7-9, 1998. The survey team consisted of: Kathleen Sherry, Jadelyn Moniz Nakamura and Steve Evans of the PTA Environmental Office, Beth Miura of the U. S. Army Corps of Engineers, Howard Hoshide, Allen Ramos and Albert Agliam of the National Park Service, Mick Castillo of the U. S. Fish and Wildlife Service, Byron Donaldson of Donaldson Enterprises Inc (DEI) and David Okita of Volcano Helitours. Due to the High Hazard designation of this area, members of the survey team were required to wear kevlar helmets and vests at all times (Figure 4).

The western section (approximately 4.5 miles, 7.2 kilometers) lies along an established road and was not surveyed for archaeological and botanical resources due to previous disturbance. This section was surveyed for surface and subsurface unexploded ordnance (UXO) during a later survey.

The eastern section (approximately 5.5 miles, 8.8 kilometers), however, is entirely off road and was surveyed for surface UXO as well as botanical and archaeological resources. Mr. Okita shuttled the survey team to the southern tip of the proposed enclosure. From here, the team worked north and northwest (Figure 5). Using a Trimble hand held GPS with a real time differential correction unit, the team was able to successfully navigate along the route mapped from the air. Any significant diversions from the previously mapped route were marked with the GPS in order to update the map. A 15 meter corridor was swept along this route for UXO, rare plants and archaeological features. The fence route was flagged with surveyor's tape as it was cleared.

EOD Findings

No live munitions were discovered within the fence corridor, however, one rocket motor remnant and three bomb fragments were sighted in the vicinity. Although these fragments themselves are not volatile, they indicate the possibility of UXO in the area (Appendix A). Mr. Donaldson recommended a subsurface clearing to precede fence construction in areas where surface sediment could possibly conceal UXO.

Archaeological Findings

Several archaeological features were discovered along the fence route (Figure 5); one habitation cave (Figure 6) and a complex of excavated pits (Figure 7). Due to time constraints, only site locations were noted for future assessment. The fence route was altered where necessary to avoid disturbance or destruction of these sites.

Botanical Findings

Silene hawaiiensis (threatened) was detected along the fence route (Figure 8). Approximately 3 individuals within 2 populations of *S. hawaiiensis* were located (Figure 5). The fence route was altered to avoid disturbance to these plants. Where feasible, the route was adjusted to the northeast to provide future protection within the enclosure. Where enclosing the plants was not an option, the individuals were marked to avoid damage during fence construction.

Subsequent Reconnaissance Surveys

Archaeological

On 7 April 1999, Jadelyn Moniz Nakamura and Kathleen Sherry, accompanied by Eric Brundage, UXO specialist from DEI, returned to the previously identified archaeological sites along the fence route. David Okita again shuttled the survey team to the habitation cave discovered in the southern portion of the area. Due to the High Hazard designation of this area, members of the survey team were required to wear kevlar helmets and vests at all times

The cave site was inspected for UXO by Mr. Brundage prior to entry. Upon clearance, Dr. Nakamura and Ms. Sherry proceeded to explore, map and photograph the cave. Three artifacts were documented inside of the cave; two bird cooking stones and a carrying pole. This information was relayed in a letter to the State Historic Preservation Office as required by Section 106 of the National Historic Preservation Act (Appendix B).

Mr. Brundage proceeded to inspect the surrounding area for UXO at which time he located an unexploded 40 millimeter round (Appendix C). Detonation of the round and further UXO supervision was recommended for the construction of this portion of fence.

The excavated pits were photographed from the air and mapped. No UXO was found in the vicinity of these features.

Explosive Ordnance

During the period of 22 March 1999 through 1 April 1999, Eric Brundage and Marco Kaldi of DEI conducted a visual and subsurface survey of the western section of the proposed fence route (Appendix D). This section lies entirely on the Bobcat Trail and therefore did not require a full resource survey. No live ammunition was detected during this survey however 3 containers of blank small arms were retrieved and disposed of according to Army regulations.

Results

After the surveys were completed, adjustments to the route were inputted into Arcview and a new map was created. The current proposal, known as KA-2, encompasses 3,900 acres (1,578 hectares) within a 10 mile (16 kilometer) perimeter fence. The project was divided into three phases to be completed over three years. Two miles will be constructed in FY99, another four miles will be constructed in FY00 and the final four miles will be completed in FY01.

Ungulate Removal Plan

The large size of the area, the extremely dense vegetation and the large proportion of the area that is off limits present an extremely difficult challenge in the removal of feral ungulates. Experience with two other exclosures at PTA has provided guidance in creating the Ungulate Removal Plan for KA-2 (Appendix E).

Status of Project

As of 1 September 1999, the National Park Service completed a two mile (3.2 kilometer) section of fence along Bobcat Trail (Figure 5). The second phase (four miles) is currently scheduled for February, 2000.

Previous Fencing in Kipuka Alala

In February of 1999, the northern section of Kipuka Alala was fenced. This 5.5 mile (9 kilometer) exclosure, known as KA-1, encompasses 1,050 acres of the kipuka (Figure 4).

In January of 1998, the proposed east-west alignment was surveyed. Several routes were inspected for rare plants, UXO, rough terrain and dense vegetation. The route that encountered the fewest of these factors was selected.

The northeastern section of the KA-1 fence was surveyed simultaneously with the Kipuka Alala ground survey. Two populations containing approximately 15 individuals of *Hedyotis coriacea* (Figure 9) were located along the fence corridor. The fence was adjusted to contain these plants where possible. Individuals not included in the fence were marked so as to avoid damage during construction as previously mentioned. No UXO was found along this portion of the fence. One archaeologically significant cave was located near the end of the route. It was documented and mapped during the aforementioned archaeological survey on 7 April 1999.

Currently, efforts are being made to remove feral ungulates from the KA-1 enclosure. Feral pigs are being baited with water and lured through one way gates leading out of the enclosure. Traps have also been placed within the area. Trapped animals are translocated to another part of the base. Two sheep have been removed thus far using leg hold traps baited with water.

In the near future, Shayne Veriato and Mark Ono of the U. S. Department of Agriculture-Wildlife Services, will conduct a staff hunt to remove feral sheep and goats that remain in the enclosure. In preparation for this hunt, two feral sheep were captured on 10 May 1999 (Figure 10). These sheep were fitted with radio collars and released into the KA-1 enclosure. Since their release, one of the sheep has exited the enclosure through a one way outlet. Fortunately, the other sheep has joined a herd within the fence. This sheep will aid in locating the herd during the upcoming staff hunt.

Figure 1. Island of Hawaii

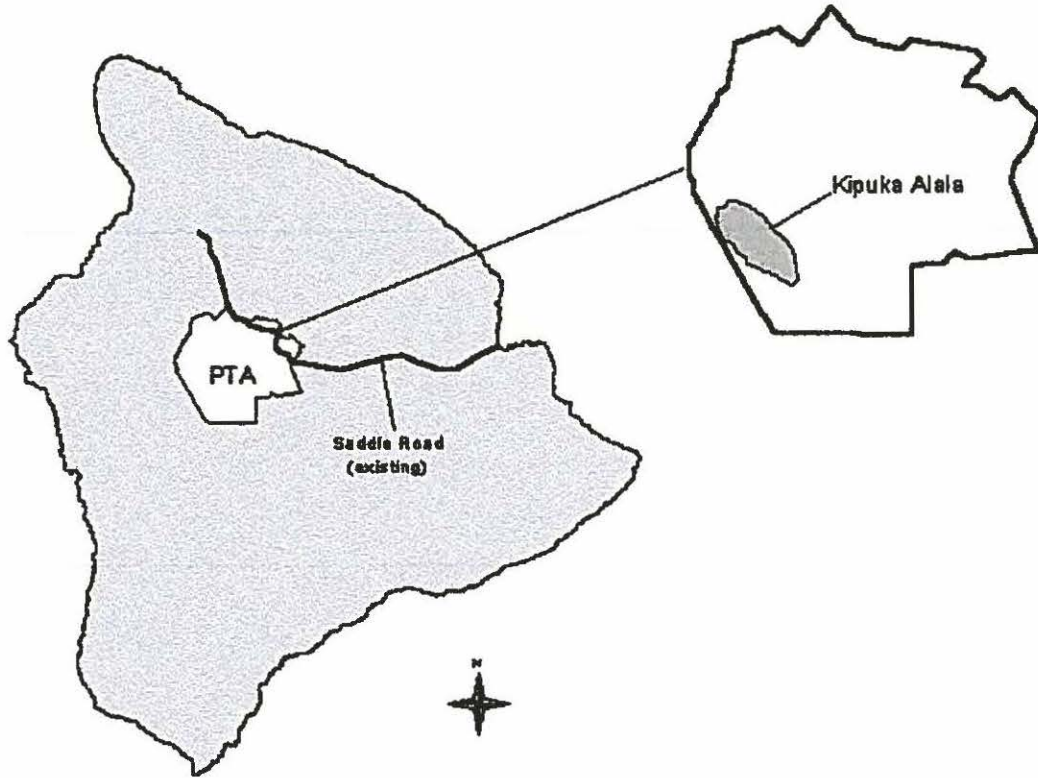


Figure 2. The palila (*Loxiodes bailleui*).



Figure 3. Options for the Kipuka Alala Fence Route.

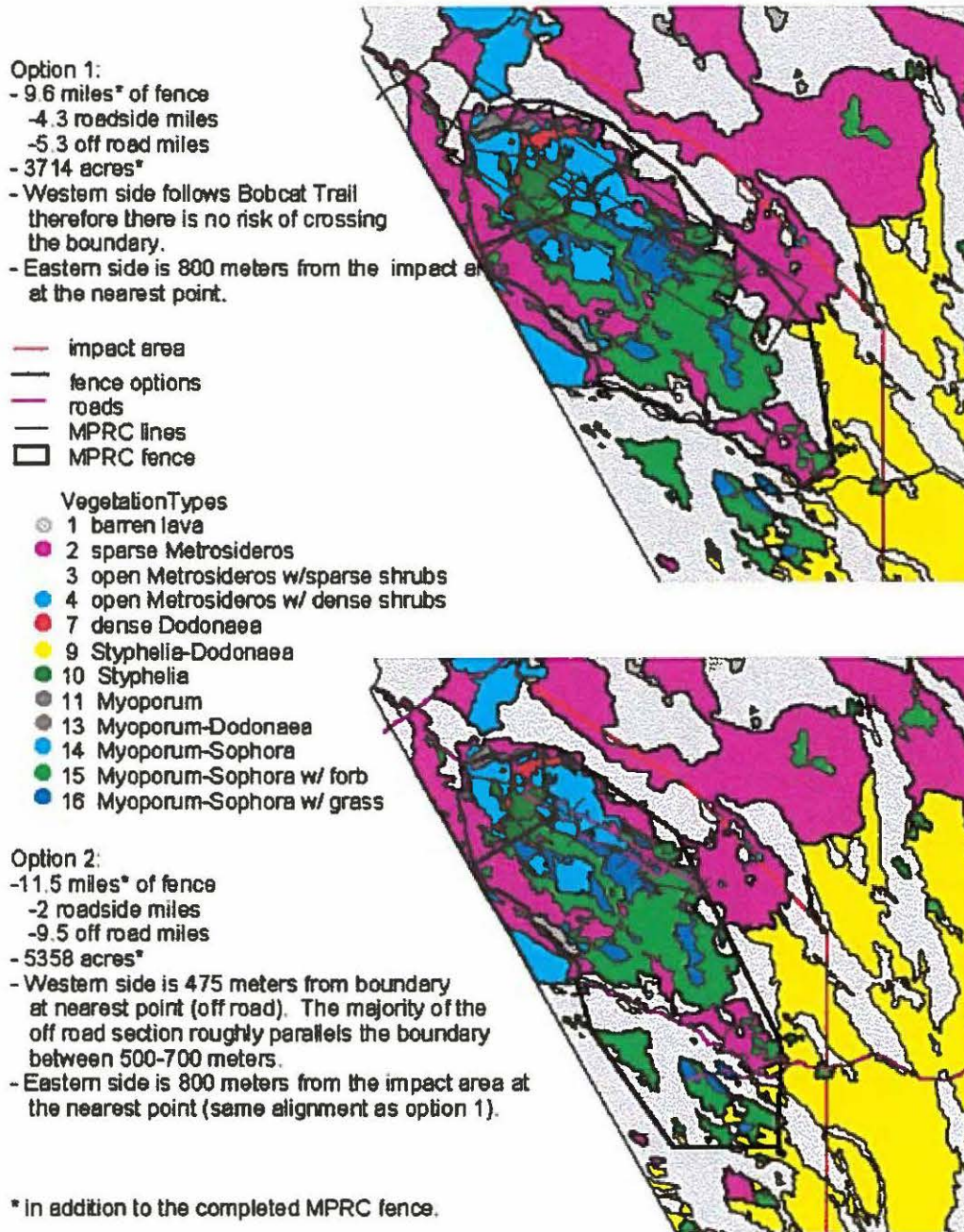


Figure 4. Kipuka Alala survey team outfitted in protective equipment.



Figure 5. Kipuka Alala survey area.

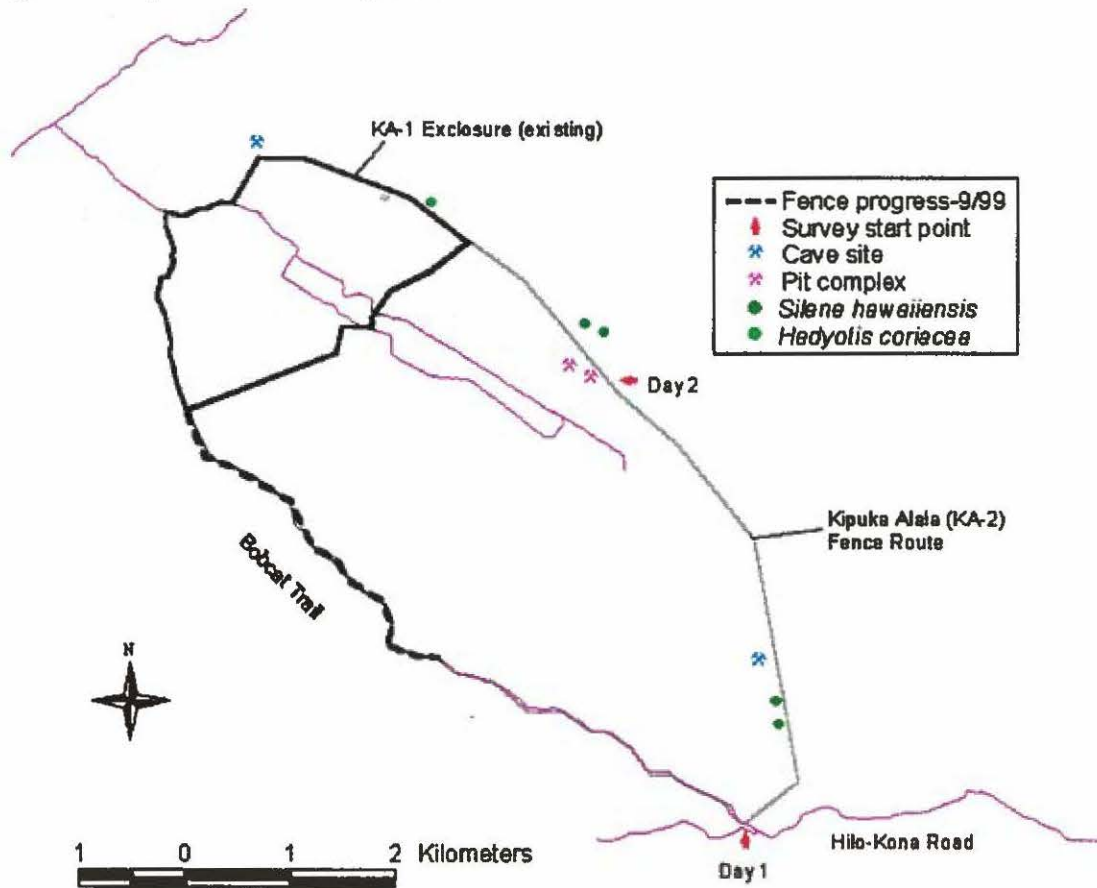


Figure 6. Habitation cave near fence route.



Figure 7. Excavated pit near fence route.

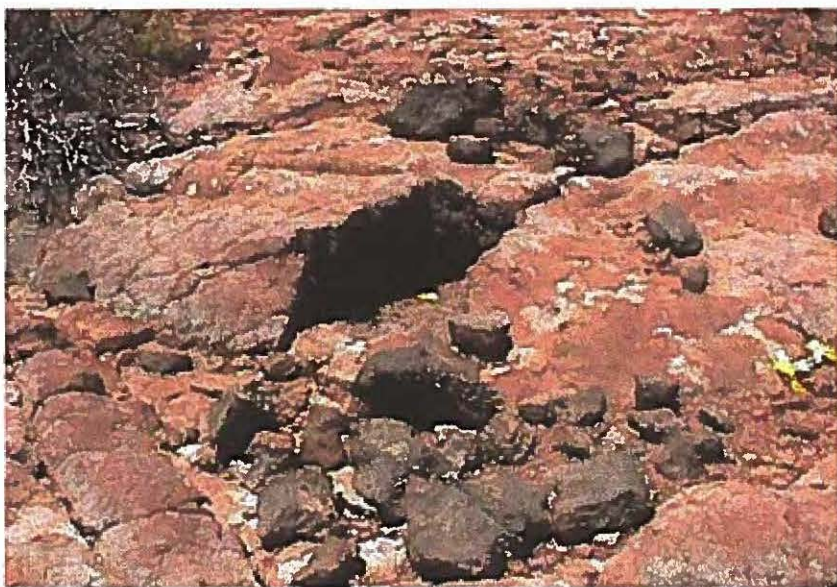


Figure 8. *Silene hawaiiensis*.



Figure 9. *Hedyotis coriacea*.

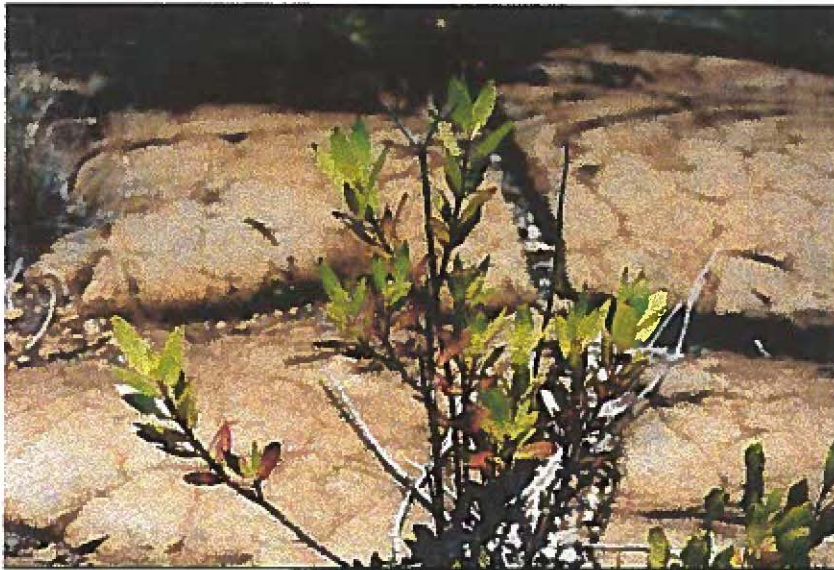


Figure 10. Live capture and radio collar attachment of sheep in Kipuka Alala.



References

Gooding, Jeremy et al. 1998. Feral Ungulate Movement and Home Ranges, Pohakuloa Training Area, Island of Hawaii. Hawaii Volcanoes National Park, Resources Management Division.

U.S. Department of Transportation, Federal Highway Administration, Central Federal Lands Highway Division and Hawaii Department of Transportation. 1999. Final Environmental Impact Statement, Saddle Road (State Route 200), Mamalahoa Highway (State Route 190) to Milepost 6 – Volume I.

Appendix A:
UXO Report, Ground Reconnaissance Survey



7 January 1999

Ms. Beth Miura
United States Army Engineer District, Honolulu
Engineering Division
Environmental Branch
CEPOH-ED-ES
Building 252
Fort Shafter, Hawaii 96858-5440

Subject: Implementation of Ecosystem Management Activity (Ordnance Avoidance), Pohakuloa Training Area, Island of Hawaii (DACA83-96-D-0007/0040)

Dear Ms. Miura:

This letter report was prepared by Wil Chee - Planning, Inc. in accordance with sections 4.c., 5.b.(2), and 12. of the above-referenced project scope of work dated 31 August 1998 and pursuant to U.S. Army Engineer District, Honolulu (USAEDH) contract no. DACA83-96-D-0007, delivery order no. 0040. It summarizes the observations of a senior unexploded ordnance (UXO) supervisor during visual reconnaissance for ordnance and explosive waste (OEW) of a proposed fence line at Kipuka Alala, Pohakuloa Training Area (PTA), Hawaii Island, Hawaii (see Figure 1), and offers recommendations based on those observations.

Donaldson Enterprises, Inc. (DEI) was subcontracted by Wil Chee - Planning, Inc. to assist an environmental team in the performance of a visual survey of the approximately 10-mile-long fence line proposed by the National Park Service (see Figure 2). DEI representative and senior UXO supervisor, Byron Donaldson, accompanied the environmental team to visually locate and, if possible, identify OEW discovered within and along the proposed fence line corridor. Members of the reconnaissance team and their respective affiliations were:

National Park Service

- Albert Agliam
- Howard Hoshide
- Allen Ramos

U.S. Fish and Wildlife Service

- Mick Castillo

WIL CHEE - PLANNING, INC.
*Land Use Planners and
Environmental Consultants*

H M S A C e n t e r
1400 Rycroft Street
Suite # 928
Honolulu, Hawaii 96814
Phone 808-955-6088
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PTA

- Steven Evans
- Jade Moniz-Nakamura
- Kathleen Sherry

USAEDH Environmental Branch

- Beth Miura

DEI

- Byron Donaldson

Mr. Donaldson arrived in Hilo at approximately 0945 hours, 7 December 1998, and met with other off-island members of the reconnaissance team. Subsistence and incidental items (e.g., foodstuffs, beverages, toiletries) were procured in Hilo for consumption or use at PTA during the survey effort. Project personnel then proceeded to PTA.

Upon arrival at PTA, Noble Kila of PTA Range Control conducted a safety briefing for the benefit of project personnel. The briefing adjourned at approximately 1345 hours at which time the above-listed individuals proceeded by ground transport to Kipuka Alala, and specifically the Multipurpose Range Complex (MPRC) administration area. Personnel arrived at the MPRC administration area at approximately 1600 hours whereupon a base camp was established thereat.

At approximately 1900 hours, Mr. Donaldson conducted a UXO safety briefing to apprise other on-site project personnel of standard protocols to be employed during the fence line reconnaissance. Personnel were instructed not to handle or otherwise touch any object that could potentially be considered to be OEW. If a suspect item is discovered, personnel were to apprise Mr. Donaldson of the discovery for identification and hazard evaluation.

At 0800 hours, 8 December 1998, project personnel mobilized at a pre-designated helicopter landing zone (LZ) located near the MPRC administration area. At the LZ, Mr. Donaldson boarded a chartered Manuiwa Airways helicopter piloted by David Okita and was transported along the proposed fence line's eastern corridor to stage a second LZ and to confirm the absence of OEW at that location. The second LZ was established at the southernmost end of the proposed fence line where the day's reconnaissance would commence (refer to Figure 2). Due to aircraft cabin space limitations, project personnel were shuttled in small groups by helicopter to the second LZ.

Messrs. Castillo and Donaldson led the reconnaissance team along the east fence line corridor. By day's end, an approximately 5-kilometer-long by 15.25-meter-wide area was visually surveyed. At the stopping point, project personnel hiked to an MPRC access road to meet ground transport for the return trip to the administration area base camp. Although no live UXO was discovered during traversal of this corridor, Mr. Donaldson identified the remnant of what was surmised to be a motor from a 2.75-inch folding fin air rocket. The remnant measured approximately 2 to 3 inches long and 3 inches diameter. Also discovered were three bomb fragments about 3 to 4 inches square and 1 inch thick purported to be from an air-dropped munition. Although observed to be outside the fence line corridor, these items merit address herein as they were situated vicinal to said corridor. Mr. Donaldson postulates the items may have originated from ordnance fired at or dropped on a *puu* situated just west of the fence line corridor as said *puu* is reportedly scarred with impact craters. Although horizontal coordinates by GPS were not

established, the approximate location of the OEW items is demarcated on Figure 2. PTA Range Control was summarily apprised of the discovery.

At 0630 hours, 9 December 1998, project personnel departed the base camp by ground transport to the previous day's stopping point. Visual reconnaissance of the remaining segment of the east fence line corridor commenced at approximately 0715 hours and concluded at about 1245 hours. No OEW was observed by Mr. Donaldson or others of the reconnaissance team during this reconnaissance.

National Park Service and PTA personnel exited Kipuka Alala following conclusion of the east fence line corridor visual reconnaissance. Departure of these individuals consequently precluded reconnaissance of the west fence line. As a result, Ms. Miura and Messrs. Castillo and Donaldson conducted a windshield survey of a portion of that corridor by traversing an approximately 1 kilometer segment in a southerly orientation from the administration area. Mr. Donaldson observed no OEW along this segment.

Based on his observations, Mr. Donaldson recommends that the remainder of the fence line not visually surveyed from 7 to 9 December 1998, i.e., within and along the west fence corridor, be inspected for surface and subsurface OEW. This recommendation also encompasses alignment modifications to segments of the proposed fence line subsequent to visual reconnaissance of those segments from 7 to 9 December 1998 as discussed herein. Areas at which fence post anchors are to be installed, i.e., sites along the fence line characterized by a surface to shallow subsurface soil or sediment stratum, be geophysically surveyed to ascertain the presence or absence of buried OEW. The location of subsurface anomalies encountered during the geophysical survey should be marked and subsequently investigated. Due to the relative paucity of OEW within and along the east fence line corridor, the requirement to don Kevlar helmets and flak jackets is diminished.

Please do not hesitate to contact the undersigned should you have any questions regarding the information contained herein.

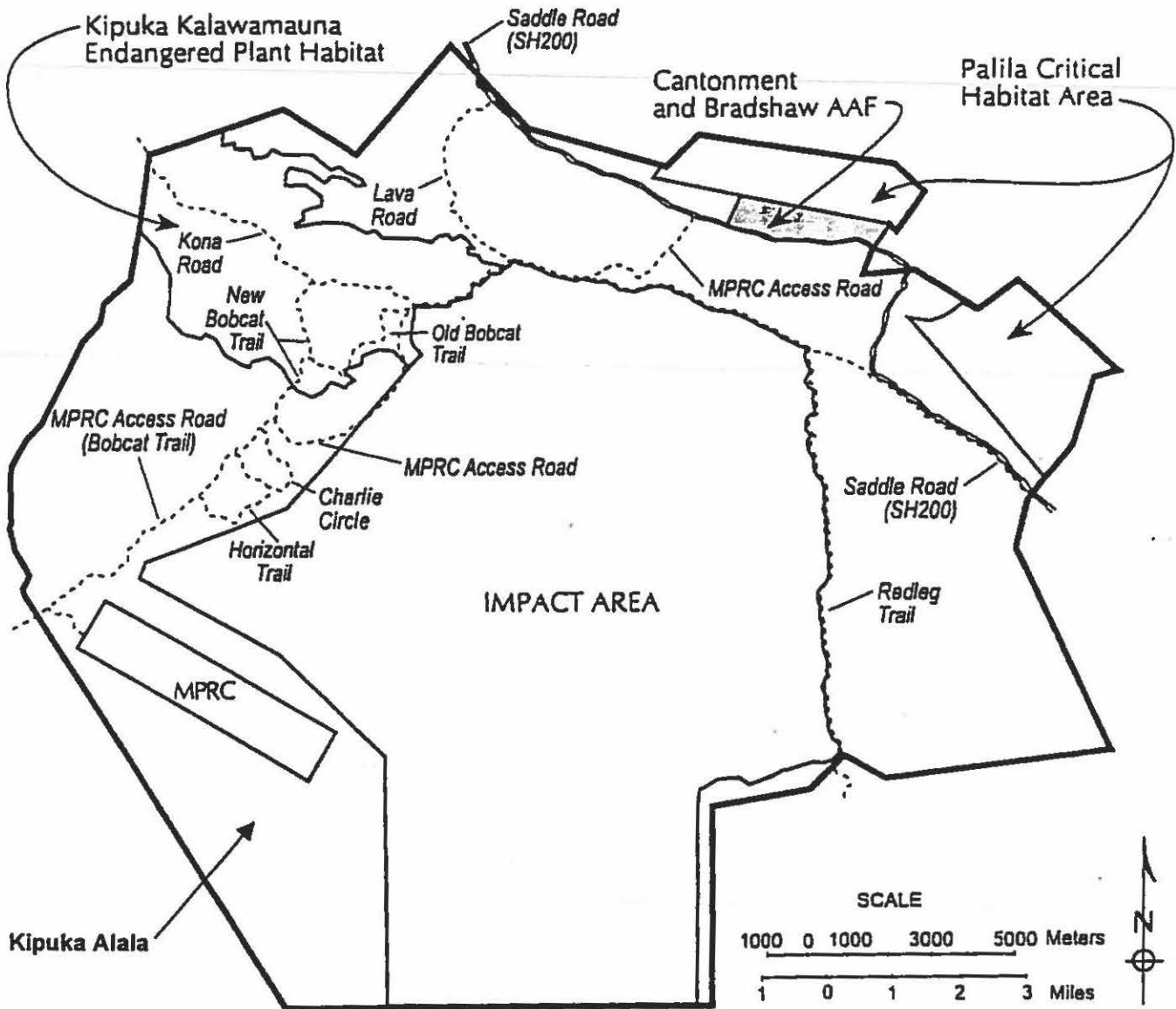
Sincerely,
WIL CHEE - PLANNING, INC.



Derek Yasaka

Attachments: Figures (2)

cc: Donaldson Enterprises, Inc.



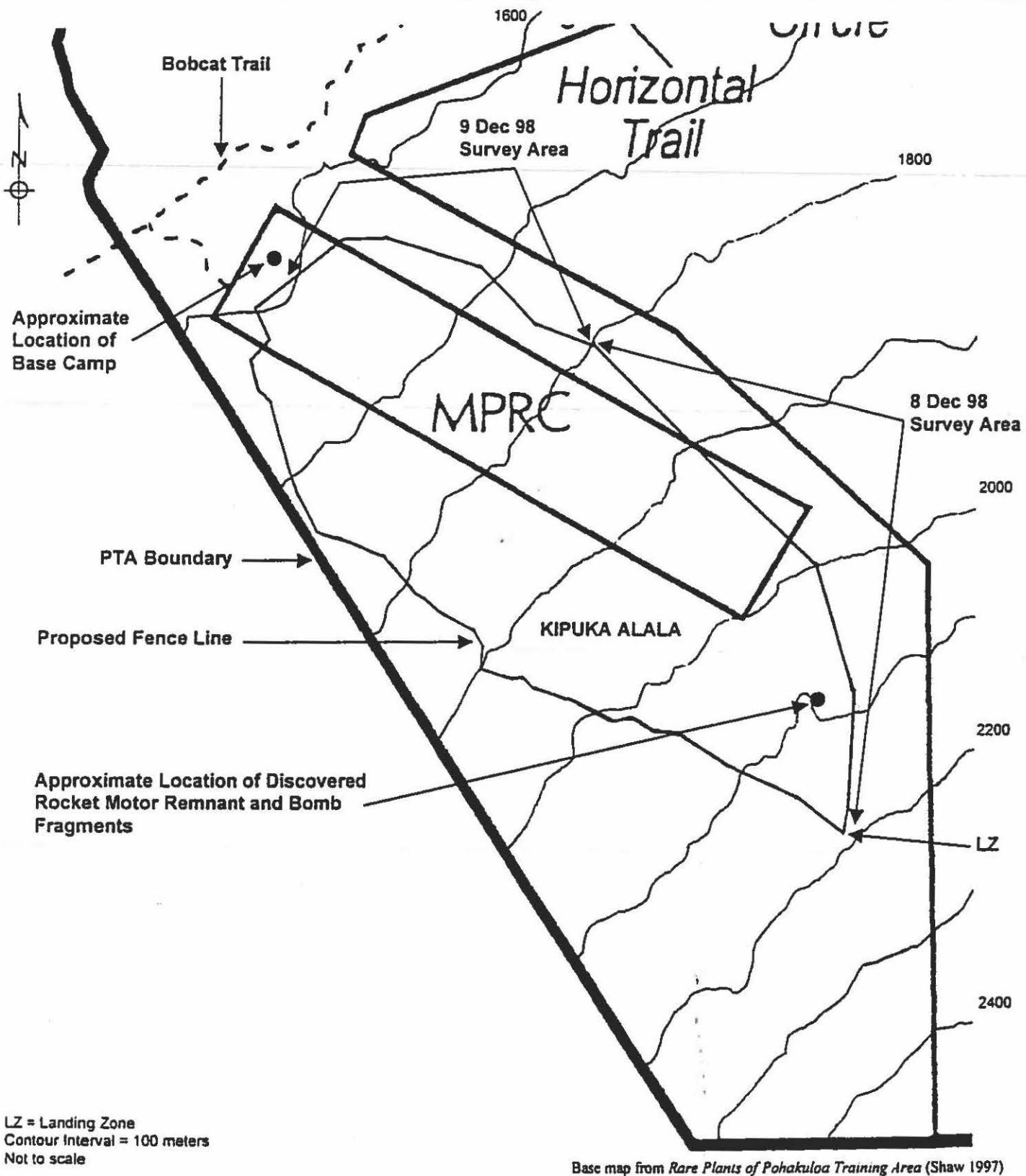
From: *Rare Plants of Pohakuloa Training Area, Hawaii* (Shaw 1997)

Implementation of Ecosystem Management Activity
 (Ordnance Avoidance)
 Pohakuloa Training Area, Island of Hawaii

Contract No. DACA83-96-D-0007
 Delivery Order No. 0040

Figure 1

**Location of Kipuka Alala
 Pohakuloa Training Area, Island of Hawaii**



Implementation of Ecosystem Management Activity
 (Ordnance Avoidance)
 Pohakuloa Training Area, Island of Hawaii

Contract No. DACA83-96-D-0007
 Delivery Order No. 0040

Figure 2

**Kipuka Alala Proposed Fence Line
 and Ancillary Features**

Appendix B:
Letters to the State Historic Preservation Office

January 5, 1999

PTA Environmental Office

Mr. Michael Wilson
Chairperson and State Historic Preservation Officer
State of Hawaii
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Wilson:

The United States Army Garrison, Hawaii (USAG-HI) is proposing to construct two fence enclosures. One fence enclosure would be located in Training Area 3 (see Figures 1 and 2) and the second enclosure would be in the Kipuka Alala (see Figures 1 and 3). Construction of these enclosures are mandated as part of the biological mitigation for the Saddle Road Realignment and Improvement Project. An Environmental Assessment has been prepared to analyze the environmental consequences of this action (see enclosed EA).

Based on the analysis of the environmental consequences of the Proposed Action on Cultural Resources reconnaissance surveys of the areas were undertaken by our Archaeologist, Ms. Jadelyn Moniz Nakamura. The project specifications and the results of the surveys are briefly described below.

Training Area 3

The Training Area 3 fence enclosure is located in Kaohe ahupua'a, TMK 4-4-16:3 (see Figures 1 and 2). The project would entail construction of a 3.6-acre fence within Training Area 3. To minimize construction impacts on both the natural and cultural resources, a large part of the fence will be on existing unimproved road and in previously disturbed areas.

A survey of the project area was conducted by our Archaeologist, Ms. Jadelyn Moniz Nakamura (see attached Memorandum for Record dated December 15, 1998). Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended and 36 CFR part 800.4(e) a report of negative findings is assessed; no historic properties that may be affected exist within the area of potential effects. This letter thus fulfills the Army's obligation under Section 800.4(d) to provide documentation to the SHPD regarding this particular fencing project.

Kipuka Alala

The second fence enclosure is located in the Kipuka Alala in Kaohe ahupua'a, TMK 4-4-16:1. The project would entail construction of a 3,714 -acre fence within Kipuka Alala (see Figures 1 and 3). A large portion of the fence line will be on existing unimproved road (the Old Bobcat Road) (see Figure 3). Thus, impacts from fence construction in these areas to both natural

and cultural resources will be minimized. The remaining portion of the fence will be along pahoehoe lava flows.

Although a majority of the fenced area was surveyed in previous years prior to the construction of the Multi-Purpose Range Complex (MPRC), a reconnaissance survey of the fence line was undertaken by our Archaeologist, Ms. Jadelyn Moniz Nakamura, to determine if any known or unknown archaeological sites lay along the fence line.

The proposed exclosure will encompass at least thirty-two (32) previously known sites (see Figure 3). This most recent survey resulted in several new finds. At least eight prehistoric pit features (distributed in three separate locations), and five subsurface caves were located within ten meters of the proposed fence route (see Figure 3 and Memorandum for the Record dated December 16, 1998). Artifacts and features in at least two of these caves suggest they were used for temporary habitation.

Due to the presence of these sites, the fence line will be moved a minimum of 20 meters away to avoid negatively impacting them. If possible, the fence line will be re-routed to include the new sites in the Kipuka Alala exclosure, thus providing protection from ungulates. Following these recommendations we conclude that this project will have "no effect" on any significant archaeological or historic sites.

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended and 36 CFR part 800.4(e) we are seeking your concurrence on this action. If you have any questions or comments please contact Jadelyn Moniz Nakamura at (808) 523-5196 (O'ahu) or (808) 969-1966 (Hawai'i Island).

Sincerely,

DAVID HERGENROEDER
Lieutenant Colonel, U.S. Army
Commanding Officer

cf. DPW Environmental, Wheeler, Oahu
U.S. Army Corps of Engineers, Honolulu District

June 8, 1999

PTA Environmental Office

Tim Johns
Chairperson and State Historic Preservation Officer
State of Hawaii
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Johns:

The purpose of this letter is two-fold. First, we write to inform you of the successful completion of mitigation measures outlined in a consultation letter from your office dated January 21, 1999. The mitigation concerned three sites (21747, 21748, and 21749) recently identified in Kipuka Alala (see attached previous correspondence). Your office requested that these sites be mapped and evaluated prior to any fence construction. On April 7, 1999 all three sites were mapped, photographed, and evaluated. Please see the attached Memorandum for the Record dated April 19, 1999, site database forms, site descriptions, photos, and sketch maps for details.

The second purpose of this letter is to inform your agency of the discovery of an unexploded 40-mm round approximately 30-m southeast of site 21747. The round was likely fired from a helicopter. It is not known when the round was fired, however, this area was used heavily during the World War II era. After the war much of the land in this part of the training facility became part of a larger impact area. In recent years, however, the use of Kipuka Alala has changed. In the 1980s a portion of it was cleared for construction of the Multi Purpose Range Complex (MPRC). At that time, use of the MPRC as an impact area ceased.

Because of its previous use, much of Kipuka Alala is still considered high hazard, and Explosive Ordnance Disposal (EOD) unit is required to accompany all personnel working in the area. Resource management activities require that the area be as safe as possible for humans to travel through and despite the use of EOD, unexploded ordnance in the area is a great threat. The 40-mm round found near site 21747 is highly explosive and poses a danger to those working in the area. Thus, Pohakuloa Training Area's Range Control has requested permission to detonate the ordnance in place. Range Control proposes to use approximately 0.5 lb. of explosives to detonate the device. The explosion will create a hole about the size of a baseball cap where the 40-mm now lies (Noble Kila, Range Officer, personal communication). The explosion is rather small, and is not expected to cause damage to site 21747.

Using these methods we conclude that this project will have "no adverse effect" on any significant archaeological or historic sites. Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended and 36 CFR part 800.4(e) we are seeking your concurrence on this action. If you have any questions or comments please contact Jadelyn Moniz Nakamura at (808) 523-5196 (O'ahu) or (808) 969-1966 (Hawai'i Island).

Sincerely,

DAVID HERGENROEDER
Lieutenant Colonel. U.S. Army
Commanding Officer

cf. DPW Environmental, Wheeler, Oahu
PTA Range Control

Appendix C:
UXO Report, Archaeological Survey



DONALDSON ENTERPRISES, INC.
Bomb Disposal Services

US Army Engineer Division, Pacific Ocean Division
ATTN: Beth Miura
ATTN: CEPOH-ED-ES Bldg 230
Fort Shafter, HI 96858-5440

Subj: UXO Report, MPRC Archaeological Escort

1. Donaldson Enterprises, Incorporated (DEI) provided UXO escort in support of PTA Environmental Division personnel during an archaeological investigation of three sites within the MPRC at PTA. While PTA Environmental personnel mapped a lava tube vicinity grid 213721, Eric Brundage of DEI conducted a UXO sweep of the surrounding area. During the sweep a dud 40mm high explosive grenade was found. The dud 40mm was marked by placing red flagging tape on several surrounding bushes. Upon completion of the day's activities Mr. Brundage filed a dud ordnance report with PTA Range Control.
2. Location of the dud 40mm was unexpected based upon the small amount of ordnance related material (fragmentation, etc.) found in the area. In addition, no other dud 40mm grenades or fragments from grenades were found in the vicinity. Due to the limited area searched, however, the possibility exists that other dud ordnance may be present in the area.
3. DEI recommends that the dud 40mm grenade be detonated in place as it is located at sufficient distance (approximately 30 meters) to prevent possible damage to the nearby archaeological site. Due to the proximity of the UXO to the proposed fence alignment, DEI recommends that a detailed UXO sweep be conducted of a 25-foot wide corridor along the proposed fence alignment. While this would provide the best coverage, at a minimum the fence installation crew should include UXO escort personnel while in the area. Finally, we recommend that further entry into this area include UXO escort and proper personnel protective equipment (i.e. Kevlar vest and helmet) until the area is fully swept and cleared.
4. DEI remains ready to provide any further information or assistance you may require.


Eric A. Brundage
UXO Supervisor

Appendix D:
UXO Report, Bobcat Trail Subsurface Clearing

DONALDSON ENTERPRISES, INC
Bomb Disposal Services
45-1055 Kamehameha Highway, Suite 203
Kaneohe, Hawaii 96744
Tel (808) 235-Bomb Fax (808) 235-Fuse

5 April 1999

Wil Chee Planning
1400 Rycroft Street, Suite 928
Honolulu, Hawaii 96814

Subj: Final Report, UXO Sweep of Bobcat Trail, Pohakuloa Training Area

1. During the period 22 Mar 1999 through 1 April 1999, Donaldson Enterprises, Inc. (DEI) conducted a surface/subsurface UXO sweep of a 5.2 mile section of Bobcat Trail, Pohakuloa Training Area, Hawaii. The start of the sweep area was characterized by the corner of the existing fenceline (vicinity grid 158754) and the endpoint characterized by flagging tape and a road intersection vicinity grid 212706. (Note: Grid locations are taken from map sheet "Pohakuloa Training Area", edition 6-29, series W731S, sheet PTA.) A chronology of key actions is detailed in Attachment A.
2. A sweep of the existing Bobcat Trail roadbed, an area 12-15 feet wide, was conducted using Schonstedt Model GA-72Cd Magnetic Locators. The high concentration of ferrite in the soil and in certain types of rock required frequent excavation and investigation to determine whether a magnetic anomaly was natural or a possible UXO. A visual inspection of the trailway was conducted concurrently with the subsurface sweep. No UXO or UXO related scrap were found during the sweep of the trailway.
3. In addition to the sweep of the trailway, a visual and subsurface sweep was conducted of a 3-foot wide section immediately along the northern edge of the trailway. This area was swept to ensure no UXO existed in the area where workers would likely be installing the future fenceline. No live UXO was encountered in this area. Of note, however, one 5-inch long piece of fragmentation, believed to be from a large bomb, was found in the vicinity of grid 200713 approximately 5 feet from the north edge of the trailway. In addition, a cartridge casing from an aircraft fired 20mm cannon was found vicinity grid 204712 laying approximately 10 feet from the northern edge of the trailway. While neither item was hazardous and both were outside the sweep area, both were spotted and recovered.
4. One group of hazardous items was recovered during the sweep. In vicinity grid 184722, three full ammunition cans containing blank 7.62mm small arms were discovered. These items were in a single location approximately 20 feet from the northern edge of the trailway and were apparently abandoned in a crevice in the lava. These cans were later turned-in to the PTA Ammunition Supply Point at the direction of PTA Range Control. A photograph of recovered items is included in attachment B.

2. A significant problem was encountered due to the unimproved nature of this portion of Bobcat Trail. The initial 2 miles of the trail leading from the MPRC camp area to the sweep starting point was graded but not compacted. This caused severe sidewall damage to rental vehicle tires as the weight of the vehicle compressed the rough roadbed and allowed sharp basalt rock and cinders to come in contact with the sidewall of the tires. This resulted in a "cheese grater" effect that shredded the sides of the tires and, in one instance, resulted in a flat tire. In addition, while the initial portion of the trail had been graded the remainder of the trail after the sweep starting point was extremely rough with large rocks, ruts and furrows. Despite slow and careful driving the rental vehicle periodically bottomed out resulting in minor damage to the vehicle underside. The trail became virtually impassable halfway between the start and end points. Vehicle damage resulting from the unimproved nature of the trail will likely result in severe damage charges from the rental company. Recommend that the trail be improved by grading and by filling with gravel and/or cinders prior to further use.


Eric A. Brundage
UXO Supervisor

Attachment A – Chronology of Work Conducted

22 Mar 99 – DEI team Byron Donaldson (Vice-President), Eric A. Brundage (UXO Supervisor) and Marco Kaldi (UXO Specialist) deploy from Oahu to PTA. Team receives briefings at PTA Range Control and conducts coordination with Beth Miura and PTA Environmental personnel. At completion of meetings, DEI personnel proceed to MPRC to establish base camp.

23 Mar 99 – DEI team proceeds to starting point where Byron Donaldson conducts orientation for other team members. After supervising a surface/subsurface sweep of approximately ½ mile, Byron Donaldson departs MPRC to return to Oahu. Other team members begin visual sweep of entire trail area. After completing visual sweep and while returning to base camp DEI team has flat tire due to puncture of sidewall by basalt rocks. Tire is replaced and team returns to camp at approximately 1600.

24 Mar 99 – DEI team proceeds to Hilo to replace flat tire and returns to PTA Base Camp at approximately 1100hrs. Team encounters a 30 minute delay in signing for MPRC keys due to a gas leak at Range Control. Team begins sweep activity at approximately 1300 hours and conducts surface/subsurface sweep of approximately .7 mile. Team terminates sweep at 1600 and returns to MPRC camp at approximately 1700.

25 Mar 99 – DEI team conducts surface/subsurface sweep of approximately 2 miles of Bobcat Trail. Three full ammunition cans containing 7.62mm blank small arms are found and marked.

26 Mar 99 – DEI team does not conduct sweep operations due to distance to starting point (approximately 1.5 hours drive) and need to wash and buff scratches from rental vehicle. Team cleaned and secured MPRC camp prior to departing enroute Oahu.

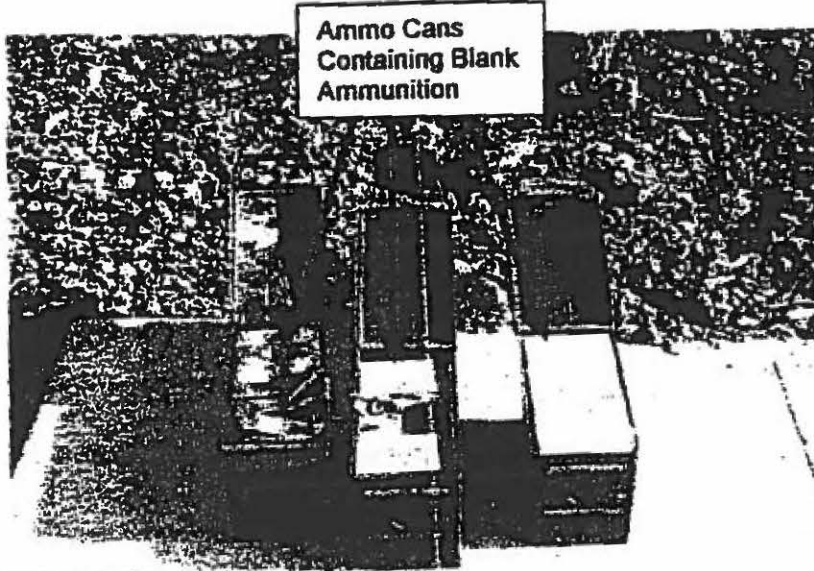
29 Mar 99 – DEI team consisting of Eric Brundage and Marco Kaldi deploys from Oahu to PTA. Team coordinates with PTA Range Control and DoD Police prior to proceeding to MPRC to establish camp.

30 Mar 99 – DEI team conducts surface and subsurface sweep of approximately 1.5 miles of Bobcat Trail. Time available for sweep is reduced due to long travel time to starting point. Team is required to walk partway to starting point due to inability of rental vehicle to transit road without severe damage. One bomb fragment and one 20mm cartridge case are recovered. Detailed search of areas surrounding the fragment and the cartridge case fail to reveal other ordnance-related items.

31 Mar 99 – DEI team completes surface and subsurface sweep of Bobcat Trail at approximately 1000 hrs. Team marks endpoint with strip of red flagging tape. Team recovers the three cans of blank ammunition and, per instructions from PTA Range Control, delivers same to PTA Ammunition Supply Point. Eric Brundage conducts short outbriefing for PTA Environmental personnel. Team returns to MPRC camp to clean equipment and prepare for redeployment.

1 Apr 99 – DEI team cleans MPRC camp, returns keys to PTA Range Control and departs PTA at approximately 0900 hrs enroute Hilo/Oahu.

Attachment B – Recovered Ordnance Photo



Ammo Cans
Containing Blank
Ammunition

20mm Cartridge Case



Bomb Fragment



Appendix E:
Ungulate Removal Plan

**Ungulate Removal Plan
Kipuka Alala
16 June 1999**

A 3,900 acre fence enclosure (KA-2) encompassing Kipuka Alala (see Figure 1) is scheduled to be completed in FY 01. This enclosure will inevitably surround at least portions of the feral sheep, goat and pig populations that currently reside in this area. Factors such as access/UXO concerns, locations of animals, vegetation density and substrate will influence the methods in which these ungulates are removed.

Access into Kipuka Alala is currently permitted only within the Multi Purpose Range Complex (MPRC) boundary (30% of the area) (see Figure 1). The remainder of the kipuka is designated High Hazard Area and can only be entered with an Explosive Ordnance Division (EOD) escort. This limits the options for ungulate removal.

During the period of February 1997 through February 1998, three aerial ungulate censuses were conducted by the National Park Service and PTA staff biologists. Although the focus of these censuses is to provide baseline data rather than actual population size, rough population estimates were provided in the Ungulate Census 1997-1998 Report (Hoshide and Fancy, 1998). These estimates are based on the numbers of animals seen using the line transect method. Within Kipuka Alala, the estimated populations are 173 sheep (107-278 with 95 percent Confidence Interval) and 76 goats (39-148 with a 95 percent Confidence Interval).

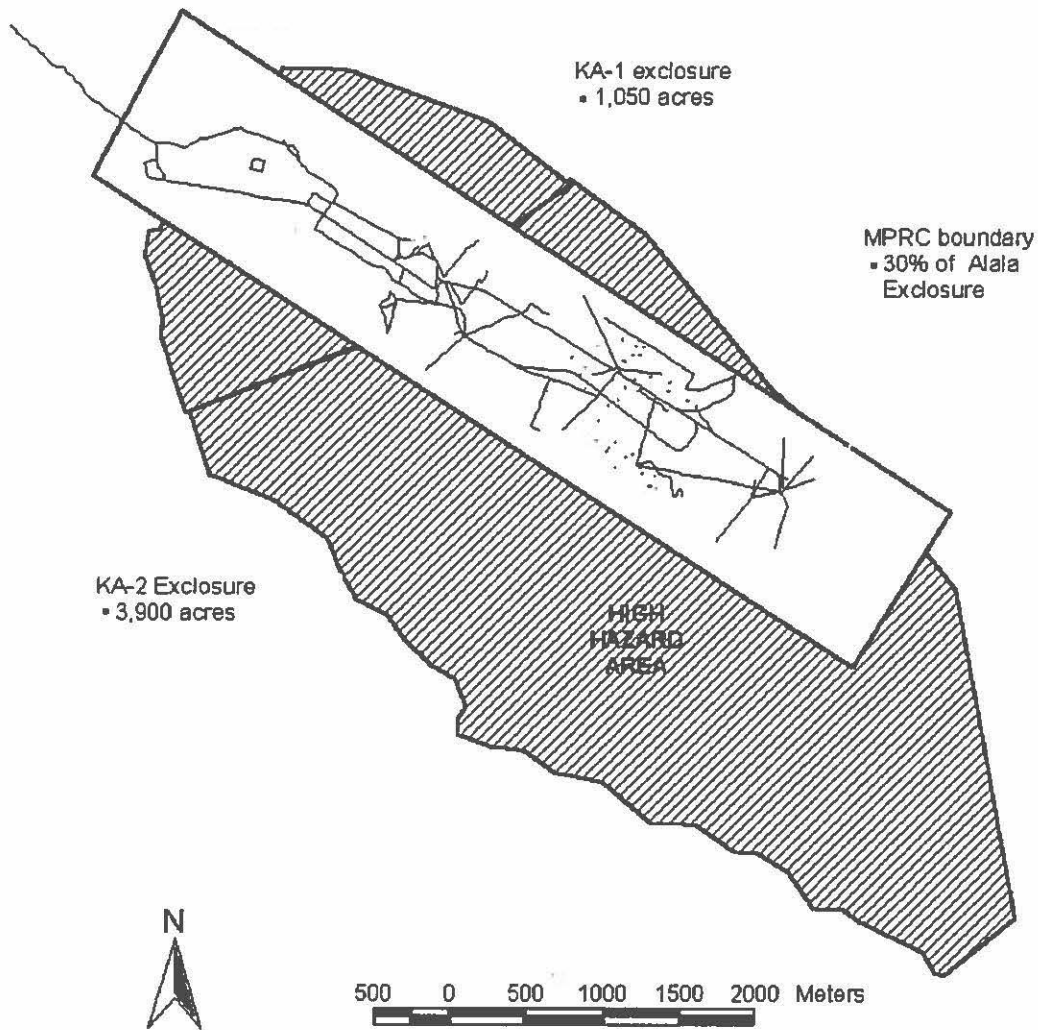
According to the Feral Ungulate Movement Report (Gooding et al, 1998), the feral sheep population in Kipuka Alala tends to be sedentary within the kipuka, occasionally venturing north east into the impact area. Gooding states that there is no indication of seasonal migration or movement over large areas by the feral sheep. Due to the isolation of the kipuka, it is reasonable to assume that there would not be a great influx of new animals from the western side. It will therefore be useful to begin removing ungulates prior to fence completion.

Within the MPRC boundary, PTA staff hunters (U. S. Department of Agriculture-Wildlife Services employees) will conduct ground hunts starting in FY99. Hunts will target sheep, as they are the most abundant animal in this area, but will also include any pigs and goats encountered. Ground hunts will be 7 to 14 days long and will continue on a quarterly basis. These time periods are subject to revision depending upon success.

Due to high costs, it would not be prudent to perform multiple aerial hunts during the three year construction process. Aerial hunting will take place upon completion of the enclosure in FY 01. PTA does not have trained and certified staff so these hunts will be contracted out. Aerial hunting will be the main method of removing goats, as they inhabit the southern, inaccessible portion of the High Hazard Area. These hunts will target all remaining ungulates.

The current success of pig removal via one way gates in Kipuka Kalawamauna warrants a continued effort in Kipuka Alala. Upon completion of the fence, one way gates will be installed in areas with suitable substrate for pig traffic. The gates will be baited with water and papaya and movement will be monitored by an infrared sensing camera and an event recorder. Another method of pig removal will be the use of dogs by the PTA staff (USDA-WS) to herd and hunt within the MPRC boundary.

Figure 1. Kipuka Alala exclosures.



Monitoring the Effects of Wildfire on Vegetation

Introduction

A wildfire in July of 1994 burned approximately 1,790 hectares of arid montane shrubland on the western side of PTA. This area, designated the Kipuka Kalawamauna Endangered Plants Habitat (KKEPH), was home to six species of rare plants; one threatened and five endangered. A set of plots was established prior to the fire and has been monitored five times since. Details of the project follow in the poster section.

Field work

Field work was conducted from 22 September through 2 October, 1998. The field crew consisted of Kathleen Sherry, Rosa Kuo and Steve Evans of the PTA Environmental Office, Paul Malaspina of the PTA Range Control Office and Mick Castillo of the U. S. Fish and Wildlife Service.

Data analysis

Several types of data including photo points, belt transects and line transects were collected at each of the plots. Data was entered into Excel spreadsheets and merged with all of the data from previous monitorings. The data was then analyzed to assess changes in plant community structure.

Paper

A scientific paper reporting on the results of the four years of data collected after the fire in the KKEPH is currently in press. It will be submitted upon completion.

Poster

An abstract was submitted to the Secretariat of Conservation Biology and a poster was displayed at the 1999 Hawaiian Conservation Conference. The following material is the poster, reorganized to fit into a report format.

Effects of Wildfire on Community Structure and Rare Plant Species in the Kipuka Kalawamauna Endangered Plants Habitat, Pohakuloa Training Area, Hawaii.

Introduction

For three days in July of 1994, a wildfire burned through the northeast portion of the Pohakuloa Training Area (PTA) (Figure 11). Of the 2,750 hectare area designated as the Kipuka Kalawamauna Endangered Plant Habitat (KKEPH), 1,790 hectares (approximately 65%) were burned. The KKEPH consisted mainly of 'a'ali'i (*Dodonaea viscosa*) and naio (*Myoporum sandwicense*) shrublands. Research was conducted to determine the effects of wildfire on the plant community structure as well as to observe the effects on six federally listed plant species. Fortunately, plots had been established and monitored in the burn area prior to the fire allowing for complete comparative analysis (Figure 12).

Fire Severity

Fire severity was determined using the BEHAVE fire behavior prediction system. This involves inputting various types of information such as fuel models, fuel moisture values and slope to determine fire behavior estimates and ultimately fire severity. Custom fuel models were created from fuel loads and cover data collected after the fire. Table 1 contains examples of outputs from the BEHAVE system that were used to determine fire severity. Fire severities within the KKEPH were classified as low to moderate depending upon degree of slope.

Table 1. Data from the BEHAVE system used in determining fire severity.

Community Type	Flame Length (meters)	Heat per Unit Area (btu/ft ²)
<i>Dodonaea</i> shrubland	3.5-4.0	1,039
<i>Myoporum</i> shrubland	1.7-2.0	1,142

Methods

- Vegetation was sampled on permanent plots established by the Land Condition Trend Analysis (LCTA) program in 1993. This program utilizes standard methodology to assess status and trends of natural resources on Army lands.
- Permanent photo points are another component of the LCTA program utilized for this research.
- Immediately after the fire, known populations of rare plant species were relocated and plots were established. These plots were monitored again for this study.

Vegetation Sampling

Eight of the LCTA plots originally established within the KKEPH were resampled in 1998. Others were excluded due to location in a recently designated high hazard area (inaccessible). LCTA plots consist of a base stake, an end stake and a pin every 25 meters to ensure consistency in monitoring on a long term basis. One hundred meter line transects were read using the point intercept method to determine aerial cover. One hundred by six meter belt transects were read to determine woody plant density.

Photo Points

Photo points were established at three meters behind the base stake on each of the LCTA plots. Photos were taken prior to the fire and five times after the burn at one month, six months, one year, two years and four years.

Threatened and Endangered Species Plots

No specific threatened or endangered species plots were established prior to the fire. After the burn, known populations were relocated and assessed for survivors. Specific sampling of these populations did not begin until 1996. During previous monitorings, observations were recorded on survivors as well as regeneration.

Results

Vegetation Sampling

After four years:

- Herbaceous species cover regained preburn values (Figure 13).
- Woody species cover had reached approximately the 50% of preburn value (Figure 14).
- Woody species density surpassed preburn values (Figure 15).
- Woody species richness varied only slightly post fire (Figure 16).
- Short lived woody species such as *Chamaecyse multiformes* and *Chenopodium oahuense* drastically increased in density (Table 2).
- *Dodonaea* maintained or increased its dominance (Table 2).
- Long lived woody species such as *Myoporum sandwicense* drastically decreased in density (Table 2).
- The recovery of alien species will be further analyzed in the final report.

Table 2. Woody Plant Density in Two Community Types over Time

Plant community	Species	Time				
		Preburn	6 month	1 year	2 years	4 years
Dodonaea shrubland	<i>Chamaecyse multiformis</i>	230	295	60	424	958
	<i>Chenopodium oahuense</i>	196	0	5	21	366
	<i>Dodonaea viscosa</i>	427	433	391	658	945
	<i>Myoporum sandwicense</i>	0	0	0	0	0
	other shrubs	318	63	159	139	275
Myoporum shrubland	<i>Chamaecyse multiformis</i>	38	144	62	121	376
	<i>Chenopodium oahuense</i>	44	0	25	368	684
	<i>Dodonaea viscosa</i>	109	84	90	91	108
	<i>Myoporum sandwicense</i>	68	1	51	3	3
	other shrubs	60	79	31	36	75

Photo Points

Photo points are extremely useful in providing visual assessments as well as supplementing data analyses. Currently, there are only two full sets of data points accessible. Figure 17 exhibits the changes in vegetation on *Dodonaea* plot 37 beginning one month prior to the fire and continuing for four years after. The entire set of photo point series will be included in the final report.

Threatened and Endangered Species Plots

Six species of federally listed plants occurred in the KKEPH prior to the fire (Figure 18). *Silene hawaiiensis* is a threatened species while the rest are endangered.

Populations of these species have been monitored for recovery since the fire. Since no standard monitoring procedures were established on these plots until 1996, this research utilizes observations on the recovery of these species (Table 3).

Table 3. Observations of the Effects of Wildfire on Rare Plants in the KKEPH

Species	Recovery	Resprouting	Seed Recovery	Post Fire Browse
<i>Haplostachys haplostachya</i>	Robust	From roots	Yes	Light
<i>Stenogyne angustifolia</i>	Robust	From roots	Yes	Heavy
<i>Silene hawaiiensis</i>	Robust	From roots	No	None
<i>Silene lanceolata</i>	Weak	None	Minimal	Heavy
<i>Tetramalopium arenarium</i>	Weak	None	Minimal	None
<i>Zanthoxylum hawaiiensis</i>	None	None	None	N/A

Discussion

- Plant community structure was affected similarly in both *Dodonaea* and *Myoporum* communities.
- Herbaceous plants rebounded to preburn cover values faster than woody plants.
- Both plant communities exhibited a decline in long lived woody species density and an increase in short lived woody species density.
- The characteristically deeper soils of *Dodonaea* dominated communities may explain the rapid recovery of herbaceous plants.

Conclusions

- Fire is a major factor driving the conversion of native Hawaiian shrublands to grasslands.
- Due to the time required for woody plants to regain dominance, higher frequencies of wildfires are likely to increase the rate of this conversion.

Management Recommendations

- Use rare plant recovery data to prioritize fire management areas.
- Expand and maintain the network of existing fire breaks to better prevent wildfires.
- Develop and implement a fuel load management program.

Figure 11. Locations of Hawaii, PTA and the Kipuka Kalawamauna Endangered Plant Habitat (KKEPH).

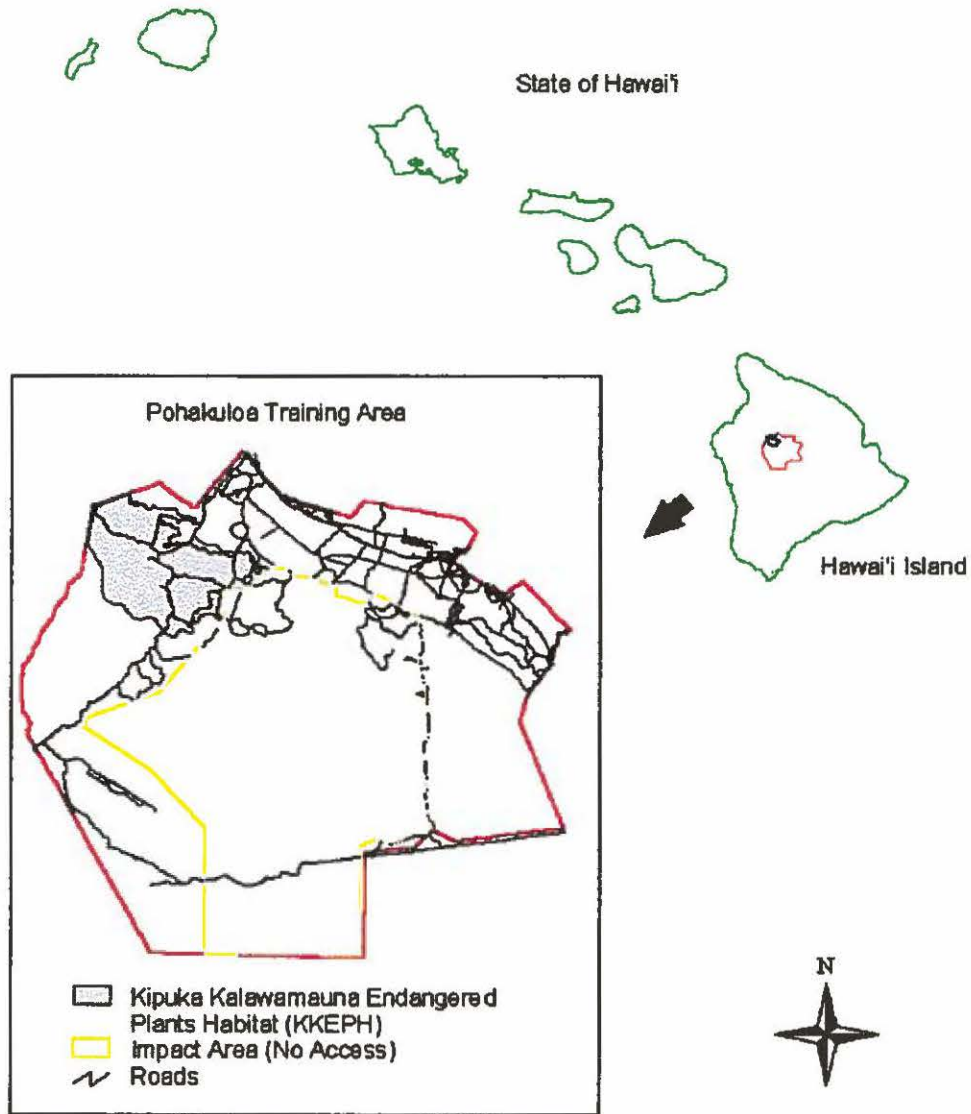


Figure 12. Location of study area.

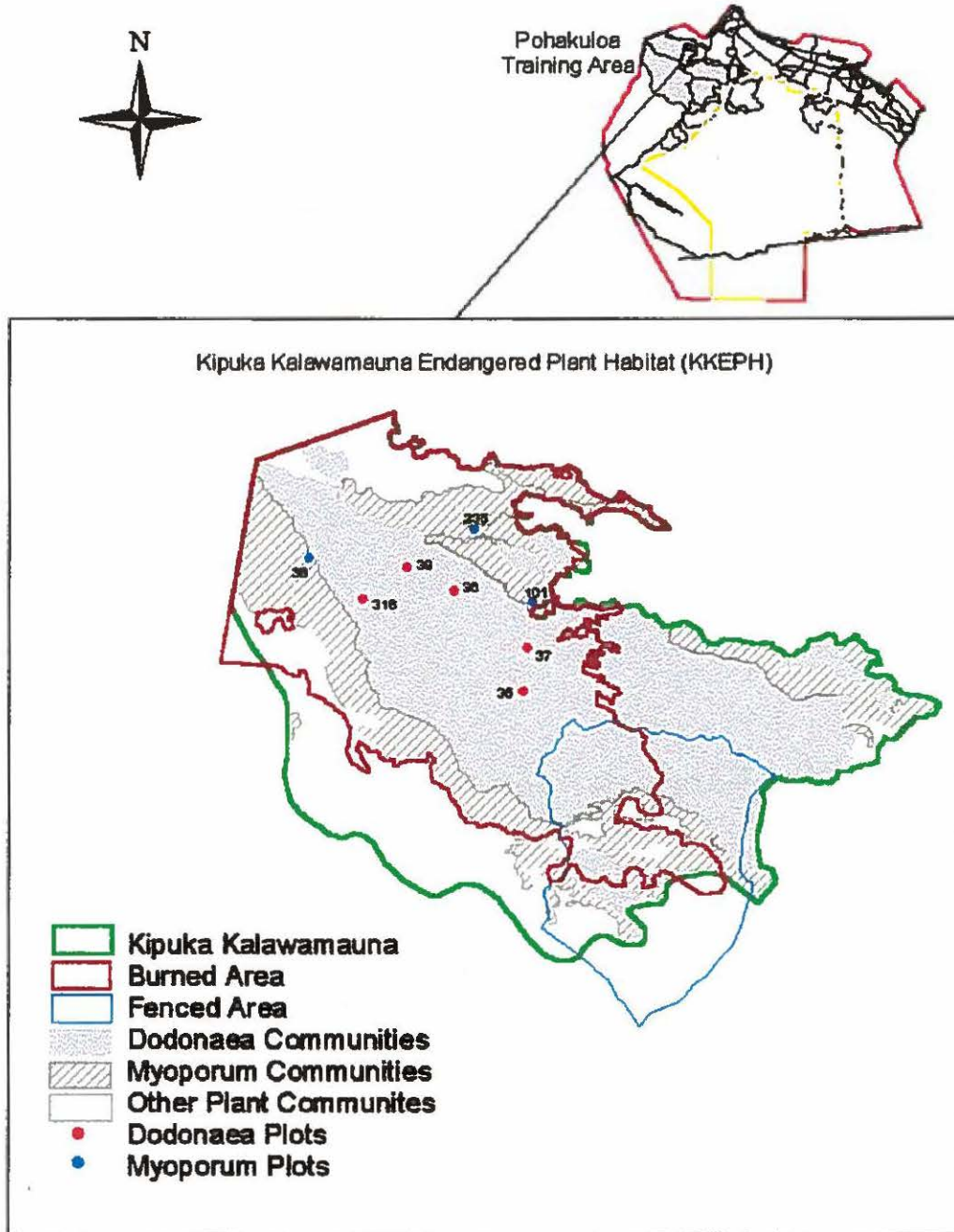


Figure 13. Herbaceous cover results.

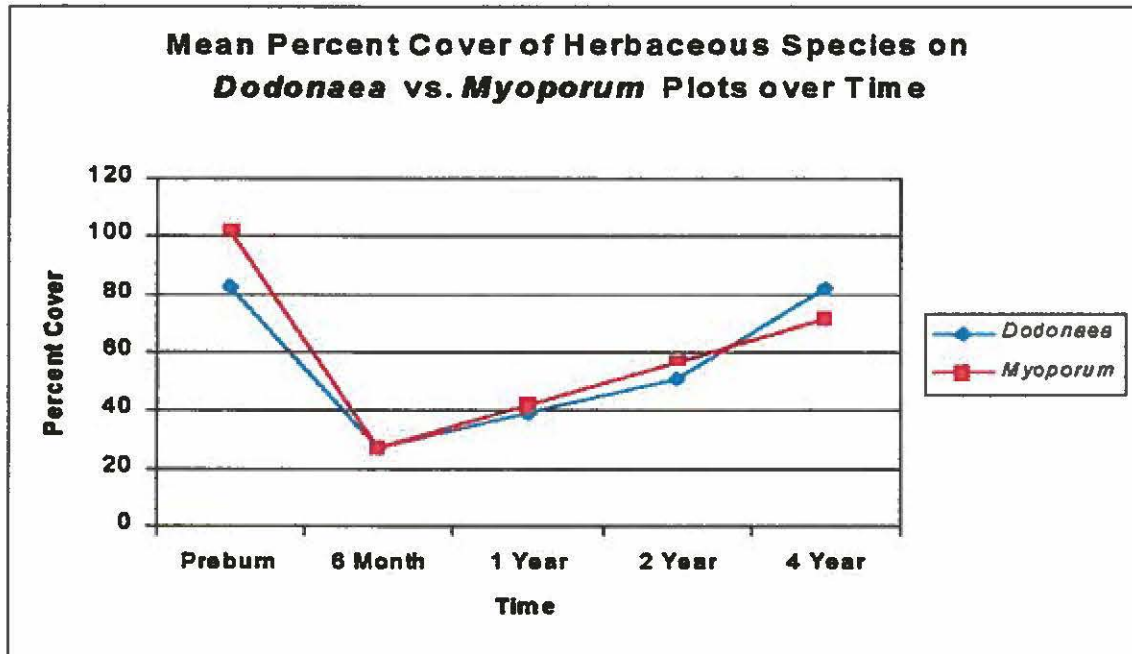


Figure 14. Woody cover results.

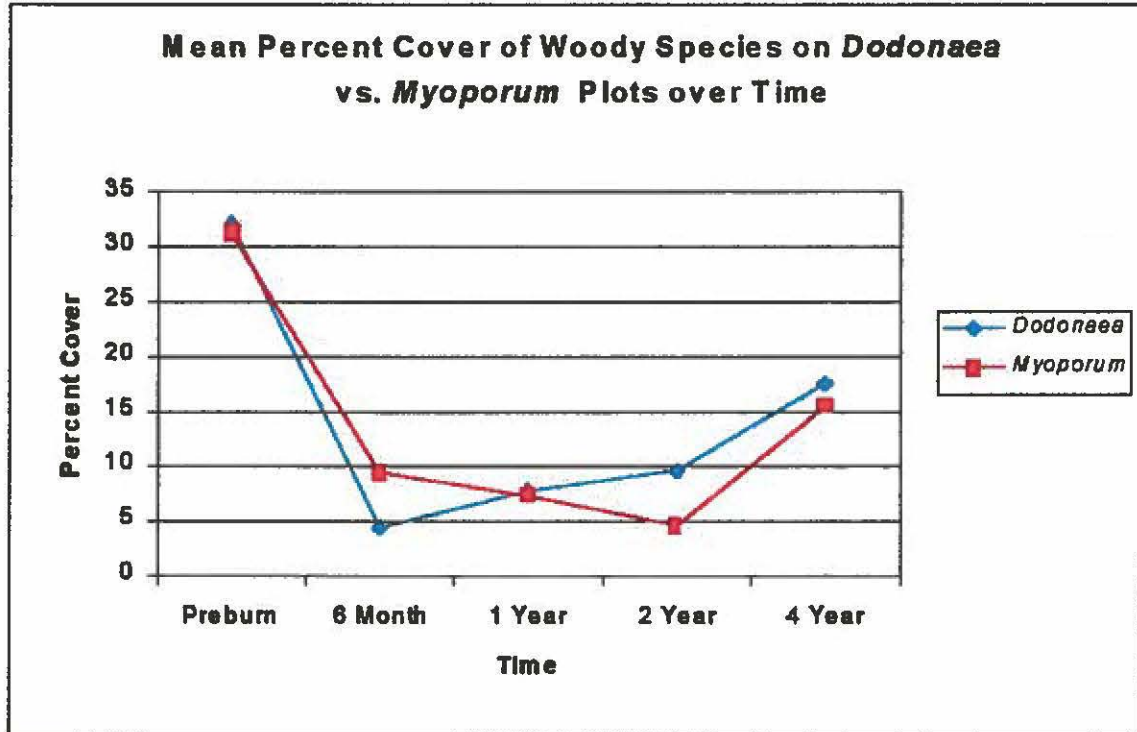


Figure 15. Woody density results.

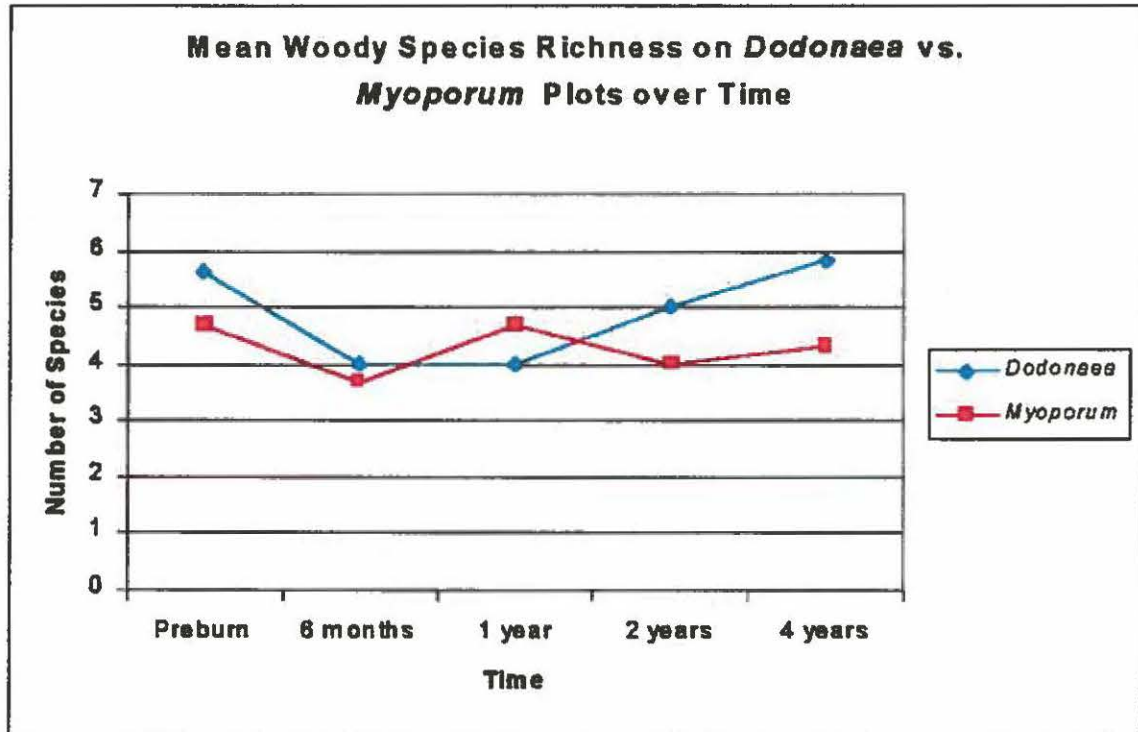


Figure 16. Woody species richness.

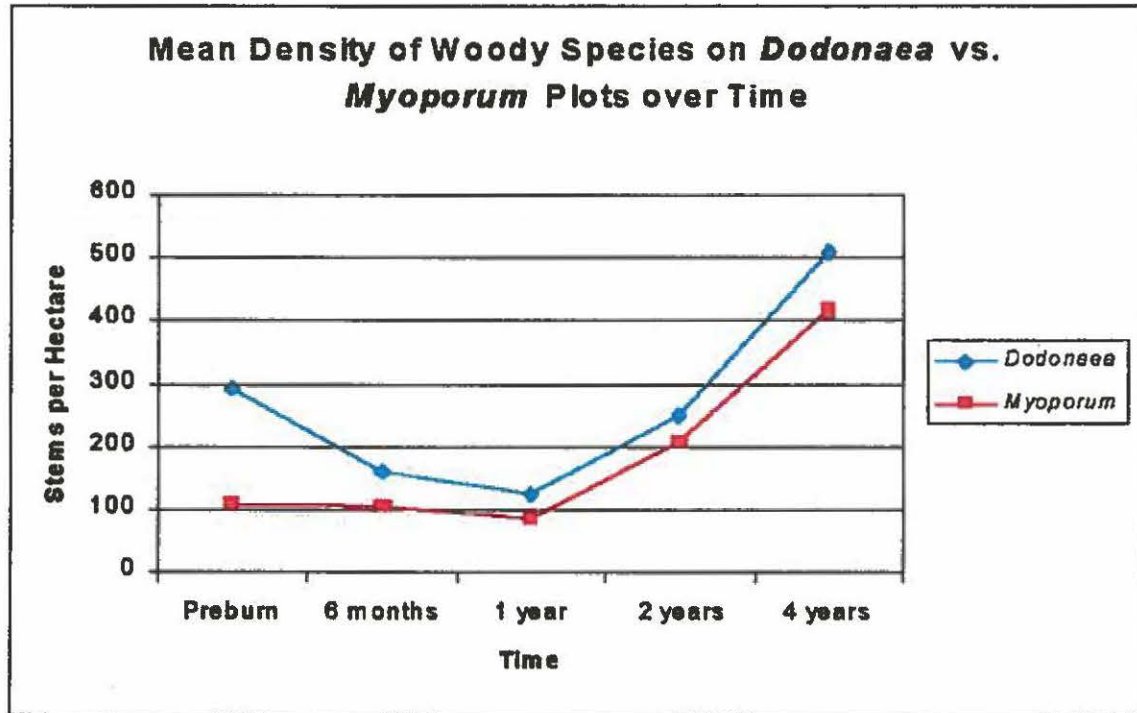
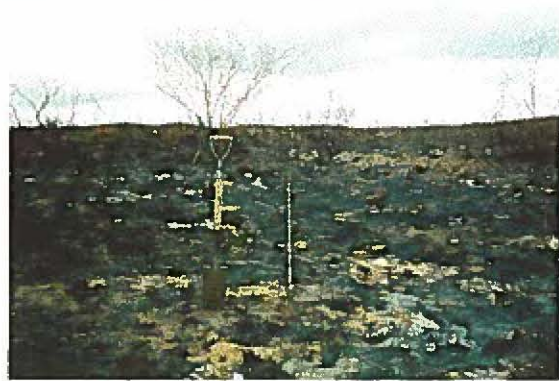


Figure 17. *Dodonaea* plot 37.



Preburn



One month



Six months



One year



Two years



Four years

Figure 18. Rare plants historically in the KKEPH.



Haplostachys haplostachya



Stenogyne angustifloia



Silene hawaiiensis



Silene lanceolata



Tetramalopium arenarium



Zanthoxylum hawaiiensis