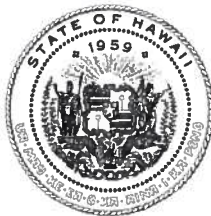


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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

December 27, 2011

Gary Hooser, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

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OFFICE OF ENVIRONMENTAL
QUALITY CONTROL

Dear Mr. Hooser,

Subject: Draft Environmental Assessment for the Pu'u Maka'ala Natural Area Reserve Management Plan (Puna and South Hilo Districts, Hawai'i)

The Department of Land and Natural Resources has reviewed the Draft Environmental Assessment for the subject project, and anticipates a Finding of No Significant Impact (FONSI) determination. Please publish notice of availability for this project in the January 8, 2012 OEQC Environmental Notice.

We have enclosed a completed OEQC Publication Form and one (1) copy of the document in pdf format on a CD; and one (1) hardcopy of the Draft EA. Please call Tanya Rubenstein at 586-0027 or Tanya.Rubenstein@hawaii.gov if you have any questions.

Sincerely,

Randy Kennedy

for Paul J. Conry, Administrator
Division of Forestry and Wildlife

**Publication Form
The Environmental Notice
Office of Environmental Quality Control**

Instructions: Please submit one hardcopy of the document along a with determination letter from the agency. On a compact disk, put an electronic copy of this publication form in MS Word and a PDF of the EA or EIS. Please make sure that your PDF documents are ADA compliant. Mahalo.

Project Name: Pu'u Maka'ala Natural Area Reserve Management Plan

Applicable Law: Chapter 343, HRS
Type of Document: Draft Environmental Assessment
Island: Hawai'i
District: Puna and South Hilo
TMK: 1-8-12:03, 1-9-01:1, 2-4-8:19, 2-4-8:21, 2-4-8:25 (portion),
and 2-4-008:09 (portion)

Permits Required: None

**Applicant or
Proposing Agency:** Department of Land and Natural Resources, Division of Forestry
and Wildlife
Address 1151 Punchbowl St., Room 325, Honolulu, HI 96813
Contact & Phone Tanya Rubenstein (808) 587-0027

**Approving Agency/
Accepting Authority:** Department of Land and Natural Resources, Division of Forestry
and Wildlife
Address 1151 Punchbowl St., Room 325, Honolulu, HI 96813
Contact & Phone Tanya Rubenstein (808) 587-0027

Consultant:
Address
Contact & Phone

Project Summary: Summary of the direct, indirect, secondary, and cumulative impacts of the proposed action (less than 200 words). Please keep the summary brief and on this one page.

The Division of Forestry and Wildlife has prepared a management plan for Pu'u Maka'ala Natural Area Reserve with actions proposed to protect and manage one of the best remaining forest ecosystems in Hawai'i, as well as the rare and endangered plants and animals it supports.

This 18,706 acres (7,570 ha) Reserve was established to protect native wet forest. The overall management goal is to protect, maintain, and enhance Pu'u Maka'ala's unique natural, cultural, and geological resources. Proposed actions to achieve include fencing, feral ungulate removal, weed control, habitat restoration, outplanting rare plants, monitoring, public access, outreach and education, fire management, enhanced enforcement and continued collaboration with partners.

The purpose of the actions proposed is to manage threats to the integrity, diversity and functioning of the Reserve's forests so that the unique natural and cultural resources and watershed are protected, maintained, and enhanced. Proposed management actions are needed to effectively reduce major threats as well as ensure the long-term protection of this important native forest ecosystem.

Proposed actions are expected to have primarily positive effects on the resources in the NAR. No significant adverse effects to the environment, archeological features, or public access or use of this area are anticipated.

DRAFT ENVIRONMENTAL ASSESSMENT

Pu‘u Maka‘ala Natural Area Reserve Management Plan

Puna & South Hilo Districts
Island of Hawai‘i

In accordance with
Chapter 343, Hawai‘i Revised Statutes

Proposed by:

Hawaii Branch Natural Area Reserves System
19 E. Kawili St.
Hilo, Hawai‘i 96720

January 2012

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I. INTRODUCTION

Project Name:

Pu‘u Maka‘ala Natural Area Reserve Management Plan

Project Location

South Hilo and Puna Districts

Island of Hawai‘i

TMKs: 1-8-12:03
1-9-01:1
2-4-8:19
2-4-8:21
2-4-8:25 (portion)
2-4-8:09 (portion)

Land Use:

State Conservation District (Protective, Restricted Subzones)
State Natural Area Reserve

Applicant

State of Hawai‘i Department of Land and Natural Resources

Approving Agency:

State of Hawai‘i Department of Land and Natural Resources

Anticipated Determination:

Finding of No Significant Impact (FONSI)

Agencies & Organizations Consulted (complete list in Appendix C):

Federal:

National Park Service, Hawaii Volcanoes National Park
USDA Forest Service
USDA Natural Resources Conservation Service
US Fish and Wildlife Service, Pacific Islands Field Office
US Geological Survey, Biological Resources Division

State:

Department of Hawaiian Home Lands
Department of Health
Department of Land and Natural Resources
Division of Forestry and Wildlife
Division of Historic Preservation
Division of Historic Preservation, Hawai‘i Island Office
Land Division
Office of Conservation and Coastal Lands

Hawai‘i Island Burial Council
Natural Area Reserves Commission
Office of Environmental Quality Control
Office of Hawaiian Affairs
Office of Planning

County of Hawai‘i:

Office of the Mayor
Department of Public Works
Department of Water Supply
Planning Department

Other Organizations:

Bishop Museum, Hawai‘i Biological Survey
Conservation Council for Hawai‘i
Earthjustice
Hawai‘i Audubon Society
Hawai‘i Hunting Advisory Council
Kahea – The Hawaiian-Environmental Alliance
Kamehameha Schools
Native Hawaiian Legal Corporation
Pig Hunters of Hawai‘i
Sierra Club, Moku Loa Group
The Nature Conservancy of Hawai‘i
Wildlife Conservation Association of Hawai‘i

II. SUMMARY OF PROPOSED ACTIONS

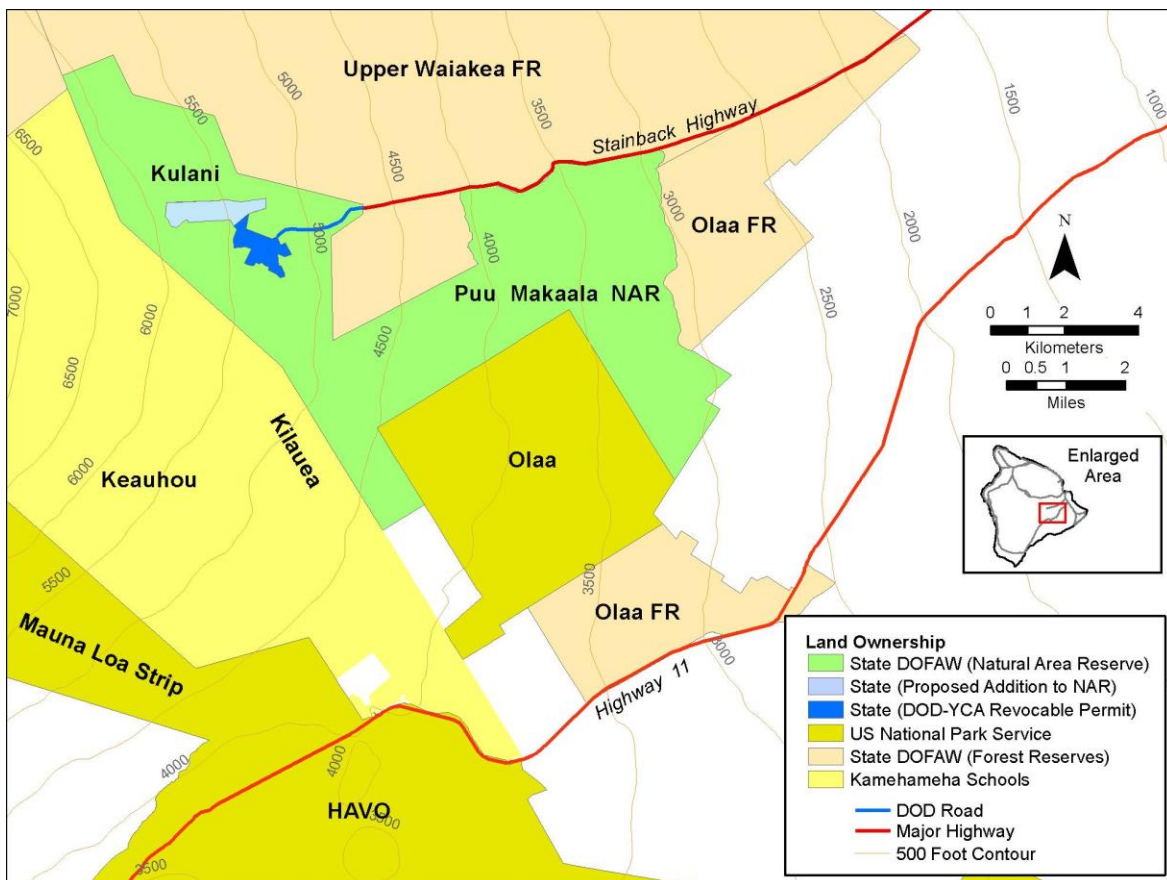
The Hawai‘i Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) Natural Area Reserves System (NARS) has developed a fifteen-year management plan for Pu‘u Maka‘ala Natural Area Reserve (NAR or Reserve). Appendix A contains the management plan in its entirety, and the plan contains additional detail on the environment and proposed actions. This management plan updates the 1989 Management Plan to reflect management accomplishments and current management needs of this Reserve. The overall management goal is to protect, maintain, and enhance the Reserve’s unique natural, cultural, and geological resources. Proposed actions to achieve this goal include fencing, feral ungulate removal, weed control, habitat restoration, outplanting rare plants, monitoring, public access, outreach and education, fire management, enhanced enforcement and continued collaboration with partners.

Governor Abercrombie’s *A New Day in Hawai‘i* plan calls for the stewardship of the natural resources that our survival, economy, and quality of life depend on. Priority actions of this DLNR initiative include managing invasive species, increasing Hawaii’s ability to withstand impacts from climate change, and

restoring capabilities of the DLNR by finding additional sources of funding. The New Day Status Report also tasks the DLNR to ensure mauka watersheds are fully functioning so fresh water resources can be utilized and enjoyed by the people of Hawai'i in perpetuity. *The Rain Follows the Forest* is the Department's plan to implement these central goals of the Abercrombie administration. *The Rain Follows the Forest* identifies priority watersheds, including Pu'u Maka'ala NAR, and outlines on-the-ground actions and projects required to protect and sustain Hawaii's critical water sources.

Pu'u Maka'ala NAR is situated on lands within the South Hilo and Puna Districts on the island of Hawai'i. It was formally established in 1981 by Governor's Executive Order 3102 to protect native wet forest. In November 2010, a portion of the former Kūlani Correctional Facility property was added to the NAR, bringing the total acreage of the NAR to 18,706 acres (7,570 ha). This addition protects additional forest and native species as well as links important conservation areas including the 'Ōla'a Tract of Hawai'i Volcanoes National Park (HAVO) and the upper elevation native forests of Kilauea, Keauhou, and Upper Waiākea. These forests comprise an important water resource for the lower Puna and Hilo regions of Hawai'i island, and provide exceptional habitat for a wide diversity of native plant and animal species.

Figure 1. Map of Project Area



III. PROJECT PURPOSE AND NEED

The purpose of the actions proposed in the plan is to manage threats to the integrity, diversity and functioning of Pu‘u Maka‘ala NAR ecosystems so that the unique natural and cultural resources are protected, maintained, and enhanced. Proposed management actions are needed to effectively reduce major threats to the Reserve as well as ensure the long-term protection of this important native forest ecosystem.

Management actions proposed in this plan support the purpose for which the Reserve was established. The NARS was created in 1971 by the Hawai‘i State Legislature to “preserve in perpetuity specific land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites, of Hawai‘i. (HRS § 195-1). The legislature further found that these unique natural assets should be protected and preserved, both for the enjoyment of future generations and to provide baselines against which changes to Hawai‘i’s environment can be measured.

The primary threats to biodiversity and watershed integrity at Pu‘u Maka‘ala NAR are feral ungulates (wild, hoofed animals such as pigs, sheep, goats and cattle), especially feral pigs (*Sus scrofa*) and non-native, invasive weeds.

Feral pigs destroy native vegetation and prevent its regeneration by eating, trampling, and digging up plants, and may accelerate the invasion of weed species by dispersing seeds on their coats and in their droppings. Pig disturbance of native ground cover through rooting and wallowing facilitates the invasion and establishment of weeds. In addition, pig wallows and pig-hollowed out hāpu`u trunks provide mosquito-breeding sites that can promote the spread of avian diseases such as avian malaria and pox – the two most deadly diseases for native forest birds. The cumulative impact of ungulates is the decline of intact native ecosystems and compromised watershed functionality. In similar forest communities, removal of feral pigs has resulted in dramatic increases in native seedling recruitment and enhanced survivorship which improves habitat for native wildlife.

Invasive non-native plants, or weeds, constitute a severe threat to the native ecosystems in the NAR. Certain priority weeds are problematic because they can establish and survive in undisturbed native forest; disperse long distances via wind or birds; affect large portions of land; displace native vegetation; grow and reproduce rapidly; convert diverse assemblages of native plants to monoculture of alien species; and encourage fire by increasing fuels on formerly natural fire breaks (i.e. lava flows). These weeds can displace distinctive native flora, resulting in a loss of species diversity and eventually in more pronounced and permanent changes to ecosystem function such as alteration of primary productivity and nutrient cycling. Many invasive weed species completely replace native vegetation resulting in total loss of native habitats thereby

negatively affecting native bird, arthropod and snail communities. Certain invasive weeds with great potential for spreading and causing habitat modification are identified in the management plan as high priority for control or eradication.

Other threats to Pu‘u Maka‘ala NAR discussed in the management plan (Appendix A) include other invasive animals, fire, disease, climate change, volcanic activity, and illegal human activity.

IV. PROJECT LOCATION AND DESCRIPTION

Location

Pu‘u Maka‘ala NAR occupies 18,706 acres (7,570 ha) in the Puna and South Hilo districts on the island of Hawai‘i (Figure 1). The NAR includes the following TMKs: 1-8-12:03, 1-9-01:1, 2-4-8:19, 2-4-8:21, 2-4-8:25 (portion), and 2-4-008:09 (portion).

Landmarks include Kūlani Cone, Pu‘u Kipu and Pu‘u Maka‘ala. The Reserve is bordered by the Upper Waiākea FR on the north and east, the ‘Ōla‘a FR on the east, the ‘Ōla‘a Tract of HAVO to the south, and private property to the west (Kamehameha Schools), southwest and southeast (numerous agricultural parcels). The former Kūlani Correctional Facility is being used by the state Department of Defense Youth Challenge Academy (DOD-YCA) under a revocable permit from DLNR.

Project Description

The overall management goal is to manage threats to the integrity, diversity and functioning of Pu‘u Maka‘ala NAR ecosystems so that the unique natural and cultural resources are protected, maintained, and enhanced.

Management programs that support this overall goal include the following:

1. Ungulate Management
2. Weed Management
3. Habitat Protection and Rare Species Restoration
4. Fire Prevention and Response
5. Monitoring
6. Public Access, Outreach and Education
7. Enforcement
8. Partnership Collaboration
9. Infrastructure and Other Actions

Cultural resources are addressed through the protection of the natural resources through the programs above. According to Maly (2004), “...the mountain landscape, its’ native species, and the intangible components therein, are a part

of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property.”

Ungulate Management

Objective: Preserve and protect native forest and watershed from feral ungulate damage by maintaining existing fenced units, increasing the total acreage of ungulate-free areas through the construction of four new fenced management units, and completely removing ungulates from all fenced management areas.

Actions:

1. Maintain integrity of nine existing fenced units (Kūlani Cone, Wright Rd, ‘Akū, Na Lua Mahoe, Lava, Pu‘u Kipu, Mauna Loa Boys School, North Boundary and South Boundary) and new fenced units through regular inspection, maintenance and replacement of existing fencing.
2. Monitor existing nine fenced ungulate-free units for ungulate ingress, and control ungulates, if necessary.
3. Construct approximately 17 miles (27 km) of new fencing within the NAR to subdivide an existing management unit in the Kūlani section of the NAR and create four new fenced management units between the existing fenced units of the Kūlani and Pu‘u Maka‘ala sections of the NAR, and Hawai‘i Volcanoes National Park.
4. Install pedestrian walkovers and gates for pedestrian access into fenced units.
5. Implement feral ungulate control using a variety of methods that may include special public hunts, trapping, staff control, and snaring to completely remove animals from fenced units after fence construction.
6. Monitor new units for ungulate presence following complete removal and control ingress ungulates, if necessary.

Ungulate management, primarily for feral pigs, is the highest priority management program in the NAR. Although public hunting currently accounts for some pigs taken from the Reserve, more animals need to be removed in order to protect the biological and water resources of the Reserve and limit damage to native Hawaiian ecosystems. To reduce feral pig numbers sufficiently to protect the resources of the NAR, a combination of fencing and animal removal from fenced units is needed. Without fencing, ungulate control requires ongoing effort, due to reproduction of existing populations and continued ingress from adjacent properties.

Maintenance of existing fences and monitoring for ungulate presence is necessary to prevent reinvasion of currently ungulate-free areas. Construction of new fencing, when completed, will protect an additional approximately 5,000 ac (2,023 ha) of the NAR from damage by ungulates (Figure 2). Fencing will be completed based upon the availability of funding for labor and materials. NAR and/or TMA staff and/or contractors will implement fence construction in

phases. Proposed new fenced management units have been prioritized based on quality of native ecosystems and presence of existing fencing from adjacent units. Other considerations in the design of the fenced units include logistics, accessibility, delineation of NAR boundary, and feasibility for effective feral ungulate control. Initial field surveys have been conducted to identify approximate locations for the planned fence alignments, and final fence alignments will be sited to avoid any impacts to botanical, faunal, and archaeological resources. Approximately 17 miles (27 km) of new fencing is needed to construct the four planned management units, at an estimated average cost of approximately \$100,000 per mile (labor, materials and helicopter).

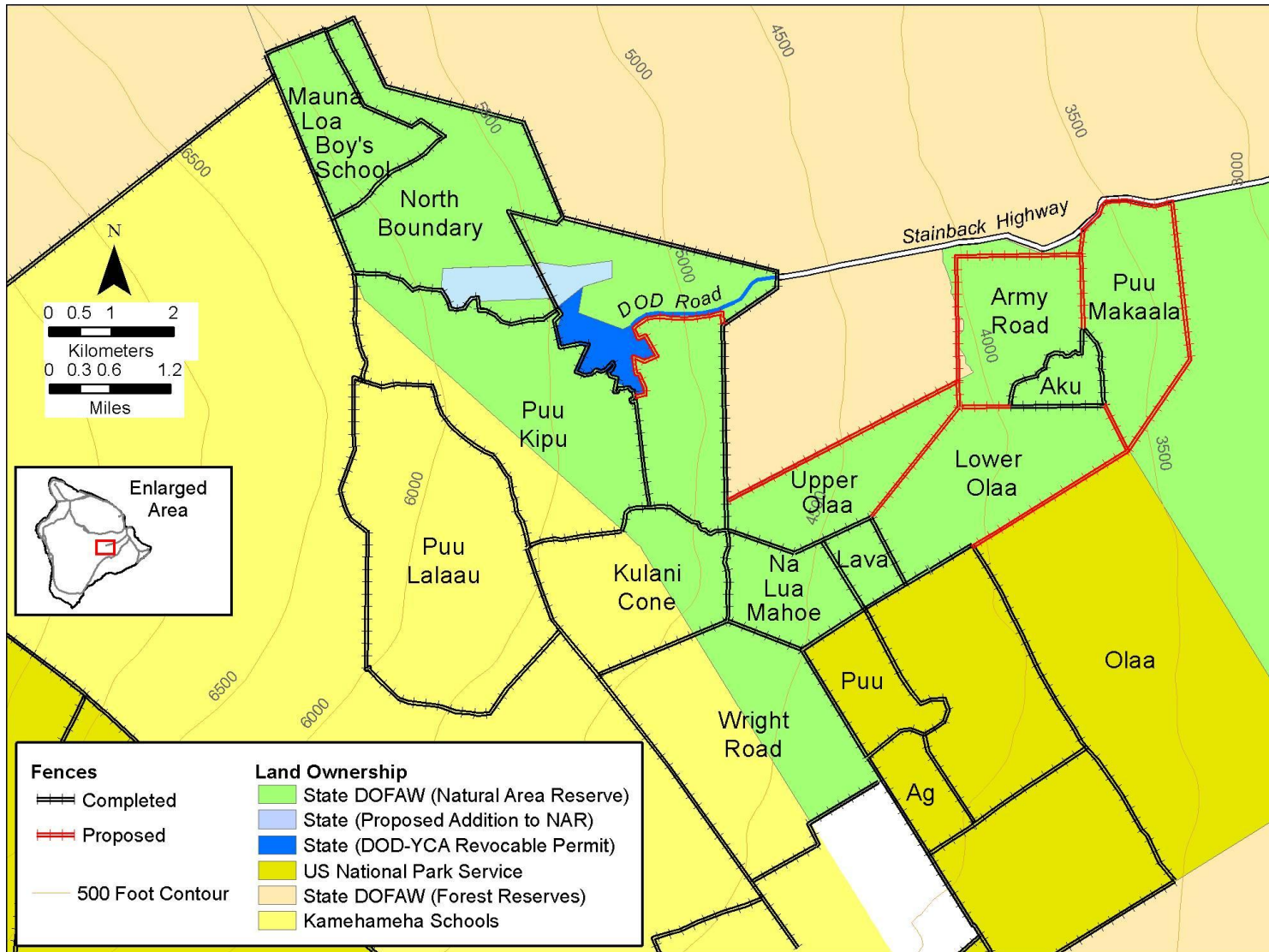
As fence construction is completed, various methods will be used to remove ungulates from the fenced units. Public hunting will be encouraged during the first phase of ungulate removal, but additional control methods including drives, trapping, staff control with dogs, and snaring, may be needed to remove all the ungulates. Upon completion of proposed new fencing and ungulate control, approximately 14,600 ac (5,908 ha) or 78% of Pu'u Maka'ala will be ungulate free.

The lower, eastern portion of the NAR (including the Ihope road region adjacent to the National Park 'Ōla'a tract up to the 3,400 feet (1,036 meters) elevation) is not currently a priority for fencing. While still native-dominated, high densities of weeds make this section a lower priority for fencing and animal removal.

Proposed New Fencing (in order of priority) (Figure 2):

- Kūlani South Boundary Unit - Subdivide the existing unit by fencing 2 miles (3,219 m) around the perimeter of the Facility and along Stainback Highway. Subdividing this large unit will help with management, should ingress of ungulates occur.
- Upper 'Ōla'a Unit - 1,000 ac (405 ha) will require 4.3 miles (6,900 m) of new fencing. This unit will tie into existing fenced units (Kūlani Cone, South Boundary, Na Lua Mahoe and Lava).
- Army Road Unit - 1,000 ac (405 ha) will require 4 miles (6,400 m) of new fencing. This unit will tie into existing fencing of Upper 'Ōla'a unit and the 'Akū unit. Fencing will follow the existing road corridor. When fencing of this unit is completed Army Road will be converted to a public, pedestrian trail.
- Lower 'Ōla'a Unit - 1,570 Ac (635 ha) will require 2.5 miles (4,100 m) of new fencing. This unit will tie into existing fencing (Lava unit as well as a portion of Hawai'i Volcanoes National Park 'Ōla'a tract fencing).
- Pu'u Maka'ala Unit - 1,215 ac (492 ha) will require 4 miles (6,400 m) of new fencing. This unit will be the lowest elevation unit currently proposed for the NAR, and will include the pu'u known as Pu'u Maka'ala.

Figure 2. Pu‘u Maka‘ala NAR Existing Management Units and Proposed Fencing



Weed Management

Objective: Protect intact native areas within the NAR by eradicating incipient weeds along common invasion corridors (e.g. roads, trails, fences), and if possible, eradicate or contain select high priority weeds in fenced units within the NAR.

Actions:

1. Identify highest priority intact native areas for intensive weed control. The highest priority areas are generally fenced, ungulate-free management units.
2. Monitor and map the distribution of high priority weeds and develop a control strategy.
3. Control weeds along invasion corridors (e.g., roads, trails, fences) and within management units using approved methods (chemical, manual and/or biocontrol).
4. Maintain procedures to prevent introduction of new weeds (i.e., sanitation protocols).
5. Support state-wide weed early detection and prevention programs and weed control research including new chemical, mechanical and biological control techniques, and participate, where appropriate, in experimental weed control management methods.
6. Monitor management efficacy in intact native areas to determine if weed control measures are effective and whether re-visitation intervals can be lengthened.
7. Monitor weeds to detect changes in long term distribution and abundance.

NAR priority areas for weed management are generally fenced, ungulate-free management units. Removal of ungulates from fenced units is a critical first step in weed control because it allows for the recovery of native vegetation by minimizing ground disturbance and reducing the spread of weeds by ungulates. Certain incipient weeds (high priority weeds that are just beginning to invade the area) may be targeted in unfenced areas to prevent their establishment and spread within the NAR.

The NAR has an ongoing weed monitoring and mapping program, and this data provides a valuable baseline for weed distribution and abundance. Weed mapping is essential to developing a comprehensive control strategy. Distribution mapping includes compiling transect monitoring data, incidental observations and reconnaissance surveys to map the distribution and abundance of weeds. Results from surveys will then be used to better delineate the weed populations core extent and outlying individuals, and permit the development of an effective control strategy. NAR staff monitor weed control areas to evaluate the effectiveness of control efforts.

Weed control goals for the existing Pu‘u Maka‘ala management units and proposed new fenced units include early detection and preventing the establishment of incipient, habitat modifying weeds that are not currently present in the NAR (e.g. miconia) or are still localized. For priority weeds already present in the NAR, the goal is to eliminate all known occurrences within targeted control areas and/or to contain the spread of priority species. Due to limited resources for monitoring and control throughout these dense rainforest areas, NAR staff will focus control efforts in disturbed areas such as roads, trails, and fence lines as these often serve as corridors for weed establishment and spread. Prevention is a critical component of the weed management program, and it is important to avoid and/or reduce the inadvertent introduction and spread of weeds by researchers, managers and students working in and visiting the area. NARS staff and volunteers will follow protocols for cleaning of boots, equipment and vehicles prior to entry into the NAR.

NAR staff will also completely sweep fenced management units as funding and resources become available. Units are divided into management blocks, and these blocks are prioritized for control based on weed density, proximity to managed sites, and logistical feasibility. Blocks are systematically swept at 3 – 5 year intervals, although highly weed infested sites may be re-visited annually for follow-up control. Staff will focus on removing all priority species within fenced units but will also remove other non-native weeds encountered.

A combination of control techniques including manual, mechanical and herbicides are used to remove weeds. The technique used is based on the characteristics of the target species, the sensitivity of the area in which the species is found, and the effectiveness of the control technique. Weed control research into new monitoring, mapping (including remote sensing) and control methods will be integrated into the weed management program over the course of this plan as appropriate. Due to widespread and heavy infestations of certain weeds (e.g. banana poka and strawberry guava) and limited resources, NARS staff and partners intend to test the efficacy of approved biocontrol agents within the Reserve, when available. The banana poka fungal biological control agent (*Septoria passiflorae*) has been approved and shown to be successful in tests elsewhere on the island, and the effectiveness of this agent needs to be determined for the NAR.

Proposed Weed Control Projects (in priority order):

- Early detection and rapid response weed monitoring and control on a quarterly basis along invasion corridors in and adjacent to fenced management units.
- ‘Akū Unit – Complete sweeps for priority weeds including palm grass, strawberry guava, selaginella, banana poka, and yellow Himalayan raspberry. Palm grass will be targeted initially because this species is relatively localized in the southeast portion of the unit. All priority species will be targeted in subsequent sweeps.

- Wright Rd Unit – This unit is too large for complete control sweeps with currently available resources so staff will focus on sweeps in weed hot spots for priority species including banana poka, kāhili ginger, and yellow Himalayan raspberry. More complete sweeps of the unit will be made as additional resources are available.
- Pu‘u Kipu, South Boundary, North Boundary, Mauna Loa Boys School, Kūlani Cone, Na Lua Mahoe, and Lava units - These higher elevation units have relatively low densities of weeds, and the focus of control in these areas will continue to be weed invasion corridors and known weed hotspots, until resources are available for more complete weed control sweeps. Priority weeds in these areas are primarily banana poka and yellow Himalayan raspberry.
- New fenced units – These lower elevation units have more weed problems than the existing units currently targeted for weed control. As new fenced units are completed and ungulates are removed, these areas will become a higher priority for weed management. NARS staff will follow a similar strategy for weed control in these areas (e.g. installation of weed monitoring transects, control in invasion corridors and more complete sweeps if resources are available).
- Weed monitoring and mapping will be conducted every five years along transects in fenced management units and every 10 years in the unfenced sections of the NAR to detect changes in weed distribution and abundance over time as well as detect incipient invaders.

Habitat Protection and Rare Species Restoration Program

Objective: Manage high quality forest habitats, rare, threatened and endangered plant and animal species at sustainable community and population levels.

Actions:

1. Maintain the integrity of high quality forest habitats to the extent possible through the maintenance and expansion of fencing, feral ungulate control and weed control programs.
2. Prevent the introduction of incipient habitat-modifying species and new threats (e.g. new weed species, coqui frogs etc) and remove them before they become established.
3. Map, monitor and protect existing wild populations of rare and endangered species to contribute to their population stabilization and recovery.
4. Re-introduce certain species of rare and endangered plants in appropriate protected habitat through outplanting, and coordinate outplanting and other management actions with the PEPP and other agencies and organizations working on rare plant recovery.
5. Enhance habitats for forest birds, nēnē, and ‘ua‘u or Hawaiian petrel through small mammalian predator removal and other habitat management

(reducing larval habitat for mosquitoes and controlling yellow-jacket wasps).

6. Release ‘alalā (Hawaiian crow) and other endangered birds in appropriate habitat.
7. Implement native habitat restoration projects (e.g. forest restoration in disturbed areas, *Carex* wetland restoration) and monitor the results of management activities.

Fencing and ungulate removal is discussed in the section on the Ungulate Management program. Fencing and the creation of ungulate-free areas is critical to the long-term health and recovery of native ecosystems including rare plants, forest birds and other native species. These management actions, along with weed management and the prevention of new habitat-modifying species are the most critical actions needed to protect existing native habitat and rare species. NAR staff may need to implement other habitat restoration and species management, as necessary.

In some instances, large scale habitat protection and restoration through the implementation of priority management actions is not enough to recover certain rare and endangered plants. These species may have wild populations that are so low that the species cannot survive and recover without additional management. Over the past decade, numerous species of rare plants have been propagated and reintroduced into fenced, ungulate-free areas of the NAR to contribute to their overall recovery in the wild. These species (Table 1) will continue to be a focus for the NAR rare species program. The goal of NAR rare plant management is to remove threats to these species and ensure their long-term survival in secure and self-sustaining wild populations.

NAR staff work will work cooperatively with other organizations and agencies on rare plant recovery including FWS, TMA, The Hawai‘i State Plant Extinction Prevention Program (PEPP) and the Volcano Rare Plant Facility (VRPF) of the University of Hawai‘i. Management actions specific to rare plant recovery includes rare plant surveys to locate wild individuals, collection of propagation and genetic storage materials and reintroduction through outplanting. PEPP is focused on preventing the extinction of taxa with fewer than 50 individuals in the wild. The VRPF propagates all rare plants used in the NAR program.

NAR staff will follow rare plant collection and reintroduction guidelines recommended by the Hawaii Rare Plant Restoration Group (interagency group of rare plant experts) <http://www.hear.org/hrprg/>. Rare plants reintroduced into the NAR include *Argyroxiphum kauense*, *Anoectochilus sandvicensis*, *Clermontia lindseyana*, *Clermontia peleana*, *Cyanea shipmanii*, *Cyanea stictophylla*, *Joinvillea ascendens ssp. ascendens*, *Phyllostegia velutina*, *Phyllostegia floribunda*, *Platydesma spathulata*, *Pritchardia beccariana*, *Sicyos alba*, *Schieda diffusa*, and *Stenogne scrophularioides*. Additional rare and endangered species historically known from the NAR and/or nearby will be

reintroduced to the Reserve, as appropriate (Table 1). NAR staff will tag and map the locations of all outplanted plants and monitor their survival and growth. They will do additional management of wild and/or reintroduced populations if needed (e.g. fencing wild plants that are not within fenced management units, control of damaging weeds, insects, slugs, plant disease and/or mammalian predators).

Small mammalian predator removal (e.g., removal of rats, mongoose, cats) may provide significant benefits to endangered birds and plants, but is extremely difficult and costly to implement on a large-scale using currently existing methods. NAR staff may implement predator removal in certain high priority areas (e.g. upper elevation, fenced management units, bird nesting sites) using existing, approved methods (trapping and application of rodenticides using bait stations). New methods for widespread control of these species across large conservation areas are currently being developed and will be implemented if they are approved and offer a cost-effective way to remove predators.

Other management may also benefit forest birds and will be implemented, as feasible. Upper elevations of the NAR in the Kūlani area will be targeted for these actions as these areas provide the most important habitat for native forest birds. NARS staff will work with adjacent landowners (e.g. Kamehameha Schools and State DOD YCA) to eliminate or treat larval habitats for mosquitoes (standing water associated with cattle troughs, water catchment and stock ponds that are located within or adjacent to forest bird recovery areas. Larval habitats associated with residential and agricultural development may be primary sources for mosquitoes responsible for seasonal epizootics of pox and malaria. Reducing or eliminating vespulid wasps (yellow jackets) may also provide benefits to forest birds, as these wasps prey on insects that provide food for forest birds.

The current captive population of ‘alalā is at the point where restoration of a wild population can proceed. The Kūlani portion of the Reserve has been identified as a high priority release site for re-establishment of this species in the wild due to the high quality of native forest and its ungulate-free status. The restoration of a wild population of ‘alalā will require minimizing threats, including implementing control of non-native mammalian predators. Releases and managing (e.g., providing supplemental food) will require semi-permanent infrastructure and a constant, long-term human presence. Holding or release aviaries will need to be erected at release sites. These will most likely be placed on scaffolding to minimize predator access. DOFAW will attempt to place aviaries in natural openings in the forest; however, some clearing of native vegetation may be necessary. Given the need to have staff on site at all times, the construction of a remote cabin or weatherport will be needed. The release and monitoring team (3 – 5 individuals) will care for, feed, monitor, and track released birds. This team will need to maintain a constant presence at the release site for an undetermined length of time. It is difficult to estimate the

length of time that the release and monitoring team will have to remain on site. Much will depend on the availability and use of wild foods by the ‘alalā, their dependence on supplementary food, their health, and how they adjust to their new environment. Other management actions involved with ‘alala release may require additional staff to control predators, monitor ‘io abundance, restore food plants, monitor vegetation recovery, track and control invasive species and check and repair fence.

Nēnē are present in the Kūlani portion of the Reserve and in adjacent areas. NARS staff will assist DOFAW Wildlife Staff in banding and monitoring nēnē in the general area and working with adjacent landowners, particularly DOD-YCA, to enhance overall nēnē efforts across the island of Hawai‘i. Other actions such as small mammalian predator control and habitat improvement may be implemented in localized areas to protect and manage nēnē.

NARS staff will also implement targeted habitat restoration projects as resources allow. Although the forest canopy in the Reserve is largely intact, certain localized areas that have been disturbed or invaded by weeds may require more intensive management. Non-native pasture grasses will be targeted for control in certain areas to enhance the natural regeneration of native trees and shrubs and prevent fire. *Carex* wetlands are also targeted for restoration as these areas were more disturbed by past feral pig activity and are subsequently more highly invaded by weeds. NAR staff and volunteers will eradicate invasive weeds and reintroduce native plant species to restore these wetlands.

Fire Prevention and Response

Objective: Employ appropriate fire management strategies including pre-suppression, suppression, and post-suppression rehabilitation to reduce wildfire occurrence and minimize wildfire impacts.

Actions:

1. Work with Hawai‘i island Protection Forester (DOFAW) to update fire response maps to show the Kūlani portion of the NAR to be a DOFAW primary response area.
2. Implement fire prevention measures, including educational outreach to neighbors and signage along roads.
3. Suppress fires safely and aggressively using appropriate means.
4. Continue NAR staff training and certifications for effective and safe fire response.

Due to the high rainfall at Pu‘u Maka‘ala, fire is not normally a concern for the project area. However, fire management is incorporated as part of this management plan because of the impact fire can have on native communities. It is recognized that, though unlikely, fire may be a risk in the project area,

particularly in the drier Kūlani portion of the Reserve. Thus, strategies to prevent and minimize the impacts of fire are incorporated into this plan.

Many fires are caused by humans, so fire prevention measures will include increased educational efforts for those accessing the property, road or area closures in the event of extreme fire danger and suppression of non-native grasses in fire prone areas. Weed control and planting of common native species will be used to restore certain disturbed areas to prevent fire and/or following damage from fire.

In the event of fire, DOFAW will respond to fires in the Reserve. The most effective control of a fire will be through measures that result in the least amount of impact or disturbance to natural and archeological resources. The method of suppression will be determined by the on-site situation, with special regard to the potential expansion of fire damage to the resources within the Reserve. Minimum impact methods of suppression will be applied whenever such methods are sufficient. Bulldozing or other extreme fire control measures are justified when a fire cannot be otherwise controlled and the bulldozing damage is outweighed by a probable greater loss of natural and archeological resources. NARS staff will maintain current fire response certifications by attending regular required staff trainings.

Monitoring

Objective: Monitor current status and trends of natural resources throughout the NAR as part of a long-term monitoring program.

Actions:

1. Continue ongoing monitoring programs for ungulates, weeds and rare plants to measure the success of management and detect changes in abundance and distribution.
2. Continue ongoing monitoring program for forest birds in the Kūlani portion of the Reserve in cooperation with TMA and the Hawai‘i Forest Bird Interagency Database Project.
3. Develop improved monitoring protocols, data management and analysis for existing monitoring programs.
4. Review and summarize past monitoring data and inventories.
5. Identify critical gaps in natural resource inventories for the NAR and initiate additional surveys.
6. Develop and/or identify appropriate monitoring protocols and implement monitoring for key community indicators that are not currently being monitored (e.g., native vegetation communities, invertebrates etc).

NAR staff regularly monitors ungulates, weeds and rare plants and are planning on continuing these monitoring programs. Ungulate monitoring is used in fenced units that are being managed for ungulates to detect the presence or

absence of ungulates. Units that are free of ungulates are regularly monitored to detect ingress animals. Units with active ungulate control programs are monitored to assess the success of and/or direct control efforts.

Weed monitoring will continue to be conducted every five years along transects in fenced management units and every 10 years in the unfenced sections of the NAR to detect changes in weed distribution and abundance over time as well as detect incipient invaders. Weed control areas are monitored to determine the success of management efforts.

Rare plant monitoring is conducted to assess the survival and growth of wild and re-introduced rare plants. NAR and PEPP program staff monitor rare plants to assess their survival and reproduction, collect propagation materials, search for additional wild individuals and determine whether additional management is necessary.

NAR staff has also monitored changes in native understory diversity and nonnative invasive plant distribution to assess the results of pig removal. This type of monitoring will be continued, as resources permit, to assess the long-term results of management actions.

The TMA has monitored forest birds in the Kūlani portion of the NAR as well as on adjacent Kamehameha Schools land and NARS is planning on working with the TMA to continue these annual surveys. Monitoring transects in the Mauna Loa Boy's School Unit, Pu'u Kipu Unit and Kūlani Cone unit have been monitored annually since the early 1990's. Monitoring data will be provided to the Hawai'i Forest Bird Interagency Database Project for analysis of bird population densities and trends.

NAR staff will refine and modify existing inventory and monitoring programs (monitoring protocols, data management and analysis) for ungulates, birds, weeds and rare plants in order to make the program more effective. It would be valuable to expand the monitoring program as time and resources permit to include surveys and monitoring of invertebrates as well as native plant communities. Establishing and implementing new long-term monitoring programs for key community indicators, especially in the face of new threats such as climate change and the introduction of new diseases and pathogens will be critical to informing future management of native ecosystems and species in the NAR. Collaboration with partners such as researchers, students and adjoining landowners may help improve and expand inventory and monitoring programs if NAR staff time and resources are limited.

Public Access, Outreach and Education

Objective: Provide public access to Reserve and build public understanding and support for the NAR and the state's unique native resources through outreach and education.

Actions:

1. Enhance public access, hiking opportunities and interpretation of NAR resources by providing public access into the Kūlani portion of the Reserve as well as improving the Wright Road and Army Road trails for pedestrian use.
2. Hire Outreach Specialist to provide periodic interpretive trips to the Reserve for the general public as well as other outreach and educational activities listed below.
3. Maintain and expand opportunities for volunteer service trips, student internships and teacher workshops.
4. Maintain and expand NAR staff presentations and outreach to schools and community groups.

Public access to all portions of the Reserve is allowed for recreational and cultural uses. Recommended public access points are shown in Figure 3; however the public is allowed to access the Reserve in other areas as well (e.g. along Stainback Highway). Current public use of Pu'u Maka'ala primarily includes hiking, bird watching, and hunting. Hunting in portions of the NAR is regulated by Chapter 13-123, Hawaii Administrative Rules (Rules Regulating Game Mammal Hunting), and areas where hunting is allowed are designated as part of Hunting Unit K. Hunters should check with the DOFAW office (19 East Kawili Ave., Hilo, HI 96720) to get current information on hunting rules and any changes in special conditions, bag limits, seasons and open areas. Some public uses of the Reserve, including groups larger than ten individuals, research, scientific collecting, gathering (including Native Hawaiian religious and customary gathering rights) and commercial uses require a Special Use Permit from the Executive Secretary of the NARS Program in Honolulu (808-587-0063) (HAR§ 13-209-4).

Public access to all parts of the Kūlani portion of the NAR will be open for pedestrian use. The primary recommended access points are along Stainback Highway. NAR staff will improve trails into the area by clearing old trails and adding additional directional and interpretive signage along recommended routes (Figure 4). NARS staff and volunteers will also provide periodic guided educational tours of the Kūlani portion of the NAR for community groups and/or the general public. DOFAW will be developing a Memorandum of Agreement with DOD-YCA to address public pedestrian access.

New proposed interpretive hiking opportunities within Pu'u Maka'ala will provide opportunities for the public to learn more about the NAR, its unique

native species and ecosystems, threats to the NAR, and ongoing management activities. The two areas proposed for improvement (Army Rd. and Wright Rd) already have existing unimproved trails or roads and are the most accessible portions of the Reserve. In addition, trail improvements such as rest areas/benches, viewing platforms, and boardwalks over particularly wet areas of trail and the installation of interpretive signs at points of interest (e.g. significant trees, geologic features, wetlands and lookout areas) will improve the outdoor experience for general users and provide an enjoyable opportunity to learn about Hawaii's native forests.

Proposed Interpretive Trail Development Projects (Figures 5 and 6):

- At Wright Road, the current unimproved trail runs perpendicular to a management access road. Constructing a 1-2 mile (1.6 -3.2 km) new connector trail between the existing management access road and unimproved trail and would create a 3-4 mile (4.8-6.3 km) loop trail, located entirely within the fenced Wright Road unit. The newly constructed portion of trail will be located entirely on State land. In addition, the existing management access road and unimproved trail portions of the loop will be improved for public pedestrian use. This loop trail will provide new opportunities for public recreation in the NAR and will also enhance NAR management of the Wright Rd. unit by providing management access.
- At Army Road, an existing four-wheel drive road is currently open for public vehicular access in two sections (mauka and makai). Vehicle access between these two sections is blocked due to existing 'Akū unit fencing (although public access is allowed on foot). This area is proposed to be fenced and become an ungulate-free management area (Army Rd. Unit). Proposed fencing will follow the road corridor. When the Army Rd. Unit is fenced, the existing road will be converted to a public trail with improvements such as rest areas, covered picnic tables and interpretive signs. Access will be restricted to pedestrian use. Conversion of the road into a pedestrian trail will provide enhanced opportunities for the general public to learn about and enjoy the native forest.

At Pu'u Maka'ala, volunteer service trips are currently used to promote public understanding and support for conservation. Volunteer groups have regularly assisted with weed control; trail maintenance and restoration projects planting native species. Additionally, local students spend a week every year assisting with management efforts at Pu'u Maka'ala NAR through the Youth Conservation Corps summer program. The NAR program also regularly hires interns to assist with management and provide educational and training opportunities for students. NAR staff will continue these types of programs because they provide educational opportunities for interested groups and individuals to learn more about the Reserve and Reserve management programs. In addition, volunteers and interns contribute useful assistance in labor-intensive activities.

Beginning in 2008, NARS staff partnered with the TMA education program to jointly host standards-based teacher workshops to provide outdoor learning opportunities and lesson plans to local teachers. NAR staff also regularly provides slide shows, presentations and outreach to schools, local groups and at community events. NAR staff is planning on continuing all these activities, and expanding them as resources allow.

Figure 3 - Pu'u Maka'ala NAR Access

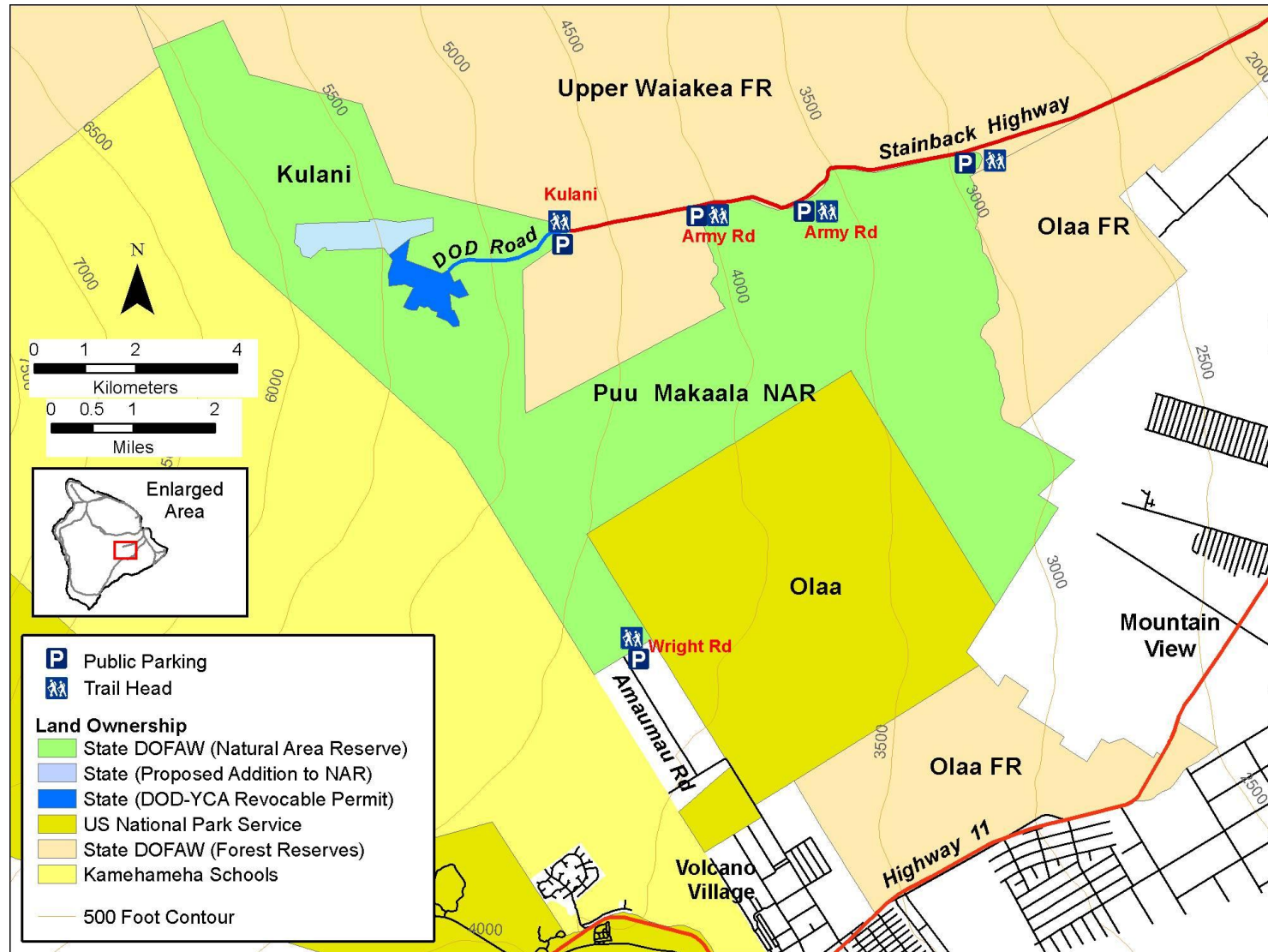


Figure 4. Kulani Access and Proposed Trail Improvement

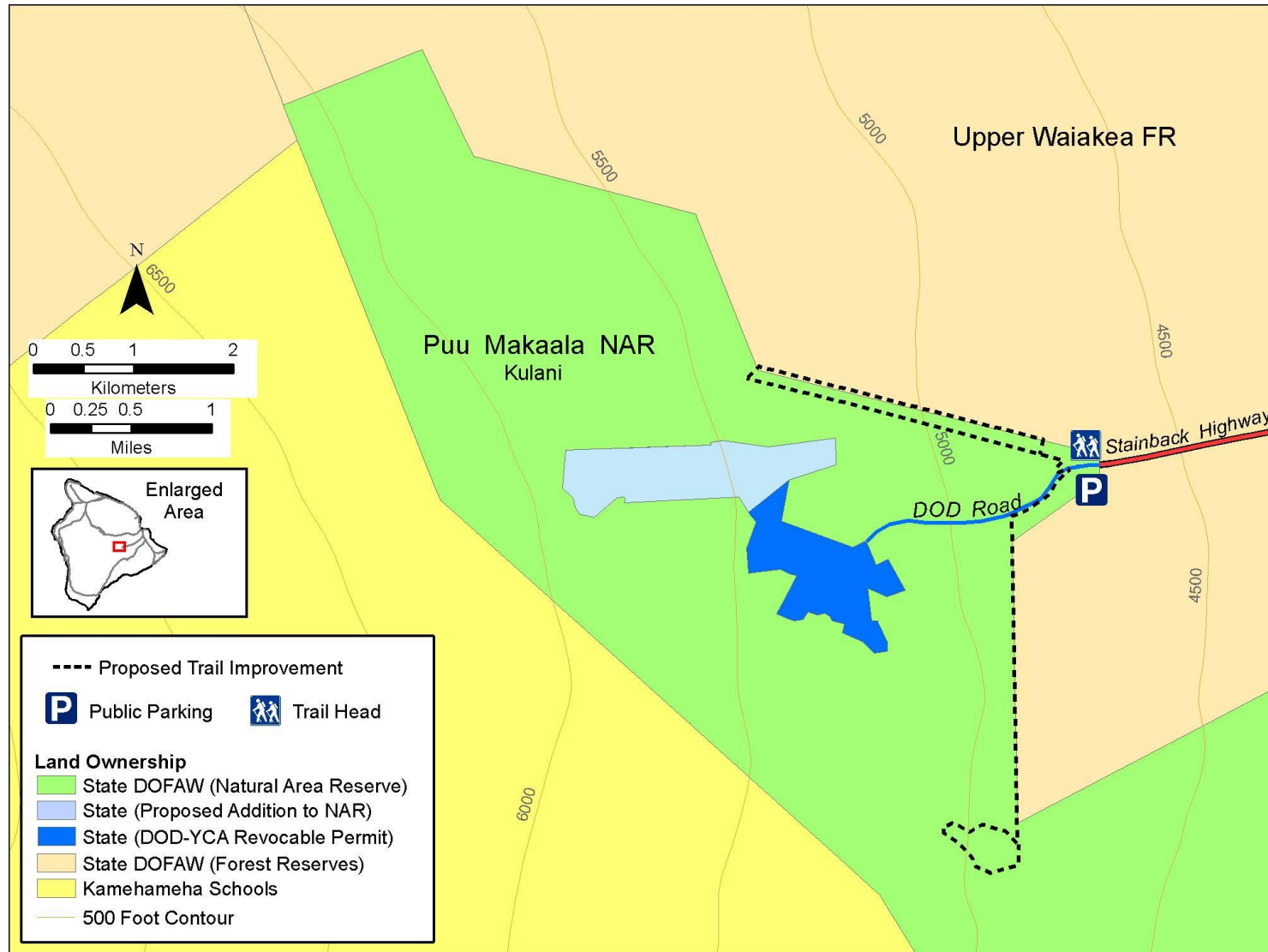


Figure 5. Wright Rd Proposed Trail and Trail Improvement.

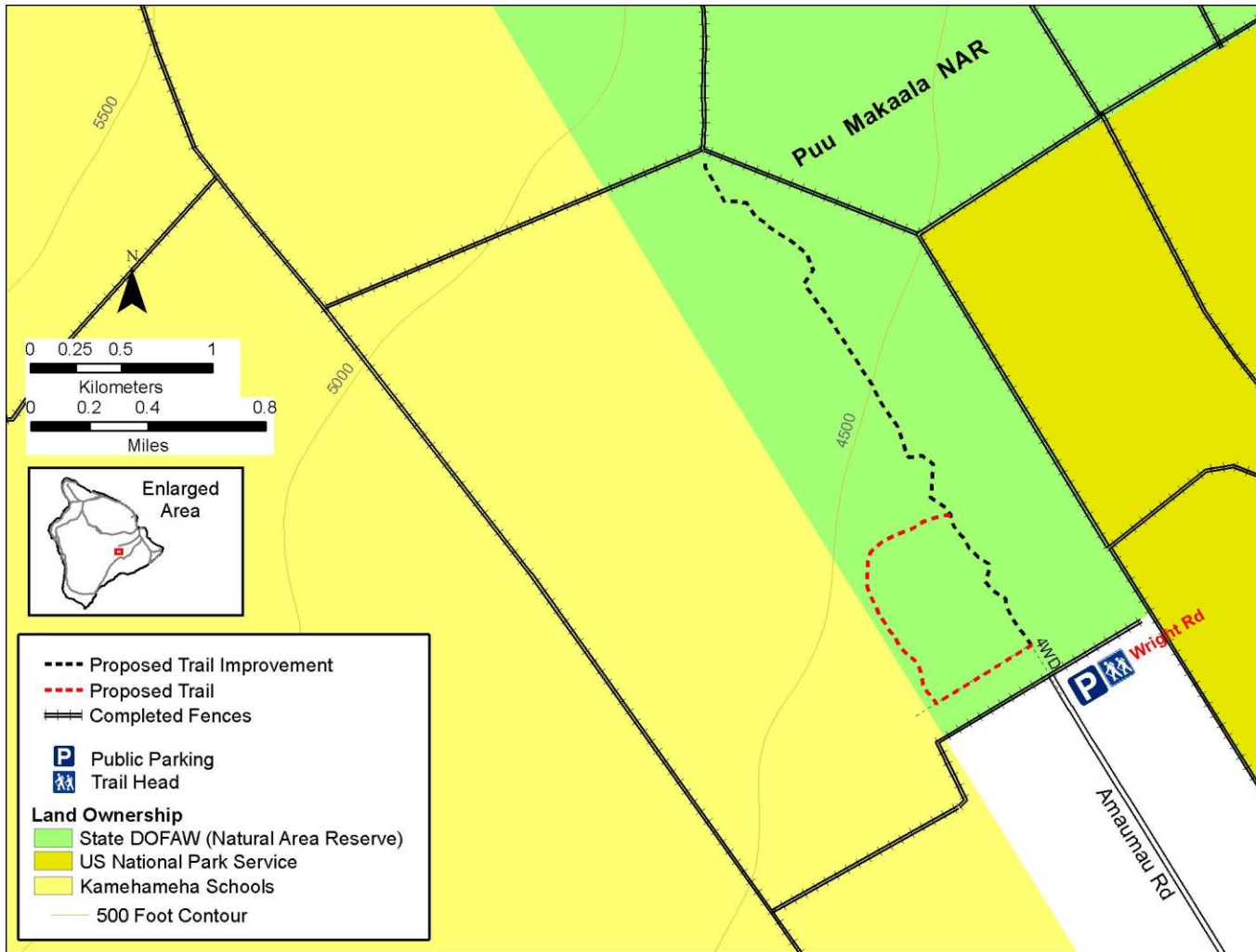
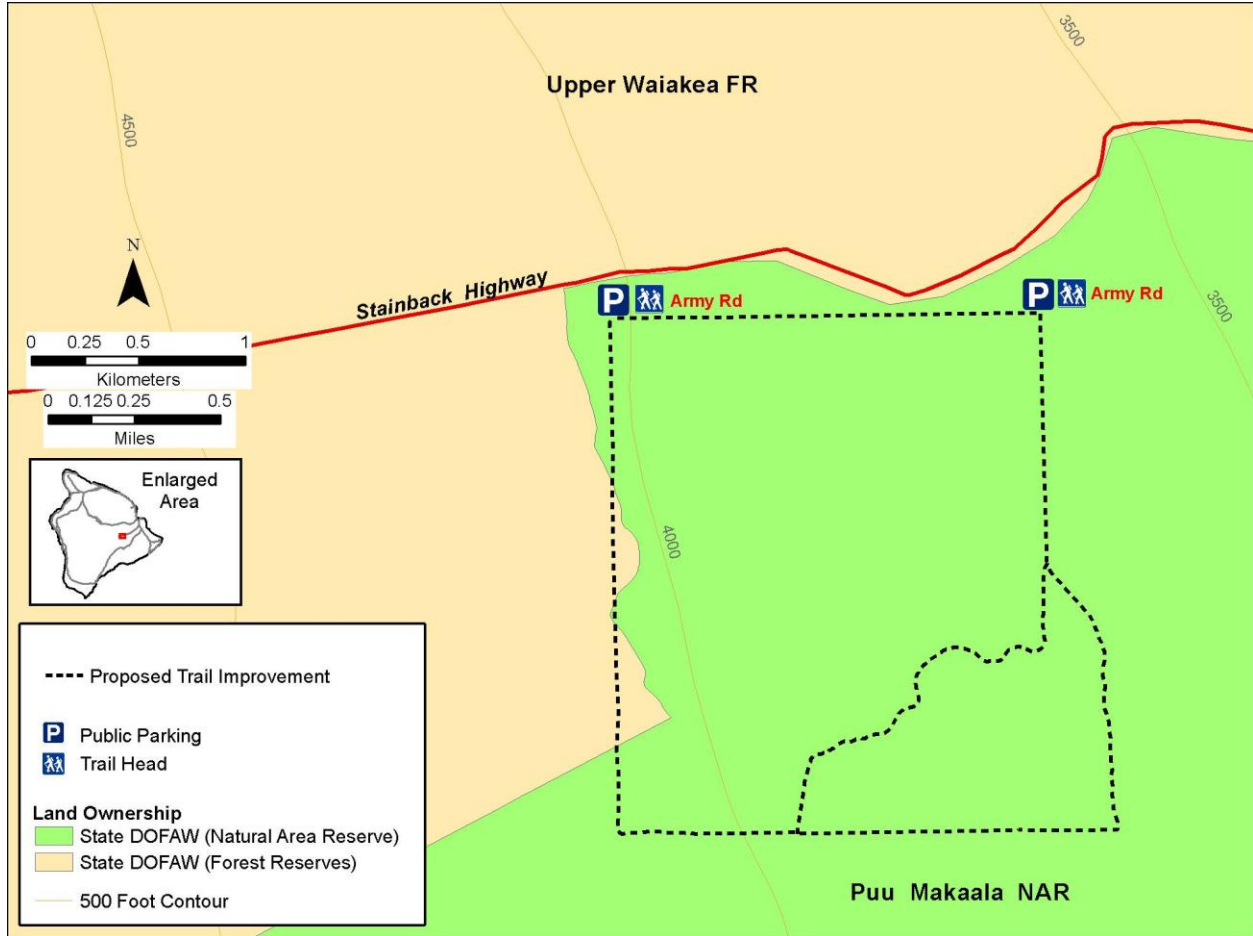


Figure 6. Army Rd. Proposed Trail Improvement.



Enforcement

Objective: Ensure effective enforcement of laws that protect Pu‘u Maka‘ala NAR.

Actions:

1. Explore opportunities to collaborate with DLNR’s Division of Conservation and Resource Enforcement (DOCARE) to improve voluntary compliance with laws and strategies to improve the effectiveness of enforcement.
2. Encourage DOCARE to focus on illegal taking of natural resources and vandalism.

The DLNR’s DOCARE is responsible for enforcement of state laws at Pu‘u Maka‘ala, including laws regulating hunting and protection of resources (e.g. illegal harvesting, vandalism etc). Improved collaboration between the NAR program and DOCARE will improve the effective enforcement of laws that protect the Reserve.

Partnership Collaboration

Objective: Collaborate with external partners to support NARS mission and goals.

Actions:

1. Continue partnerships with adjacent landowners through the TMA to address threats and management needs on a regional basis.
2. Develop a memorandum of agreement with DOD-YCA to address access by DOFAW over the internal roads at Kūlani included in the the DOD-YCA revocable permit area, conservation management within the permit area, the parties' maintenance obligations for the internal roads, and conditions under which public access will be permitted, etc.
3. Work with the DOD-YCA to cooperatively address endangered species issues on the DOD-YCA area, joint threats (e.g. invasive species) and to provide environmental service-learning and educational programs for YCA students.
4. Partner with Hawaii County Fire Department to familiarize their staff with locations of management access roads and important resources for protection in case there is an emergency such as fire or rescue.
5. Continue working with other groups collaboratively to address joint management needs (e.g. invasive species management, rare plant management, education, monitoring and research).

Many of the threats to Hawaii's natural resources, such as feral ungulates, invasive weeds, fire, invasive insects, and introduced plant and animal diseases, occur across land ownership boundaries. Working with partners can increase the effectiveness and efficiency of management with limited resources. Continued collaboration with the TMA and TMA members, particularly adjacent landowners (e.g. National Park Service and Kamehameha Schools) will enhance the effectiveness of response to regional threats like feral ungulates, weeds and fire.

NARS participation in TMA initiatives for weed control work with adjacent communities, landowners and community organizations will help protect the NAR by providing a better weed buffer and reducing the spread of harmful weeds. TMA members are also collaborating on new weed mapping and monitoring technologies such as remote sensing. Involvement in the TMA will also provide opportunities for sharing of monitoring protocols and/or joint long-term monitoring of natural resources and threats (e.g. bird monitoring across a larger landscape, intensive monitoring of National Park Service resources through the NPS Inventory and Monitoring Program). The NAR will also work with the TMA increase joint educational and outreach efforts in order to reach a larger audience.

NARS staff will also work closely with the DOD-YCA on numerous issues including staff and public access, management of native species and educational opportunities for YCA students. NARS will also encourage DOD to join and participate in the TMA. NARS staff can assist DOD with management of native species, including endangered species present on DOD-YCA managed lands adjacent to the Reserve. It will also be critical to collaborate on the management of threats to the Reserve such as preventing the establishment of coqui frogs at the YCA and the removal of invasive weeds. In addition, NARS can provide environmental education, service learning and work training for YCA students on NARS lands, which will benefit both the students and the land. NARS staff will work with DOD-YCA to develop a Memorandum of Agreement for various issues at the former Kūlani Correctional Facility area, including protocols for staff and public access over internal roads and conservation management in the DOD-YCA revocable permit area.

Continued collaboration with other groups in addition to the TMA will also assist NAR management in various areas. NAR staff will continue to work closely with the Big Island Invasive Species Committee (BIISC) to jointly address incipient invasive species of plants and animals that threaten the Reserve. NAR staff will continue to work closely with two organizations focused on rare plant recovery (VRPF and PEPP). NAR staff will also work with community groups and volunteers to assist with initial animal control in fenced units, prevent the spread of introduced species (e.g. invasive weeds and coqui), and to restore native habitat and species.

Pu‘u Maka‘ala NAR offers unique opportunities for research, and NAR staff review all research permits before they are approved. NARS staff will work with interested researchers in the academic community as well as scientists so their research can better address critical management needs.

Infrastructure and Other Actions

Objective: Manage existing infrastructure within the NAR and take other actions necessary to protect and effectively manage the NAR.

Actions:

1. Add 342 ac (138 ha) of former Kūlani pasture areas to the NAR to protect and enhance endangered species habitat (Figure 7).
2. Block off access to Mauna Loa Boy’s School structure through fencing and signage to reduce the safety hazard to the public.
3. Investigate the feasibility of renovating or demolishing of Mauna Loa Boy’s School structure to prevent safety hazard to the public.
4. Maintain water infrastructure (e.g. water tanks) in the Kūlani portion of the NAR for fire fighting and weed control activities.
5. Maintain management access roads to support management and educational programs.

6. Develop utility and access easements for entities requiring access through the NAR.

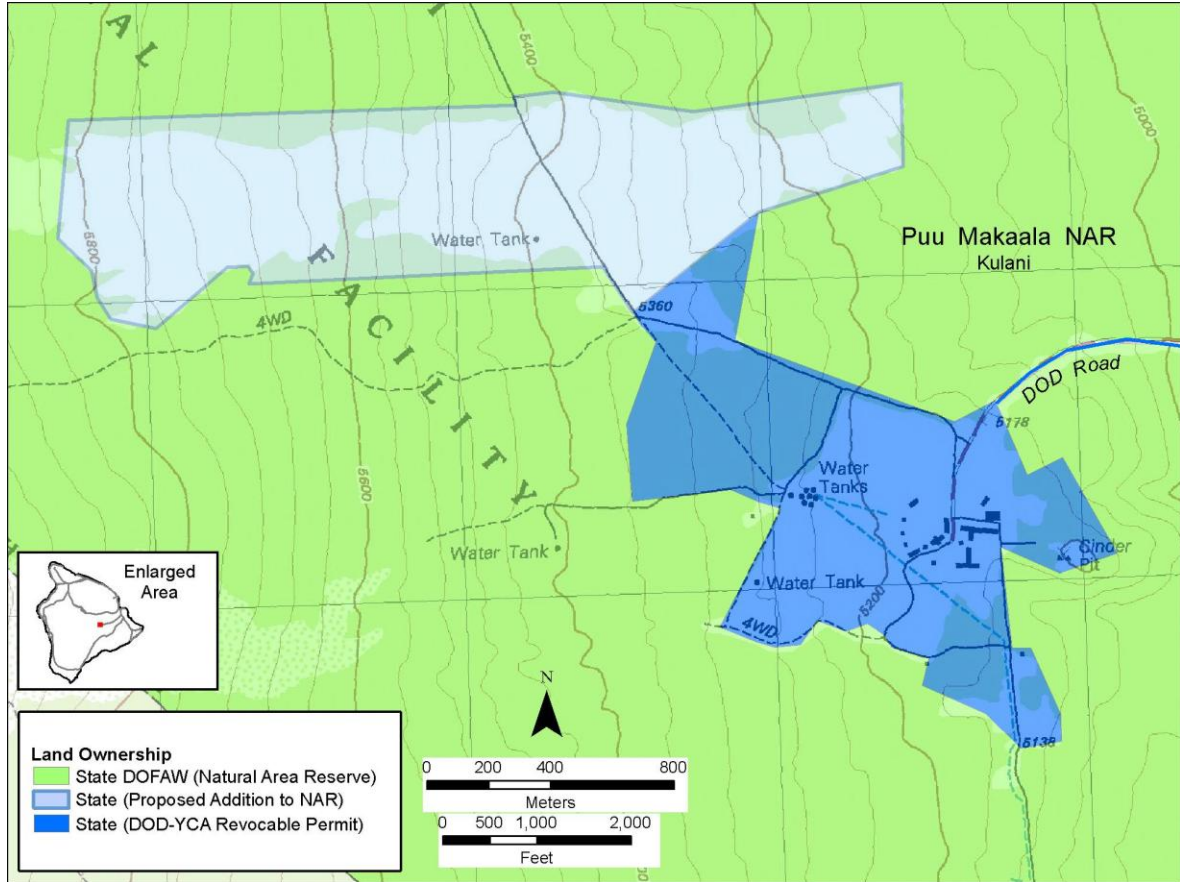
NARS will be pursuing the administrative process to add 342 ac (138 ha) of state lands to the NAR, including approval of the BLNR and an executive order from the Governor (Figure 7). DOFAW currently has a Right-of-Entry permit over this area for data collection, surveys and conservation activities. This area was formerly used for cattle ranching by the Kūlani Correctional Facility. These former pastures have not been used for cattle since 2005 and ranching is not an environmentally appropriate use of this land as it the native forest is naturally recovering and the area is known habitat for endangered plants and animals. This proposed addition is particularly important for endangered forest birds, as it provides high elevation forest habitat above the mosquito line. This area provides excellent opportunities for public service trips to work on tree planting and other restoration actions, and restoration of this area with koa-‘ōhi‘a forest will provide a critical link to connect surrounding intact forests.

The Reserve contains the Mauna Loa Boy’s School facility which has not been maintained and is in currently in severe disrepair. In the short-term, this structure may need to be blocked off with fencing and signage to reduce public safety hazard. NAR staff will investigate the cost and feasibility of renovating or demolishing this structure to remove it as a public safety hazard and implement the most feasible option. The Mauna Loa Boy’s School area was also previously used for military training and was investigated in 2010 by the U.S. Army following the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The Army’s report concludes that the majority of the area does not pose a significant threat to public health or the environment. However, a small burn pile area near the Boys’ School structure does contain levels of copper that exceed the US Environmental Protection Agency and the Hawaii Department of Health guidelines. The Army will be doing a follow-up study on the feasibility or remediating the 0.25 acre burn pile site. The burn pile site will be blocked from public access until the area is remediated and determined safe for public access.

Other former correctional facility infrastructure is also present in the Reserve (e.g. old ranch fencing, water tanks, water catchments, and roads). NAR staff would like to maintain some of this infrastructure; particularly management roads and water catchment for resources management purposes (e.g. fire fighting and weed control).

Various entities using Kūlani Cone as well as portions of the NAR for communications and utilities purposes do not have a utility and/or access easement through the NAR and other adjacent state lands. NAR staff will request that these entities work with DLNR Land Division to develop utility and access easements.

Figure 7. Proposed Addition to Pu‘u Maka‘ala NAR



V. DESCRIPTION OF AFFECTED ENVIRONMENT

Ecosystems and Species

Vegetation

Appendix A contains detailed descriptions of vegetation in the Reserve, including a vegetation map and species lists and tables (common plant species as well as rare).

Regionally, Pu‘u Maka‘ala NAR is an important conservation parcel and includes some of the best wet and mesic native forest on the island of Hawai‘i. It provides a link between the lower elevation ‘Ōla‘a Tract of Hawai‘i Volcanoes National Park and the higher elevation forests of Kīlauea, Keauhou and Upper Waiākea, thus protecting the transition between ‘ōhi‘a (*Metrosideros polymorpha*) and koa (*Acacia koa*) forest types. These forests contain a full mosaic of different-aged ‘ōhi‘a stands. While much of the forest is predominately ‘ōhi‘a canopy, characteristics of the forest (e.g. density of ‘ōhi‘a, composition of subcanopy and understory) change due to lava substrate type (ash, pāhoehoe, ‘a‘ā and cinder), lava flow age and elevation/rainfall.

Pu‘u Maka‘ala NAR contains three general vegetation zones: lowland wet, montane wet and montane mesic. The lowland wet vegetation zone includes areas in the NAR below 3,281 ft (1,000 m). This zone transitions into the montane wet forest zone at higher elevations and contains similar species. In the Kūlani portions of the NAR, the general trend is from montane wet forest in the east to mesic habitats at the upper elevation, western portions.

A diversity of native plants is found within the natural communities of Pu‘u Maka‘ala, including over 160 plant and fern species endemic to Hawai‘i (Appendix A contains a list of native and introduced plant species currently known from the NAR, including endemic species). Fifteen species of federally listed endangered plants occur in or near Pu‘u Maka‘ala NAR, and Pu‘u Maka‘ala contains federally designated critical habitat for four endangered plants: *Sicyos alba*, *Cyrtandra giffardii*, *Cyanea stictophylla*, and *Phyllostegia velutina*. Pu‘u Maka‘ala provides habitat for another twenty plant species that are Candidates for listing or considered Species of Concern (SOC).

Wildlife

Appendix A provides a list of native and non-native bird species currently and/or historically known from Pu‘u Maka‘ala as well as a list of insects collected during a 1995 survey.

The project area provides habitat for seven honeycreepers (Subfamily Drepanidinae) endemic to the Hawaiian Islands. These include four endangered species: Hawai‘i creeper (*Oreomystis mana*), Hawai‘i ‘ākepa (*Loxops coccineus*), ‘akiapōlā‘au (*Hemignathus munroi*) and ‘ō‘ū (*Psittirostra psittacea*), a species which has not been sighted in the area since the mid-1980’s and may be extinct. The non-endangered honeycreepers found in the project area include: ‘apapane (*Himatione sanguinea*), Hawai‘i ‘amakihi (*Hemignathus virens*), and ‘i‘iwi (*Vestiaria coccinea*). Other native forest birds reported from the project area include, ‘elepaio (*Chasiempis sandwichensis*), and ‘ōma‘o or Hawaiian thrush (*Myadestes obscurus*). Native forest birds are primarily found in the upper elevations of the NAR (above 4,000 ft (1,219 m)) elevation where lower numbers of mosquitoes reduce the incidence of diseases such as avian malaria and pox.

The Kūlani portion of the NAR is identified as a recovery area for Hawai‘i creeper, Hawai‘i ‘ākepa, and ‘akiapōlā‘au in the U.S. Fish and Wildlife Service (FWS) forest bird recovery plan and in the State Comprehensive Wildlife Strategy. Recovery areas are habitat that will allow for the long-term survival and recovery of endangered Hawaiian forest birds. The Kūlani area has some of the highest densities of native forest birds on the island. This relative abundance is due to large tracts of intact, upper elevation native forest. Kūlani may also be considered as a potential future release site for captive-raised

Hawaiian crow, or ‘ālalā (*Corvus hawaiiensis*). Although this species is not historically known from this area, ‘ālalā are known historically from nearby (Hawaii Volcanoes National Park) and neighboring Keauhou is being considered as a possible release site. Other native birds known from the area include the endangered Hawaiian hawk or ‘io (*Buteo solitarius*), nēnē (*Branta sandvicensis*), Hawaiian owl or pueo (*Asio flammeus sandwichensis*) and Pacific golden-plover or kōlea (*Pluvialis fulva*). Additionally, the ‘ua‘u or Hawaiian petrel (*Pterodroma sandwichensis*) and the ‘akē‘akē or band-rumped storm petrel (*Oceanodroma castro*) may overfly the NAR going to nesting areas on the upper, eastern slopes of Mauna Loa.

Non-native birds including Japanese white-eye (*Zosterops japonicus*), red-billed leiothrix (*Leiothrix lutea*), northern cardinal (*Cardinalis cardinalis*) and kalij pheasant (*Lophura leucomelanos*) are common in the NAR.

The NAR contains a high diversity of insects, spiders and snails. An arthropod survey conducted in 1995 collected and recorded 217 species of insects, related arthropods and land snails from the Wright Road unit of Pu‘u Maka‘ala. Of those identified, 58% were native species. The NAR is federally designated as critical habitat for *Drosophila mulli*, a listed endangered picture wing fly which is dependant on the native loulou (*Pritchardia beccariana*).

Hawai‘i’s only endemic land mammal, the ‘ōpe‘ape‘a or endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), also uses the area but the Reserve has not been sampled for bat activity.

A variety of non-native animals such as feral pigs, rats (*Rattus spp.*), mice (*Mus musculus*), cats (*Felis catus*), and mongoose (*Herpestes auropunctatus*) are present in the Reserve. Coqui frogs (*Eleutherodactylus coqui*) have been found at Kūlani, at the facility complex, and in areas adjacent to the NAR such as along Stainback Highway.

Current Land Use

All of Pu‘u Maka‘ala NAR is located within the State Conservation District. The Reserve includes both the Protective and Resource Subzones. Conservation District Use Permit no. SH-3/9/81-1340 approves the creation and management of the NAR as a permitted use of the Conservation District. Under the 2005 Hawai‘i County General Plan, all of Pu‘u Maka‘ala is designated as Conservation by the Land Use Pattern Allocation Guide. The area is not within the County’s Special Management Area.

In July 2009, the Division of Public Safety announced the closure of the 7,244 acre (2,932 ha) Kulani Correctional Facility. In May 2010, The NARS Commission recommended the addition of portions of Kūlani to Pu‘u Maka‘ala NAR, which was approved by the Board of Land and Natural Resources in

September 2010. In November 2010, the Governor signed Executive Order 4338 adding 6,600 ac (2,671 ha) of Kūlani to Pu‘u Maka‘ala NAR.

Public access is allowed in the NAR for recreational and cultural uses. Current public use of Pu‘u Maka‘ala primarily includes hiking, bird watching, and hunting. Hunting in portions of the NAR is regulated by Chapter 13-123, Hawaii Administrative Rules (Rules Regulating Game Mammal Hunting), and areas where hunting is allowed are designated as part of Hunting Unit K. Some uses, including hiking or nature study with groups larger than ten, research, scientific collecting, gathering (including Native Hawaiian religious and customary gathering rights) and commercial uses require a Special Use Permit from the Executive Secretary of the NARS Program in Honolulu (808-587-0063) (Hawai‘i Administrative Rules 13-209).

Significant and Sensitive Habitat

The entire project area can be considered sensitive habitat, particularly with regard to listed endangered plants and birds.

VI. SUMMARY OF MAJOR IMPACTS AND MITIGATION MEASURES

Positive Impacts

The overall long-term management goal is protection of the intact native ecosystems and watershed in perpetuity. While some proposed management actions such as fence construction, weed control and access trail improvement will entail some ground and noise disturbance, the long-term benefits of proposed management actions outweighs the limited short-term effects. Management actions proposed in the management plan for Pu‘u Maka‘ala NAR will provide long-term benefits by allowing for effective control of major threats such as feral ungulates and weeds and protection and restoration of native Hawaiian forest and endangered species. Proposed trail improvement projects will have positive social impacts by providing increased pedestrian access into the area.

Negative Impacts and Mitigation Measures

No specific major negative impacts have been identified. Discussed below are potential impacts of limited scope and associated mitigation measures.

Native animal species

Locations for fence construction will be surveyed prior to clearing and construction to avoid impacts to birds, including forest birds and nesting

Hawaiian hawks. The final fence alignment will be selected to avoid large trees and nesting hawks; thus, no impact to bird nesting habitat is anticipated.

Fence alignment clearing or trimming of woody plant suitable for 'ōpe'ape'a (Hawaiian hoary bat) roosting (e.g. greater than 15 feet tall) will be not be conducted during the bat birthing and pup rearing season (May 15 through August 15) to minimize impacts to the endangered bat.

Noise associated with the construction of fencing and trail improvement may temporarily disrupt the activities of native birds within the project area. However, the impact of construction noise on native birds is expected to be minimal and temporary.

The 'ōpe'ape'a (Hawaiian hoary bat) or native birds could fly into the fencing and get injured or die. NARS staff has not encountered any wildlife impacted by similar existing fencing in other portions of the Reserve. The anticipated benefits of fencing outweigh the small chance of any negative interaction with native wildlife. Maintenance of the fence line will include monitoring for the presence of potential interactions. If it appears that native wildlife is being injured through contact with the fence, mitigation measures will be developed and implemented (e.g. adding visual barriers to the fencing).

Invasive weed management using chemicals will avoid impacts to endangered species and sensitive habitats. All herbicide use will follow labeling requirements. Use of rodenticides and other toxic baits to control rats and mice could potentially poison non-target animals. However, use of toxic baits will be done in accordance with the toxicant registration. DOFAW will use approved baits with a low toxicity to non-target wildlife such as birds and enclosed bait stations to limit the availability of bait blocks to rodents. Release of biocontrol agents will be done in accordance with Federal and State requirements to insure no negative impacts to native species will occur.

For any biological resources (e.g. rare, threatened, endangered species/habitats) that may be impacted by proposed management actions, all work will cease and the appropriate agencies and organizations contacted for appropriate consultation and procedures.

Overall long-term impacts to native animal species are anticipated to be positive. Pu'u Maka'ala has the potential to serve as a relocation and recovery area for native birds. The NAR is also federally designated as critical habitat for *Drosophila mulli*, a listed endangered picture wing fly which is dependant on the native loulu (*Pritchardia beccariana*). Proposed management actions will create secure native habitats needed for the survival of rare or endangered species, as well as common native wildlife species that may be impacted by threats such as climate change and/or introduction of new diseases.

Native vegetation and habitats

Construction of fencing or new trails and trail improvement will result in minimal disturbance to vegetation within a limited construction corridor as a result of the clearing and construction. Fence and trail corridors will be kept as narrow as possible (up to six feet (1.8 meters)). All hāpu‘u removed from the corridors will be replanted in adjacent areas. Fence and trail alignments will be adjusted to avoid impacts to sensitive botanical resources (e.g. endangered plants) or large trees greater than six inches (15 centimeter) diameter. Although native vegetation in the corridor will grow back, ongoing maintenance requires that a portion of the fence and/or trail corridor be kept cleared of vegetation, resulting in a permanent alteration of some habitat. The recovery of native plants and habitat protected by the fencing will compensate for any damage to common species incurred during construction or maintenance of a narrow fence corridor. Similar fencing in adjacent portions of the NAR over the last ten years shows minimal long-term impacts to the fence corridor.

Disturbance of native vegetation due to pooling or congregating of feral pigs along fences will be minimized because staff will be regularly monitoring fences and will implement appropriate ungulate control measures when needed.

New fences will be aligned along existing four-wheel drive (4WD) roads where possible and follow local topography in order to minimize material transport and hand clearing costs. Prior to construction, the planned new fence alignment will be flagged and inspected for rare or endangered plant species and archaeological features. If necessary, fence alignment will be shifted to avoid individual rare plants or features. Fence construction in some areas will require clearing of a fence corridor up to six foot (1.8 meter) wide with hand and small power tools. Fence materials will be transported to the site via trucks and helicopter. Fences will be constructed by driving posts into the ground no more than ten feet (3 meters) apart and attaching four foot (1.2 meter) high, high-tensile, bezinol-coated, steel woven, wire mesh (hogwire) to the outside of the posts. The hogwire will be tight to the ground and supplemented by anchor pins between fence posts.

Overall impacts to native vegetation and habitats due to fencing are anticipated to be positive. Delineating the boundary of the NAR through fencing will prevent encroachment from adjoining properties as well as reduce illegal activities such as trash dumping and ATV use. The removal of feral ungulates will protect native vegetation and habitats.

Soil and water

Pu‘u Maka‘ala NAR is an important watershed area, and the native forest of the Reserve acts as a filter to clean and to cycle organic matter and nutrients, mitigate flood damage and prevent soil erosion and sediment run-off. Forest

plants anchor the soil preventing runoff, and the multi-layered forest canopy shelters the ground surface from frequent heavy rains that might otherwise wash away organic matter and mineral soils.

Fence construction and trail improvements may contribute to erosion or runoff, however, these impacts are anticipated to be short-term, and no changes in normal rainwater runoff or percolation are expected. DOFAW's Best Management Practices (BMPs) for Maintaining Water Quality in Hawai'i (1996) will be incorporated during the project to minimize any potential runoff and erosion. Specific BMPs to be incorporated include: locating corridors to fit topography and minimize alterations to the natural features; provision of dips and water bars to minimize erosion; avoidance of the diversion of water from natural drainages; keeping grades at less than 10%, except where unavoidable; and other measures as needed. The long-term benefits of the project, including decreased ungulate-related erosion, should counteract any short-term damage caused by construction. Existing unimproved trails and 4WD roads are not currently regularly maintained, and these areas have erosion and soil runoff. The proposed trail improvements and conversion of a 4WD road to a pedestrian trail will reduce the incidence of soil erosion and runoff in sensitive habitats.

Pesticide usage will be in full compliance with State and Federal regulations with staff trained on its safe preparation and application thereby reducing the potential for negative impacts to soil and/or watershed.

Non-native, invasive species

Proposed project management actions are expected to be positive and will reduce the negative impacts of non-native, invasive species such as feral pigs and weeds on the native forest.

Fence and/or trail construction may create conditions suitable for the establishment of non-native invasive plants and animals. Construction equipment, materials, and/or personnel may accidentally introduce new species into an area. Non-native species may also be able to take advantage of habitat disturbance to become established or more widespread in an area.

NAR staff will follow the following sanitation procedures to minimize the introduction of non-native plants and animals and to reduce the possibility of establishment: First, boots, equipment and materials will be inspected for such items such as seeds, eggs, larvae, etc., prior to delivery and/or entry into the project area, and cleaned as necessary; any vehicles used during construction will be inspected and cleaned as needed, following appropriate non-native species prevention protocol; and all workers will be instructed on specific procedures to prevent the spread or introduction of non-native plants and animals in the project area. In addition, NAR staff will do regular follow-up

monitoring and control of invasive species along fence and trail corridors both post-construction and as a part of ongoing maintenance programs.

The use of biological controls to control non-native invasive species will only be conducted in strict accordance with state and federal protocols using approved biocontrol agents. A separate environmental assessment and cultural assessment was prepared prior to the release of a biocontrol agent for strawberry guava on the island of Hawai‘i, which is the most likely agent for release in the NAR

(http://oegc.doh.hawaii.gov/Shared%20Documents/EA_and_EIS_Online_Library/Statewide/2010s/2011-11-08-FEA-Biocontrol-Strawberry-Guava.pdf).

Air pollution

Limited air pollution from helicopter transportation of materials and staff, vehicle use on existing roads and the use of small power tools may affect air quality. Use of this equipment is temporary, of limited duration, and will not significantly contribute to air pollution.

Climate

The forests of Pu‘u Maka‘ala NAR store a large amount of carbon. Management actions to conserve such areas may provide communities with carbon credits for future consideration, and may also help mitigate the effects of climate change.

Social Impacts

Periodic noise from helicopter flights, power tools, and other activity associated with fence and trail building as well as transporting staff for maintenance, surveys, and research will be needed to implement proposed management actions. However, given the remoteness of this area, it is anticipated that such noise levels would be negligible. In addition, all activities will be done during daylight hours and for short durations, thereby further mitigating potential noise disturbance.

The management plan proposes to maintain and/or expand access and use of the area for recreation and education. Maintaining current access trails and improving trails and signage will mitigate potential negative impacts such as people getting lost, accidental introduction of invasive species, soil erosion or disturbance to sensitive areas. Fence ladders or crossovers will also be installed at trails and access points along fences to facilitate access for hikers, hunters, gatherers, researchers, and others who are using the area. Education and outreach programs proposed in the management plan (e.g. volunteer service trips, teacher workshops etc) will add to the positive social impacts by educating a larger number of adults and children about the unique ecosystems and biodiversity of the NAR. The area also offers numerous potential sites for

scientific research and for field trips to reinforce classroom curricula. Improved trail management will enhance such experiences. As a result, overall social impacts of this aspect of the project are expected to be positive.

Pu‘u Maka‘ala NAR is designated as part of Hunting Unit K under Chapter 13-123, Hawaii Administrative Rules (Rules Regulating Game Mammal Hunting). Proposed management programs for fencing and feral pig removal will result in the reduction of acreage currently used for public hunting, although public hunting will continue to be allowed within some portions of the NAR. Approximately 5,000 ac (2,023 ha) are proposed for fencing and feral pig removal. The removal of these NAR lands from the public hunting acreage is not expected to have a major effect on the overall availability of pig hunting opportunities. The neighboring Forest Reserves (Upper Waiākea, Waiākea and ‘Ōla‘a (approximately 60,000 acres (24,281 ha)), as well as a large portion of the NAR not currently proposed for fencing (approximately 4,000 acres (1,619 ha)) will still be available for hunting. The supply of feral pigs from public hunting areas nearby is expected to provide a sustainable, social and economic resource well into the future. Public hunting will help with the initial suppression of feral animals within fenced areas. At the same time, additional tools for animal reduction may be employed to remove all the animals from within fenced areas including staff hunting, corral traps, snaring and other approved methods. The phased nature of proposed fencing and ungulate control projects over the fifteen years time-frame of this plan, and the use of public hunters to assist in initial feral pig control will mitigate any potential impacts to hunters.

DOFAW’s management priority for this area is protection of native ecosystems and watershed. Fencing and feral ungulate removal is required to protect and enhance native ecosystems and watershed, and the proposed feral animal removal is consistent with the NAR and DOFAW Management Policies. In 1996, the NARS Commission adopted the following Management Policies to guide management activities within the NARS:

- In Reserves, strategies to reduce populations of non-native animals to the lowest possible level will be employed.
- Sustained yield management of animals for hunting is contrary to the intent of the NARS.
- Where *practicable*, regulated public hunting will be used to control these animals.

Economic Impacts

Proposed management actions require the spending of funding including purchase of materials, hiring or contracting of crews, and the purchase or rental of equipment including helicopters. Research related to management actions will also require spending of funding in the local economy.

Tourists also enjoy these natural areas, and the continued health of the watershed, and native species and trail improvements could have a positive economic impact on the tourism industry as well as related businesses such as hotels and restaurants.

The project is not expected to have any major negative economic impacts. Economic impacts are neutral or positive and will result from the release of project funds into the State economy through the purchase of goods and services from local vendors, as well as employment for conservation workers and researchers and students from local universities and colleges.

Cultural Impact Assessment

The following steps have been taken to determine the cultural, historical, and archeological significance of the project area and impacts of proposed actions: (1) general literature review to determine if there were any reports or studies with relevant information regarding the project area; (2) the preparation of a cultural study for Pu‘u Maka‘ala Natural Area Reserve (complete study included in Appendix B) prepared by Kumu Pono Associates in 2004, which included a review of cultural, historical and archeological activities in the project area; and (3) preconsultation with Native Hawaiian organizations, agencies and individuals through a letter and/or email requesting information on the following:

1. History, land use and cultural sites e.g., historic or archaeological sites, burials;
2. Traditional gathering practices in the project area – both past and present;
3. Cultural associations through traditions, legends, traditional use, or otherwise; and
4. Referrals of kūpuna who might be willing to share their cultural knowledge of the area.

The pre-consultation mailing list for organizations, agencies, and individuals is included in Appendix C. Comments received during pre-consultation are included in Appendix D.

Archeological and Historic Sites

The State Historic Preservation Division has limited records of historic properties or archaeological sites from Pu‘u Maka‘ala NAR. However, most of this dense forest area has not been surveyed for sites. Historic sites generally known from the area include the following:

- Mauna Loa Boy’s School is a historic structure but it has not been maintained and is currently in severe disrepair.
- Puu ‘Ō‘ō trail, a historic cattle crossing route from Keauhou to Humu‘ula, is just above the Kūlani portion of the Reserve.

Trails, small forest shrines, burial caves and lava tube shelters are the types of features that may be present, as the greater area was used historically by Hawaiians for activities such as bird hunting, harvesting timber for canoe-making and gathering forest plants for medicinal uses.

The 2004 study by Kepa Maly did not note any records or references to specific archaeological sites in the proposed project area (which at the time did not include Kūlani). The study notes that “because of the remote nature of the ‘Ōla‘a and Waiākea forest lands which comprise the present-day Pu‘u Maka‘ala NAR, no government communications pertaining to historic trails or government road projects exist for the region. Boundary Commission testimonies describe trails through the forest lands, rising from the lowlands of Waiākea, ‘Ōla‘a, Keauhou and Humu‘ula. Based on the native traditions and *kama‘āina* testimonies, it is likely that “practitioner” trails existed throughout the forest region. Features such as “*kauhale manu*” (bird-catcher’s shelters), “*kahua kalaiwaa*” (canoe-makers clearings), “*oioina*” (trailside resting places and shelters), the “*ala hele*” (trails), and other features associated with traditional and customary accesses, would leave little evidence in the present-day, as the traditional features and uses generally had minimal impact on the natural landscape. Those things left behind, not cared for or maintained, were simply reabsorbed into the landscape.”

In a study for a sewage treatment plant for Kūlani Correctional Facility, Rechman (2001) reported that project site falls within the rainforest zone as defined by McEldowney (1979). The archeological expectations for the general area are very limited. Pre-contact period bird catchers may have ventured into the forest seasonally and established temporary residences. Such sites would have been constructed of perishable materials.

Rechman’s report (2001) noted that the summit of Pu‘u Kūlani or Kūlani Cone marks the traditional land divisions of South Hilo, Puna and Kā‘u and this Pu‘u should be considered a cultural property due to references in chant and legend.

The Kūlani portion of the Reserve was used since 1946 as a prison camp, and certain areas were used for logging, ranching and other activities. Hawai‘i Tribune Herald newspaper printed a series of articles on the history of Kūlani Correctional Facility and Kūlani Rd by Kent Warshauer in 2001. The Kūlani road was completed in 1945 by prison work crews from Waiākea prison camp, which was moved to Kūlani in 1946. The road from the main facility complex to an area that would become Mauna Loa Boys School, a home for delinquent boys, was completed in 1946. Construction of the Boy’s School was completed in 1952 and the facility opened as Mauna Loa Forestry Camp - modeled after the Civilian Conservation Corps camps. One proposed activity for the boys was to plant koa and naio to replace timber cut by Kūlani inmates. The Camp had numerous issues with boys escaping, including the fatality of one boy. When Territorial House members toured the camp in 1953 they called the

project “one of the most expensive and impractical projects ever constructed in the Territory of Hawai‘i,” and they closed the facility later that year. Since closure the facility was used intermittently by Kūlanī Correctional Facility and by the military for training.

Warshauer (2002) also wrote about the history of the Army Rd area of the Reserve, which was used by the military from 1964 - 1970 for the testing of chemical and biological weapons.

Historic Sites - Potential Impacts and Mitigation Measures

DOFAW Staff consulted with the State Historic Preservation Division (SHPD) and requested concurrence with a determination of no effect on historic sites. SHPD concurred with the DOFAW determination (memos are attached in Appendix D). DOFAW will incorporate SHPD recommended mitigation measures described below for fencing and other proposed and ongoing management activities.

The probability of historic properties being present in areas proposed for management actions is very low and, should any be present, the probability of their being adversely affected is low because the various actions proposed in the plan entail only minimal ground disturbance. Accordingly, we believe these projects will not affect any significant historic properties:

- Management actions (primarily fencing) are proposed for areas in remote, heavily vegetated upper elevation rain forest terrain with no known archeological or historic sites.
- Proposed management actions are limited in scope and involve minimal ground disturbance (e.g. hand-clearing of vegetation, construction of fences with no use of heavy machinery).
- Archeological studies in adjacent areas have not found any sites proposed for fencing and have determined there is a low likelihood of sites in this wet upper-elevation rain forest.
- Precise locations for proposed management actions such as fencing have not yet been finalized and are flexible. Should any historic resources be found in the field, projects can be relocated to avoid disturbance.
- Visual effects of the project will be minimal because most of the proposed fencing will be placed in areas distant from accessible viewpoints.
- The native Hawaiian ecosystems and species of the Reserve are an essential part of the overall cultural landscape. Protection and enhancement of the long-term survival of the natural resources in the Reserve through proposed management is the primary means to protect this valued cultural landscape.

If possible evidence of past human activity is observed during initial fence line assessment, construction, or subsequent monitoring; NAR staff will contact the

SHPD Hilo office and report the find. Such finds might include lava tubes, rock alignments, mounds or architectural features, excavations or areas of broken pahoehoe, indications of trails, concentrations of artifacts, or any non-natural rock formation. SHPD staff will assist in determining the age, function and significance of the find and in determining appropriate mitigation. If the find is determined to have, or potentially have traditional cultural value, consultation with Native Hawaiian Organizations and knowledgeable individuals will also occur during planning of mitigation/protection measures.

Cultural Significance of Area

Perpetuating and protecting the native forests of ‘Ōla‘a, as this project intends to do, not only benefits the native species that live there, but also protects the cultural significance of the area, as described in the 2004 study by Kumu Pono Associates.

In 2004, Kumu Pono Associates prepared He Mo‘olelo ‘Āina: A Cultural Study of the Pu‘u Maka‘ala Natural Area Reserve, District of Hilo and Puna, Island of Hawai‘i, a detailed study of historical and archival literature and limited oral history interviews and consultation with kama‘āina and others with knowledge of the land. The historical and archival research conducted for this cultural study was performed in a manner consistent with Federal and State laws and guidelines for such studies. This document is an important reference for cultural resources management in the NAR. Excerpts from the study are included below. The complete study is in Appendix B and is also available at <http://hawaii.gov/dlnr/dofaw/nars/reserves/big-island/puumakaala>.

“The Natural Area Reserve takes its name from Pu‘u Maka‘ala, literally, Stay-alert Hill—named by State Forester, Ralph Daelher in the early 1960s—the summit of which is situated a little more than 3,600 feet above sea level. While the name of the *pu‘u* is of recent origin, no older name identifiable with the hill was located. Many *pu‘u* on the uplands slopes of the Hilo and Puna Districts are named, and it is likely that in traditional times this hill too had a name or names, depending on the area it was viewed from.

The native traditions and historical accounts associated with the neighboring lands of the upper Hilo-Puna forests span many centuries, from Hawaiian antiquity to the later period following western contact. The narratives describe customs and practices of the native people who resided on these lands, walked the trails, and who were sustained by the wealth of the forest lands.

Among the most detailed descriptions of the Hilo-Puna forest lands, including documentation of traditional and customary rights, are those found in the Kingdom collections, documenting the history of land tenure, and defining the boundaries of ahupua‘a of Waiākea and ‘Ōla‘a. Detailed oral

testimonies from elder native tenants were taken in court proceedings of the mid to late 1800s, document the occurrence of traditional and customary practices, and nature of the resources within given ahupua‘a. In those records, we learn of the traditional knowledge and occurrence of native practices in the lands which today are a part of, and adjoin the Pu‘u Maka‘ala NAR.

We find in Hawaiian traditions and beliefs, that Hawaiians shared spiritual and familial relationships with the natural resources around them. Each aspect of nature from the stars in the heavens, to the winds, clouds, rains, growth of the forests and life therein, and everything in the land and in the ocean, was believed to be alive. Indeed, every form of nature was a body-form of some god or lesser deity. As an example, in this context, and in association with lands which are now included in a part of the landscape of the Pu‘u Maka‘ala NAR, we find the Kū-ka-‘ōhi‘a-Laka, is a defied guardian of the ‘ōhi‘a growth of ‘Ōla‘a; Ua-kuahine, is the body form of a goddess of the rains in ‘Ōla‘a; and Kū-lili-ka-ua is the god of the thick mists that envelop the forests of the upper Puna, Waiākea, and Keauhou lands. Indeed, tradition also tells us that the gods and goddesses of these forest lands were very protective of them. In olden times, travel through them was accompanied by prayer, and care. Traditions tell us that many a careless traveler, or collector of resources, found themselves lost in a maze of overgrowth and dense mists, for disrespectful and careless actions.

In the Hawaiian mind, care for each aspect of nature, the kino lau (myriad body-forms) of the elder life forms, was a way of life. This concept is expressed by Hawaiian kūpuna (elders) through the present day, and is passed on many native families. Also, in this cultural context, anything which damages the native nature of the land, forests, ocean, and kino lau therein, damages the integrity of the whole. Thus caring for, and protecting the land and ocean resources, is a way of life.

In the traditional context above, we find that the mountain landscape, its’ native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property. Its protection, and the continued exercise of traditional and customary practices, in a traditional and customary manner, are mandated by native custom, and State and Federal Laws (as those establishing the ‘Ōla‘a and Waiākea Forest Reserves, the Pu‘u Maka‘ala NAR, and the Endangered Species Act).

In this discussion, protection does not mean the exclusion, or extinguishing of traditional and customary practices, it simply means that such practices are done in a manner consistent with cultural subsistence, where each form of native life is treasured and protected. Kūpuna express this thought in the words, “Ho‘ohana aku, a ho‘ōla aku!” (Use it, and let it live!).”

Maly's study discusses hunting in the area, and he finds that traditional hunting practices were primarily limited to birds.

“Native testimonies describe a wide range of traditional practices in the uplands of Waiākea, ‘Ōla‘a, and in adjoining lands. The types of usage includes: travel on native trails, land use in a wide range of elevational zones; collection of resources; the collection of, or “hunting” of birds; canoe making; and the subsequent practices associated with hunting introduced ungulates—all under the control of Konohiki. In regards to hunting, it will be noted that descriptions of traditional hunting practices are limited to native species of birds, including the ua‘u, nēnē, mamō and ‘ō‘ō; while description of historical hunting practices are limited to goats, which were hunted under contract of Konohiki, the Crown, or the Government. The testimonies also record that changes had occurred on the landscape during the lifetime of the witnesses. It is of importance to note that the boundaries were known by the native tenants, and the rights to take or hunt resources in traditional times were fiercely protected— individuals without chiefly, genealogical claims, or residency ties to given lands were not allowed to trespass and take resources from the ahupua‘a.

Our review of more than 60,000 native Hawaiian land documents dating from 1846 to 1910 revealed many references to pua‘a (pigs), but nearly every reference was in the context of them being near-home and as being cared for (raised), not hunted. In the same review of the native Hawaiian land documents and a large collection of writings from native authors (e.g., D. Malo, 1951; J.P. Ii, 1959, S.M. Kamakau 1961, 1964 & 1976), every reference to traditional collection or “hunting” (a word seldom used in the historical records), was in the context of native birds—those used either for food or from which feathers were collected for royal ornaments and symbolic dress.

After ca. 1815, we find that when native Hawaiians went hunting in the uplands—as described in testimonies and historical texts of the time—they were hunting bullocks, goats and other introduced grazers, and this was generally done on the demand of their landlords, and later for the growing ranches being established in the islands. The first full-scale efforts of western-style hunting in the Humu‘ula-Waiākea and Keauhou (Ka‘ū) region does not appear in reference until around 1840 (cf. Kamakau, 1961; Government Communications in this study). Those early outings were focused on collection of hides and tallow; and controlling wild herds of animals that were a threat to travelers, agricultural fields, residences, and forest resources.”

Comments received during Pre-Consultation

Overall, the proposed action is expected to have a positive impact on native Hawaiian traditional and cultural practices. DOFAW held a public hearing on July 12, 2010 concerning the proposed addition of Kūlani to the NARS. Although the purpose of the meeting was not specifically management in Pu‘u Maka‘ala Natural Area Reserve, various comments related to management of the area were raised in public testimony. 71 members of the public attended. Fifty-five (83.5%) individuals/organizations expressed support of the addition of Kūlani to the NARS, while five (7.5%) individuals opposed and six (9%) presented comments. The complete testimony transcribed from that meeting is available at: <http://hawaii.gov/dlnr/chair/meeting/submittals/100909/C-FW-Submittals-C1.pdf>

Comments received during pre-consultation are included in Appendix D and comments relevant to cultural impacts concerned the following topics:

- Crown lands - Crown lands belong to the Kingdom of Hawaii. How can Crown lands be used for a NAR?
- Fencing and hunting - hunting is a tradition, and fencing and removal of animals impacts the hunting community.
- Off-road vehicle use - access for off-road vehicle use is important.
- Access - Fencing of the forest prevents access and access is limited to areas designated as a NAR.
- Herbicides - use of herbicides may harm watershed areas.
- Biocontrol - use of biocontrol agents affecting cultural practices involving non-native species.
- Protection of significant native ecosystems provides for the continuity of Hawaiian cultural traditions.
- The well-being of people of Hawaiian ancestry depends in large part on the existence of healthy native ecosystems such as those at Pu‘u Maka‘ala.

The ownership of Crown lands is beyond the current scope of the Pu‘u Maka‘ala Management Plan as this issue must be resolved for all crown lands. Kepa Maly’s Study (2004) discusses the history of the area, including the designation of the ahupua‘a of Waiākea and ‘Ōla‘a as crown lands and protection of these forests by the Hawaiian Kingdom. Management of the lands and forest resources of the ‘Ōla‘a, Waiākea and Kīlauea Forest Reserves then fell under the jurisdiction of the Territory, and then the State of Hawai‘i. The NAR was established in 1981 from lands withdrawn from the Forest Reserves. DOFAW NARS is managing the forests of Pu‘u Maka‘ala NAR in their natural state for the benefit of current and future generations.

Proposed actions include fencing and removal of feral ungulates such as pigs which will reduce areas available for public hunting but will provide other important cultural benefits, such as protection of native plants and animals and

improved forest condition which supports native plants used for gathering. Fencing has long been recognized as a commonly used conservation tool to protect forests from ungulates. In the early 1900's, the territorial foresters recognized the need to protect forested watershed from destruction from ungulates by fencing. Public access to the area will not be negatively affected by fencing. Gates will be installed at trails and access points along fences to facilitate access for people who are using the area. The presence of large areas open for public hunting adjacent to the NAR, the phased nature of proposed fencing and ungulate control, and the use of public hunters to assist in initial feral pig control will mitigate any potential impacts to hunters.

Access to the area will be enhanced by the proposed actions. The proposed project will increase access to some areas, by providing new access to the Kūlani portion of the NAR, which was previously off-limits to the public when operating as a correctional facility. Other projects proposed include trail improvement in several areas. Public access is allowed in the NAR for recreational and cultural uses and will continue to be allowed. Current public use of Pu'u Maka'ala primarily includes hiking, bird watching, and hunting. Hunting in portions of the NAR is regulated by Chapter 13-123, Hawaii Administrative Rules (Rules Regulating Game Mammal Hunting), and areas where hunting is allowed are designated as part of Hunting Unit K. Some uses, including hiking or nature study with groups larger than ten, research, scientific collecting, gathering (including Native Hawaiian religious and customary gathering rights) and commercial uses require a Special Use Permit from the Executive Secretary of the NARS Program in Honolulu (808-587-0063) (Hawai'i Administrative Rules 13-209).

Public off-road vehicle access at Kūlani has not been available in the past, when the correctional facility was operational and will not be proposed in our plan. Concerns with public vehicle access include the introduction and spread of weeds and invasive species such as fountain grass and coqui frogs, disturbance of nēnē and other birds due to noise, and the high costs of road maintenance.

Weed control is an important component of the plan and is required to reduce the threat poses to native forest by invasive weeds. Weed control will include the use of pesticides and approved biocontrol agents. Pesticides will be used to remove damaging invasive species. Pesticide usage will be in full compliance with State and Federal regulations with staff trained on its safe preparation and application thereby minimizing the potential of watershed contamination. The benefits of biocontrol in controlling invasive species and protecting cultural resources such as native forests are expected to outweigh potential reduction in strawberry guava.

Protection of the forest and restoration of its native habitats can benefit practices such as traditional gathering by insuring that native plant populations are healthy. In addition, overall conservation of native habitats and species will

aid in preserving the rich native Hawaiian history and spiritual connection to the forest, as places linked with oli and stories are preserved. Fencing will incorporate gates at appropriate locations so access by people is not blocked (only feral animal movement). Therefore, proposed management actions will have long-term benefits for the perpetuation of native traditions and cultural practices. Increased access to the Kūlani portion of the Reserve will also benefit traditional and cultural practices.

VII. ALTERNATIVES CONSIDERED

Three alternatives are identified and discussed here. Another alternative was considered, but was dismissed because it was not feasible to implement during the time frame of this plan due to high cost.

Alternative One - Implement Management Plan (Preferred Alternative)

Implement identified management programs and actions over the anticipated 15 years to protect, maintain, and enhance Pu‘u Maka‘ala’s unique natural, cultural, and geological resources. Fencing and ungulate removal will protect core areas of the Reserve from feral ungulates; invasive weed control will limit the habitat-modifying affects of these plants and keep forests intact and functioning; habitat protection and rare species restoration will protect and restore rare native habitats and recover endangered species; monitoring will assess the results of management and help to detect new threats; and outreach and education including trail improvement will improve understanding and appreciation of native species and ecosystems as well as provide recreational opportunities.

The preferred alternative avoids or minimizes potential negative impacts on natural and cultural resources while meeting management objectives for Pu‘u Maka‘ala NAR.

Alternative Two - Implement Management Plan with modifications of the Army Road Management Unit Fencing and Interpretive Trail Development

This alternative is the same as Alternative 1 with the exception of modifications to the implementation of one fencing project - the Army Road Unit and the elimination of the associated interpretive trail development project for the same area.

This alternative would implement Army Road Unit fencing to create the Army Road Unit by clearing a new fence corridor adjacent to the existing road rather than constructing the fence in the existing road corridor. The fence would be constructed in a new corridor on the interior of the existing road, which would allow continued use of the road by vehicles rather than conversion of the road to a public, pedestrian trail. This alternative would not include implementation of

the interpretive trail development project for the Army Road, because the road would not be converted to a public, pedestrian trail. Ungulates would be removed from within the fenced Army Road Unit using the methods described in the plan once fencing was completed.

This alternative would meet management objectives for Pu‘u Maka‘ala NAR as described above but includes greater negative impacts to natural and cultural resources. This alternative would involve greater negative impacts to native forest due to the need to bulldoze a new fence corridor approximately 8 feet wide rather than using the existing road corridor. Approximately 3 acres (1.2 ha) of forest would need to be cleared to create the new fence corridor.

This alternative would allow continued use of an existing four-wheel drive road, which is currently open for public vehicular access. This alternative would benefit people who use vehicles to access the Army Road area but would not provide benefits to people who want enhanced pedestrian access and interpretive trail development.

Alternative Three - No Action

No management action taken.

This alternative does not meet management objectives for Pu‘u Maka‘ala NAR and effectively accepts deterioration of unique natural and cultural resources by feral ungulates, invasive weeds and other threats. The no-action alternative fails to take advantage of existing funding opportunities to protect and restore native forest on public lands. The no-action alternative also fails to protect Pu‘u Maka‘ala NAR from the damaging impact of feral pigs, weeds and other threats. With no action, the existing ‘ōhi‘a forest may eventually disappear, further reducing habitat for endangered plant and animal species, degrading the watershed, and depriving future generations the opportunity to appreciate these resources. Finally, the no-action alternative reduces the potential for success of affirmative conservation measures, such as outplanting rare plants, that are necessary for the long-term recovery of many species.

This alternative is not consistent with the NARS’s mandate as described in HRS Ch. 195, nor the overall mission of the DLNR to "Enhance, protect, conserve and manage Hawaii’s unique and limited natural, cultural and historic resources held in public trust for current and future generations of visitors and the people of Hawaii nei in partnership with others from the public and private sectors."

Alternatives Initially Evaluated but Dismissed from Further Consideration

DOFAW staff evaluated an alternative to fence and remove ungulates from the entire NAR (approximately 9,000 ac (3,642 ha). This alternative would include fencing approximately 4,000 acres (1,619 ha) in the lower, eastern portion of the

NAR (including the Ihope road region adjacent to the National Park ‘Ōla‘a tract up to the 3,400 feet (1,036 meters) elevation) in addition to the 5,000 ac (2,023 ha) of fencing and ungulate removal proposed in the preferred alternative.

While this alternative is consistent with the NARS’s mandate, it was dismissed because it is not feasible with anticipated funding within the current time frame of the management plan. In addition, this area is not currently as high a priority for fencing as the areas identified in the preferred alternative. While still native-dominated, high densities of weeds make this section a lower priority for fencing and animal removal.

VIII. ANTICIPATED DETERMINATION AND REASONS SUPPORTING THE ANTICIPATED DETERMINATION

The expected determination of this project is a finding of no significant impact (FONSI). The intent of this project is to benefit native ecosystems, watershed, and rare and endangered species in Pu‘u Maka‘ala NAR. The anticipated FONSI is based on the evaluation of the project in relation to the following criteria identified in the Hawai‘i Administrative Rules § 11-200-12:

- 1) *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.*

The proposed action does not involve an irrevocable commitment to loss or destruction of any natural or cultural resource. Instead, the goal of the proposed action is to benefit the natural environment by protecting and enhancing existing native forest and watershed areas, and to provide habitat for and restore native plants and animals. The project aims to better manage endangered ecosystems and improve environmental quality. Proposed management actions will reduce or remove the primary threats to the continued survival of rare native forest ecosystems and species.

- 2) *Curtails the range of beneficial uses of the environment.*

The proposed action will not curtail beneficial uses of the environment. Instead, the project will protect and enhance a unique native forest ecosystem that provides habitat for numerous endangered plant and animal species. Actively managing the project area through proposed management actions (e.g. ungulate control, weed control, habitat and rare species restoration, public outreach and education, fire prevention, etc.) will increase the beneficial uses of the environment by improving watershed quality and protecting native Hawaiian ecosystems for current and future generations.

- 3) *Conflicts with the state’s long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.*

The proposed actions are consistent with the environmental policies established in Chapter 344, Hawai‘i Revised Statutes (HRS) as well as the goals and objectives of the NARS. The management plan contributes to protection and enhancement of endangered species as mandated by both Federal and State Endangered Species Acts (16 U.S.C. 1531-1543, as amended; Chapter 195D, Hawai‘i Revised Statutes). The management plan is also consistent with Section 4 of the County of Hawai‘i General Plan (2006), which sets goals and policies for maintaining environmental quality. Finally, protection and restoration of the native forest of Pu‘u Maka‘ala NAR implements the Hawai‘i Comprehensive Wildlife Conservation Strategy (2005), the Recovery Plan for the Big Island Plant Cluster (1996), the Recovery Plan for Multi-Island Plants (1999), and the Revised Recovery Plan for Hawaiian Forest Birds (2006).

Consistency with Other Plans and Cooperative Efforts.

Plan/Cooperative Effort	Comment
The Rain Follows the Forest - A Plan to Replenish Hawaii’s Source of Water (DLNR, November 2011)	The Reserve is identified as a priority watershed area on the island of Hawai‘i
DOFAW Statewide Assessment and Resource Strategy (SWARS) 2010	Identifies areas of greatest need and opportunity for forests in Hawaii and develops a long-term strategy for management. Objectives include: 1.1. Identify and conserve high-priority forest ecosystems and landscapes; 2.2. Identify, manage and reduce threats to forest and ecosystem health; 3. 3. Enhance public benefits from trees and forests; 3.1. Protect and enhance water quality and quantity; 3.5. Protect, conserve and enhance wildlife and fish habitat; 3.7. Manage and restore trees/forests to mitigate and adapt to global climate change.
U.S. Fish and Wildlife Designation of Critical Habitat for 12 Species of Picture-Wing Flies From the Hawaiian Islands (2009)	Supports recommendations for habitat management for <i>Drosophila mulli</i>
Three Mountain Alliance (TMA) Management Plan (2008) and TMA Weed Management Plan (2009)	Supports mission and goals of the TMA watershed partnership and TMA weed management
Puna Community Development Plan (2008)	Mentions Pu‘u Maka‘ala NAR and discusses the importance of preserving native forests and species.
U.S. Fish and Wildlife Revised Recovery Plan for Hawaiian Forest Birds (2006)	Supports recovery actions 1 and 2: protect and manage ecosystems for the benefit and recovery of native forest birds.
Hawai‘i Comprehensive Wildlife Conservation Strategy (2005)	Implements objectives 1, 2, 3, 4, and 5
County of Hawai‘i General Plan (2005)	8.2(c) Protect and promote the prudent use of Hawaii’s unique, fragile, and significant environmental and natural resources. 8.2 (d) Protect rare or endangered species and habitats

	native to Hawai'i. 8.3 (b) Encourage a program of collection and dissemination of basic data concerning natural resources. 8.3 (e) Encourage an overall conservation ethic in the use of Hawai'i resources by protecting, preserving, and conserving the critical and significant natural resources of the County. 8.3 (o) Encourage the continued identification and inclusion of unique wildlife habitat areas of native Hawaiian flora and fauna with the NARS.
U.S. Fish and Wildlife Final Designation and Nondesignation of Critical Habitat for 46 Plant Species From the Island of Hawaii, HI (2003)	Supports recommendations for habitat management for <i>Sicyos alba</i> , <i>Cyrtandra giffardii</i> , <i>Cyanea stictophylla</i> , and <i>Phyllostegia velutina</i>
U.S. Fish and Wildlife Service Recovery Plan for the Multi-Island Plants (1999)	Supports objective 1: protect habitat and control threats for <i>Adenopherus periens</i>
U.S. Fish and Wildlife Service. Big Island II: Addendum to the Recovery Plan for the Big Island Plant Cluster (1998a)	Supports objective 1: protect current populations and manage threats for <i>Phyllostegia racemosa</i> , <i>Phyllostegia velutina</i> and <i>Sicyos alba</i> .
U.S. Fish and Wildlife Service Final Recovery Plan for Four Species of Hawaiian Ferns (1998b)	Supports objective 1: protect current populations and manage threats for <i>Asplenium peruvianum</i> var. <i>insulare</i>
U.S. Fish and Wildlife Recovery Plan for the Hawaiian Hoary Bat (1998c)	Supports objective 2: protect and manage current populations and identify and manage threats
U.S. Fish and Wildlife Recovery Plan for the Big Island Plant Cluster (1996)	Supports objective 1: protect current populations and manage threats for <i>Clermontia lindseyana</i> , <i>Clermontia peleana</i> , <i>Cyanea copelandii</i> , <i>Cyanea stictophylla</i> , <i>Cyrtandra giffardii</i> , and <i>Cyrtandra tintinnabula</i> .

4) *Substantially affects the economic or social welfare of the community or state.*

The proposed action will not adversely affect the economic or social welfare of the community or state. The ecosystem-related goals of the project will directly benefit the economic, cultural, and social interests of the community and the State by preserving native forests, enhancing watershed function, and providing habitat for rare native plants and animals.

5) *Substantially affects public health.*

The proposed action is not anticipated to substantially affect public health. The proposed action may have a positive impact on public health by protecting native forest and by helping to eliminate potential threats to human health caused by feral ungulates and non-native mammalian predators.

6) *Involves substantial secondary impacts, such as population changes or effects on public facilities.*

The proposed action is not anticipated to result in any substantial secondary impacts, such as population changes or effects on public facilities, as there are no public facilities within the project area and the project does not include the building of any structure intended for human habitation.

7) *Involves a substantial degradation of environmental quality.*

The proposed action does not involve a substantial degradation of environmental quality. Instead, environmental quality is anticipated to improve with the implementation of the proposed action. Conservation management will enhance the environmental quality of the project area by providing long-term protection for watershed, native forest, and habitat for rare plants and animals.

8) *Is individually limited but cumulatively has considerable effect upon environment or involves a commitment for larger actions.*

The proposed action involves fencing approximately 5,000 acres (2,023 ha) in Pu`u Maka`ala NAR and the removal of ungulates from within the fenced area, followed by conservation management activities such as replanting native species, outplanting rare species, and removal of alien plants. The cumulative effect of fencing on the environment is positive. Ungulate-proof fencing is needed for the long-term success of any restoration or outplanting efforts. Moreover, the fencing does not necessarily require the commitment for ongoing management action as fencing and ungulate removal alone have value by protecting existing native forest and allowing for its natural recovery.

9) *Substantially affects a rare, threatened or endangered species, or its habitat.*

The project is not anticipated to negatively affect a rare, threatened or endangered species.

28 species of rare plants, including threatened and endangered species, will positively benefit from the habitat protection and management proposed in the Pu`u Maka`ala NAR Management Plan. Exclusion of feral pigs by fencing has been shown repeatedly to be one of the most important actions that can be taken to protect rare plant species in Hawai`i. Construction of fencing would provide protection for habitat that is in decline statewide – relatively intact natural communities in good condition and suitable to support the reintroduction of rare and endangered plants. Failure to implement the proposed actions would preclude the opportunity to reintroduce new plant populations into the project area. Other management actions such as weed control and habitat restoration will also benefit rare and endangered plants. Pu`u Maka`ala contains federally designated critical habitat for four species of endangered plants and *Drosophila mulli*, a listed endangered picture wing fly. The proposed management plan

implements actions recommended by U.S. Fish and Wildlife Service in recovery plans and critical habitat rules for the listed endangered plant and animal species in the NAR.

Threatened, endangered, and rare birds found within or near Pu‘u Maka‘ala NAR will also benefit from habitat protection and management. Protection of native forest through activities proposed in the management plan is a recommended action of the U.S. Fish and Wildlife Revised Recovery Plan for Hawaiian Forest Birds (2006).

10) Detrimentially affects air or water quality or ambient noise levels.

The proposed action is not anticipated to have detrimental effects on air quality, water quality, or noise levels. The area is remote, and construction noise will be localized and temporary.

11) Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

The project is not located in an environmentally sensitive area. Portions of the area may be affected by future lava flows as the area is classified as lava hazard zone 3 by the United States Geological Survey.

12) Substantially affects scenic vistas and view planes identified in county or state plans or studies.

The proposed action is not anticipated to affect any vistas or view planes identified in known County or State plans or studies. The fences will be installed in remote, densely forested areas and will not be visible to people unless they are immediately adjacent to the fencing. Based on experience with fences in similar terrain and elevations, the fencing is not expected to be noticeable from a distance.

13) Requires substantial energy consumption.

The proposed management actions do not require substantial energy consumption. The proposed project will consume small amounts of energy through the use of small power tools and transportation of materials and crews with vehicles and helicopters. Energy consumption is linked with individual projects that are short-term or temporary in nature. No infrastructure or similar elements that require on-going energy consumption is being proposed.

IX. LIST OF PERMITS REQUIRED FOR THE PROJECT

There are no permits required for the project.

X. EA PREPARATION INFORMATION

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XI. REFERENCES

References can be found in Appendix A, Pu‘u Maka‘ala NAR Management Plan.

XII. APPENDICES

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| Appendix B. | He Mo‘olelo ‘Āina: A Cultural Study of the Pu‘u Maka‘ala Natural Area Reserve, District of Hilo and Puna, Island of Hawai‘i (2004) |
| Appendix C. | Pre-Consultation and Draft Environmental Assessment Mailing List |
| Appendix D. | Comments received during pre-consultation |

Appendix A.

Pu'u Maka'ala NAR Management Plan

**Pu‘u Maka‘ala Natural Area Reserve (NAR)
Management Plan**



January 2012

**Department of Land and Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, HI 96813**

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EXECUTIVE SUMMARY

Pu‘u Maka‘ala Natural Area Reserve (NAR or Reserve) is situated on lands within the upper portions of Waiākea ahupua‘a of the South Hilo District and the kalana (sub-district) of ‘Ōla‘a within the District of Puna. It was formally established in 1981 by Governor’s Executive Order 3102 from lands withdrawn from the ‘Ōla‘a and Waiākea Forest Reserves (FR). The original 12,106 acre (ac) (4,899 hectare (ha)) Reserve was created to protect native wet forest. In November 2010, an additional 6,600 acres (2,671 ha) of the former Kūlani Correctional Facility property was added to the NAR, bringing the total acreage of the NAR to 18,706 acres (7,570 ha). This addition protects additional forest and native species as well as links important conservation areas including the ‘Ōla‘a Tract of Hawai‘i Volcanoes National Park (HAVO) and the upper elevation native forests of Kīlauea, Keauhou, and Upper Waiākea. These forests comprise an important water resource for the lower Puna and Hilo regions of Hawai‘i island, and provide exceptional habitat for a wide diversity of native plant and animal species.

The primary threats to biodiversity and watershed integrity at Pu‘u Maka‘ala NAR are feral ungulates (wild, hoofed animals such as pigs, sheep, goats and cattle), especially feral pigs (*Sus scrofa*) and non-native, invasive weeds. This management plan updates the 1989 Management Plan for Pu‘u Maka‘ala NAR to reflect management accomplishments and current management needs of this reserve, including proposed management for the Kūlani addition.

Governor Abercrombie’s *A New Day in Hawai‘i* plan calls for the stewardship of the natural resources that our survival, economy, and quality of life depend on. Priority actions of this Department of Land and Natural Resources (DLNR) initiative include managing invasive species, increasing Hawaii’s ability to withstand impacts from climate change, and restoring capabilities of the DLNR by finding additional sources of funding. The New Day Status Report also tasks the DLNR to ensure mauka watersheds are fully functioning so fresh water resources can be utilized and enjoyed by the people of Hawai‘i in perpetuity. *The Rain Follows the Forest* is the Department’s plan to implement these central goals of the Abercrombie administration. *The Rain Follows the Forest* identifies priority watersheds, including Pu‘u Maka‘ala NAR, and outlines on-the-ground actions and projects required to protect and sustain Hawaii’s critical water sources.

The Pu‘u Maka‘ala Management Plan is aligned with the priorities and actions identified in *The Rain follows the Forest*. The overall management goal is to protect, maintain, and enhance Pu‘u Maka‘ala’s unique natural, cultural, and geological resources. Management programs have been developed to support this overall goal and include the following:

1. Ungulate Management
2. Weed Management
3. Habitat Protection and Rare Species Restoration
4. Monitoring
5. Public Access, Outreach and Education
6. Fire Prevention and Response
7. Enforcement
8. Partnership Collaboration

9. Infrastructure and Other Actions

The 2012 Management Plan for Pu‘u Maka‘ala outlines the planned management activities in Pu‘u Maka‘ala over the next fifteen years, along with an estimated budget for full implementation.

INTRODUCTION

The Natural Area Reserves System (NARS) was created in 1971 by the Hawai‘i State Legislature to “preserve in perpetuity specific land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites, of Hawai‘i (HRS § 195-1).” The legislature further found that these unique natural assets should be protected and preserved, both for the enjoyment of future generations and to provide baselines against which changes to Hawaii’s environment can be measured. The NARS is administered by the Hawai‘i Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW). NARS Commission members act in an advisory capacity for the Board of Land and Natural Resources, which sets policies for the Department. Hawai‘i Administrative Rules 13-209 relate to the management of the Natural Area Reserves System.

The NARS is based on the concept of protecting ecosystems – not merely single species. Because the natural resources of Hawai‘i are under constant threat from invasive species, human encroachment, feral ungulates, climate change, and other threats, the NARS seeks to protect the best remaining examples of the State’s unique ecosystems. In addition to setting aside these areas as reserves, the NARS program strives to actively manage these reserves in order to preserve the unique characteristics that make these areas an integral part of the natural heritage of Hawai‘i. Reflecting this, the mission of the NARS program is: “The NARS exists to ensure the highest level of stewardship for Hawaii’s natural resources through acquisition, active management, and other strategies.”

The NARS presently consists of 20 reserves on five islands, encompassing more than 123,000 ac (49,776 ha) of the State’s most unique ecosystems. The diverse areas found in the NARS range from marine and coastal environments to alpine desert, and from fresh lava flows to wet forests. These areas often serve as habitat for rare native plants and animals, many of which are on the verge of extinction. The NARS also include important watersheds, contributing to Hawai‘i’s sources of drinking water. Finally, the NARS forms an important part of the scenic landscape and contributes to the natural beauty of Hawai‘i, contributing to the islands’ overall appeal to visitors. Some of the most recognizable and visited NARS include Mauna Kea Ice Age NAR (Hawai‘i), Ka‘ena Point NAR (O‘ahu), and ‘Āhihi-Kīna‘u NAR (Maui).

Pu‘u Maka‘ala NAR was established in 1981 with the issuance of Executive Order 3102, and it was created to protect unique wet native forest that provides habitat for native plants, invertebrates, and birds. The addition of 6,600 acres (2,671 ha) of the Kūlani property was completed in November 2010 with the issuance of a Governor’s Executive Order 4338. This portion of the Reserve contains additional native habitats and species, including mesic forest ecosystems and high elevation habitat that contains existing populations of three critically endangered forest birds. Long-term management of the forested watershed of Pu‘u Maka‘ala

NAR provides multiple benefits to the state including protection of the island's water resources and undeveloped open space. The natural communities within the Reserve provide habitat for a diverse range of native plants and animals, from rare birds to endemic invertebrates, preserving Hawai'i's biodiversity.

The NARS website located at <http://hawaii.gov/dlnr/dofaw/nars> provides general information on NARS programs and policies as well as information on NARS management across the state.

PU'U MAKA'ALA NAR: BIOPHYSICAL RESOURCES

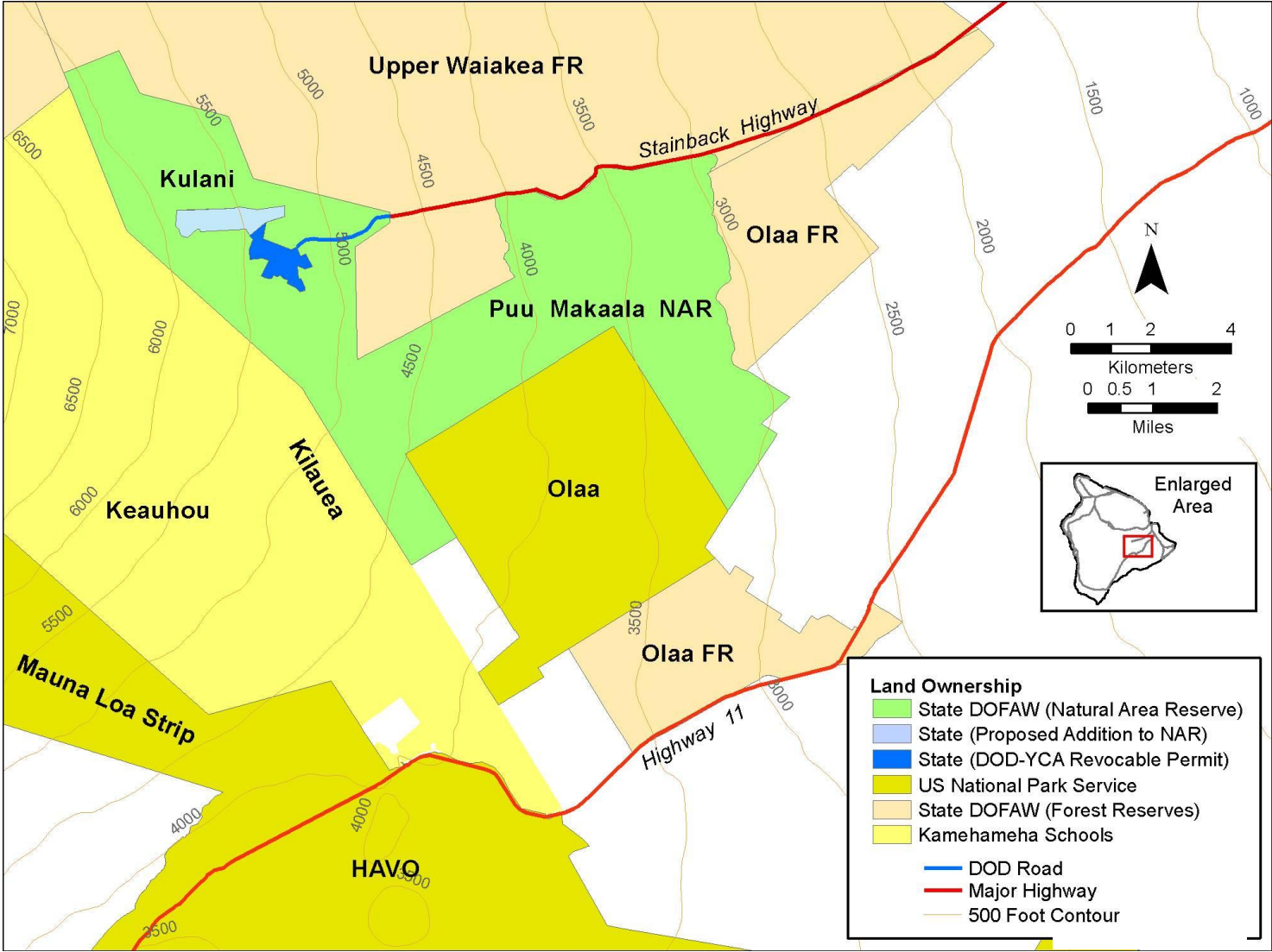
Location

Pu'u Maka'ala NAR occupies 18,706 acres (7,570 ha) in the Puna and South Hilo districts on the island of Hawai'i (Figure 1). The NAR includes the following TMKs: 1-8-12:03, 1-9-01:1, 2-4-8:19, 2-4-8:21, 2-4-8:25 (portion), and 2-4-008:09 (portion).

Landmarks include Kūlani Cone, Pu'u Kipu and Pu'u Maka'ala. The Reserve is bordered by the Upper Waiākea FR on the north and east, the 'Ōla'a FR on the east, the 'Ōla'a Tract of HAVO to the south, and private property to the west (Kamehameha Schools), southwest and southeast (numerous agricultural parcels). The former Kūlani Correctional Facility is being used by the state Department of Defense Youth Challenge Academy (DOD-YCA) under a revocable permit from DLNR. DOD-YCA controls access into the developed portions of the facility from the end of Stainback Highway.

Access to the NAR is from Volcano (via Wright Road and Amaumau Rd) and along Stainback Highway (Figure 11).

Figure 1. Pu'u Maka'ala NAR



Topography, Climate, Geology, and Soils

Pu‘u Maka‘ala NAR is located on the eastern, windward slopes of Mauna Loa. Elevations within the NAR range from 2,800 - 6,229 feet (ft) (853 – 1,899 meters (m)).

The average annual rainfall is approximately 79 - 157 inches (2,000 – 4,000 millimeters) and the Reserve receives the prevailing northeast trade winds for much of the year. Condensation from ground-level clouds (fog drip) contributes additional moisture at higher elevations. The moist side of an ecotone (a transition to drier conditions) runs along the western edge of the NAR. Only the uppermost areas are subject to some seasonal nighttime freezing.

The NAR contains a variety of different ages and types of lava flows from Mauna Loa’s northeast rift zone, which contributes to the diversity of soils and vegetation within the Reserve. U.S. Geological Survey (USGS) has mapped seven different age lava substrates in the Reserve (Figure 2). Flow substrate ages range from recent flows (1942) in the northwest corner of Kūlani to flows older than 10,000 years. There are several prominent cinder cones in the Reserve, including Kūlani Cone and Na Lua Mahoe. This area is classified by USGS as within Volcanic Hazard Zones 2 and 3. The Kūlani portion of the NAR is within Zone 2, which includes areas on the northeast rift zone. Since Mauna Loa’s rift zones form prominent ridges, all the areas in Zone 2 are downslope of potential eruption sites. About 20 percent of this area has been covered by lava in historical time, 5 percent since 1950. Other portions of the NAR are within Zone 3, a designation for areas gradationally less hazardous than those in Zone 2 due to greater distance from recently active vents or because the topography makes it less likely that lava flows will cover the area.

Soils in the Reserve were formed in and on various aged volcanic substrates including cinder, ash, pāhoehoe and ‘a‘ā, and the age and type of lava substrate greatly influences soil type (Figure 3). Natural Resources Conservation Services (NRCS) draft soils classification for the area includes twenty-five different soil types. Soils that cover the greatest extent of the NAR include the Ekeuiki-Pekailio complex (3-10% slopes), which consists of deep soils that formed in volcanic ash deposited over ‘a‘ā. Lower elevations of the NAR contain Hao medial loam (3-10 % slopes), which consists of deep and very deep, moderately well drained soils that formed in volcanic ash. The Reserve also contains large areas of Kiloa extremely cobbly highly decomposed plant material (3 – 10% slopes) which consists of thin, well drained soils that formed in organic material and ash overlying ‘a‘ā lava and Keei very cobbly slightly decomposed plant material (3 - 10% slopes) which is similar to Kiloa but formed over pāhoehoe. Other major soil types in the Reserve include deep, well drained soils formed in volcanic ash deposited over cinders (Kūlani hydrous mucky loam) and in material weathered from or formed in volcanic ash (Piuhonua hydrous silty clay loam and Puaulu hydrous silt loam).

Figure 2. Pu'u Maka'ala NAR Geology (Substrate Age)

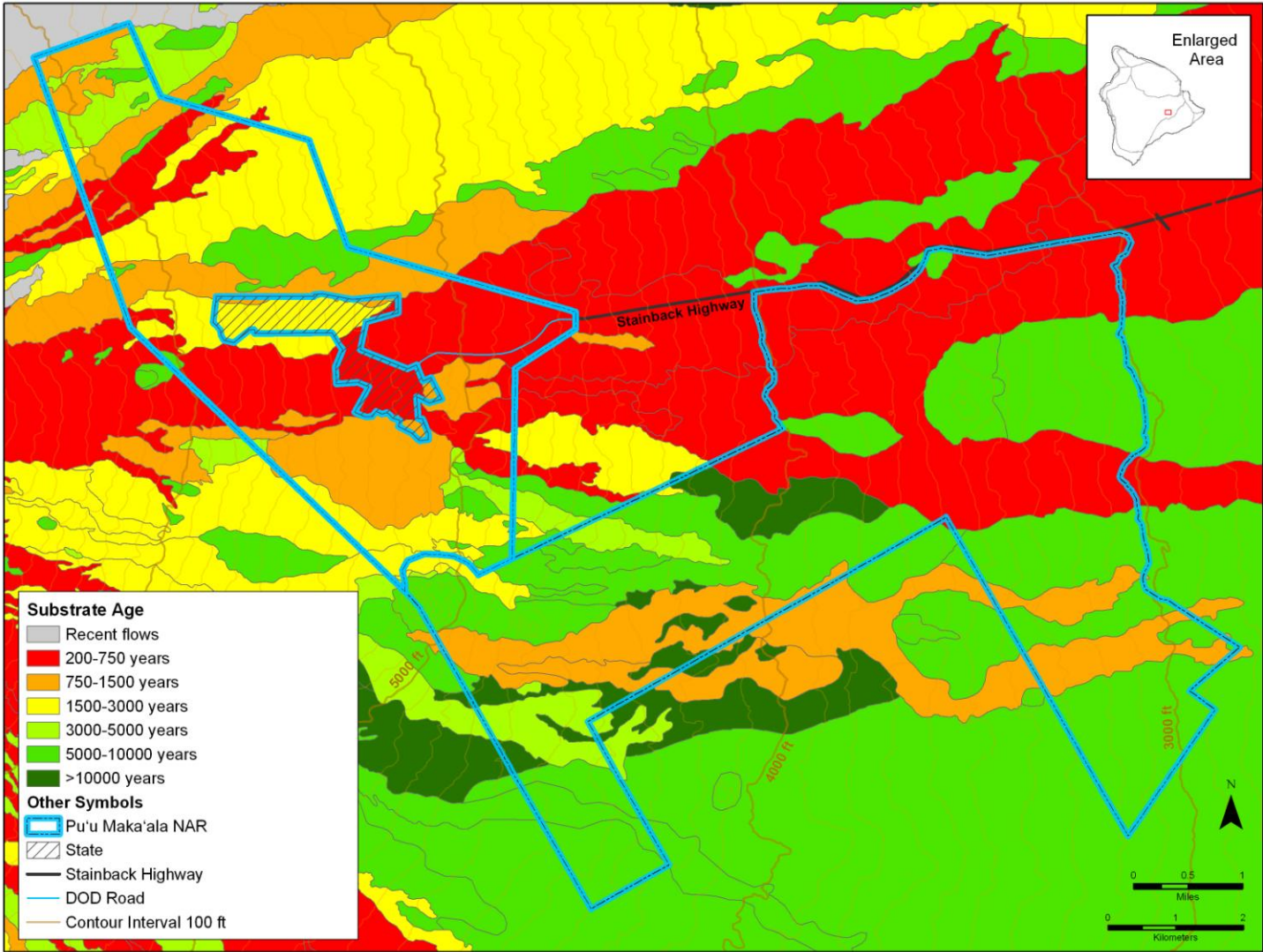
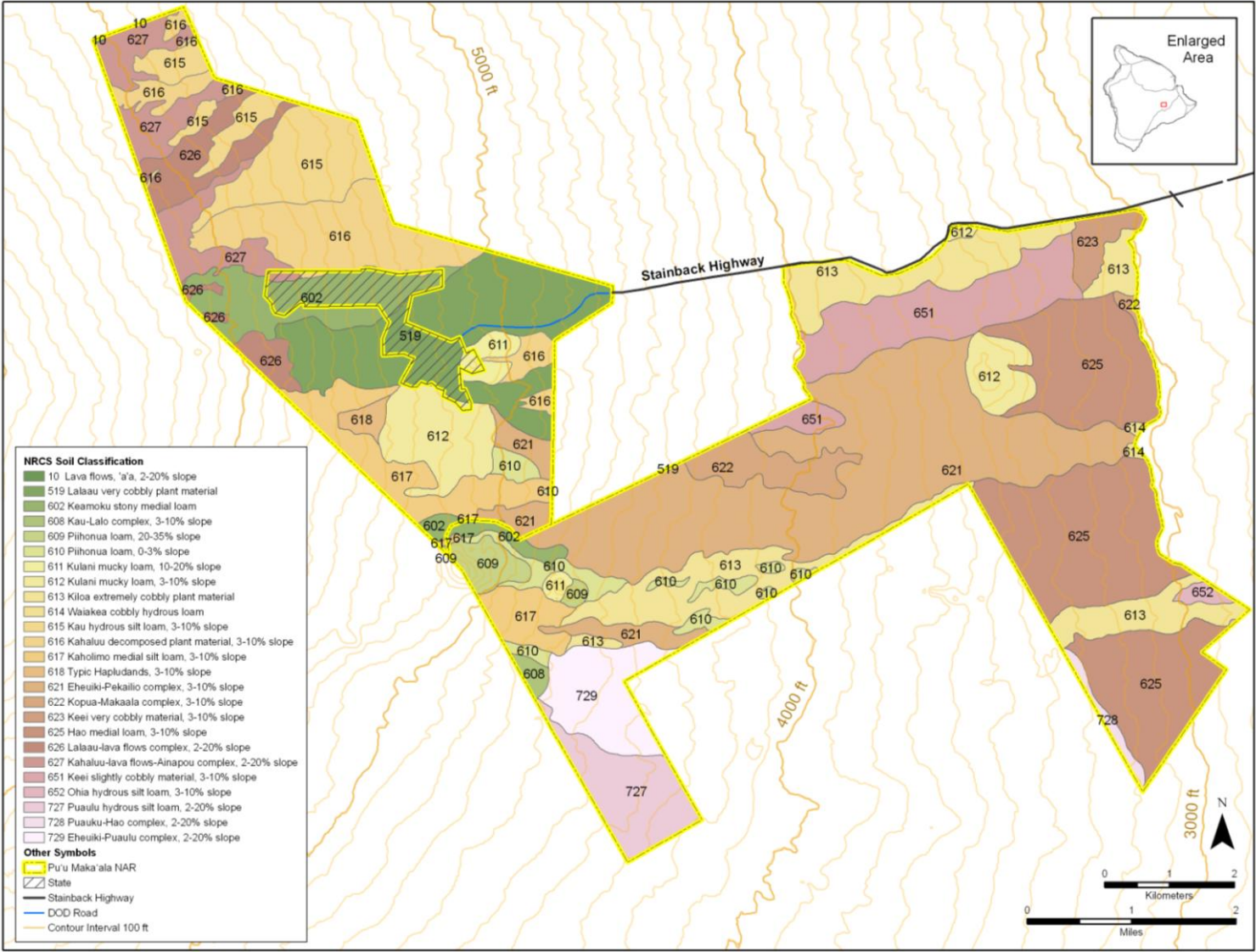


Figure 3. Pu'u Maka'ala Soils



Ecosystems and Species

Vegetation

Regionally, Pu‘u Maka‘ala NAR is an important conservation parcel and includes some of the best wet and mesic native forest on the island of Hawai‘i. It provides a link between the lower elevation ‘Ōla‘a Tract of Hawai‘i Volcanoes National Park and the higher elevation forests of Kīlauea, Keauhou and Upper Waiākea, thus protecting the transition between ‘ōhi‘a (*Metrosideros polymorpha*) and koa (*Acacia koa*) forest types. These forests contain a full mosaic of different-aged ‘ōhi‘a stands. While much of the forest is predominately ‘ōhi‘a canopy, characteristics of the forest (e.g. density of ‘ōhi‘a, composition of subcanopy and understory) change due to lava substrate type (ash, pāhoehoe, ‘a‘ā and cinder), lava flow age and elevation/rainfall.

Pu‘u Maka‘ala NAR contains three general vegetation zones: lowland wet, montane wet and montane mesic. The lowland wet vegetation zone includes areas in the NAR below 3,281 ft (1,000 m). This zone transitions into the montane wet forest zone at higher elevations and contains similar species. In the Kūlani portions of the NAR, the general trend is from montane wet forest in the east to mesic habitats at the upper elevation, western portions (Figure 4). Appendix A contains a list of plant species currently known from the NAR.

‘Ōhi‘a Lowland Wet Forest is present in the lower elevation, eastern side of the NAR (Figure 4). This forest type contains ‘ōhi‘a canopy with hāpu‘u (*Cibotium spp.*) and other native trees and shrubs similar to those in the ‘Ōhi‘a/Hāpu‘u Montane Wet Forest described below. Non-native weeds, particularly strawberry guava (*Psidium cattleianum*) are a major component of the lowland wet forests in the NAR. Along the NAR’s boundary, approximately 360 ac (146 ha) of tropical ash (*Fraxinus udei*) plantations constitute the Reserve’s only non-native dominated community. Within the scattered ash trees are elements of the surrounding ‘ōhi‘a/hāpu‘u forest, as well as a variety of non-native species. The tropical ash is spreading into the surrounding native-dominated forest and control of this species is addressed in the weed management program section of this plan.

The montane wet zone contains three native plant communities: ‘Ōhi‘a/Hāpu‘u Montane Wet Forest; Koa/‘Ōh‘ia Montane Wet Forest; and *Carex alligata* Montane Wet Grassland (Figure 4).

‘Ōhi‘a/Hāpu‘u Montane Wet Forest occupies the majority of the Reserve. A variety of substrate types result in a mosaic of different-age stands of ‘ōhi‘a/hāpu‘u forest. The closed ‘ōhi‘a canopies can exceed 75 ft (23 m) in height. Other sections of the ‘ōhi‘a/hāpu‘u forest are in various stages of dieback. These range from a few senescent trees to sections where all trees are dead and fallen, with a few snags standing over a 15 to 30 ft (4.5 to 9 m) canopy dominated by hāpu‘u and native trees. The hāpu‘u layer is dominated by *Cibotium glaucum* (hāpu‘u pulu), but hāpu‘u ‘i‘i (*C. menziesii*) and meu (*C. chamissoi*) can be locally abundant. Native trees include ‘ōlapa (*Cheirodendron trigynum*), kāwa‘u (*Ilex anomala*), pilo (*Coprosma spp.*), kōlea (*Myrsine lessertiana*), smaller stature ‘ōhi‘a, and occasionally naio (*Myoporum sandwicense*), manono (*Hedyotis spp.*), and loulou (*Pritchardia beccariana*). Vegetation under the hāpu‘u layer includes

a mix of native ferns such as *Pneumatopteris sandwichensis*, hō‘i‘o (*Diplazium sandwichianum*), ‘ama‘u (*Sadleria* spp.), *Dryopteris* spp., and uluhe (*Dicranopteris linearis*), native shrubs like kanawao (*Broussaisia arguta*), ‘ōhā wai (*Clermontia* spp.), ha‘iwale (*Cyrtandra* spp.), hāhā (*Cyanea* spp.), maile (*Alyxia oliviformis*), ālani (*Melicope* spp.), and ‘ōhelo (*Vaccinium* spp.), and herbs such as pa‘iniu (*Astelia menziesiana*) and ‘ala‘ala wai nui (*Peperomia* spp.). Sedges such as *Carex alligata* and *Uncinia uncinata* are also present.

Koa/‘Ōhi‘a Montane Wet Forest occupies a small portion of the northwestern edge of the Reserve on cinder and ash substrate in the Kūlani Cone area. Scattered individual koa trees, from 60 to 120 ft (18 to 36.5 m) in height, emerge from a layer of 30 to 90 ft (9 to 27 m) tall ‘ōhi‘a. Under the canopy is an association of native trees that include kōlea, kāwa‘u, ‘ōlapa, pilo, and young ‘ōhia. While the ‘ōhi‘a/hāpu‘u and koa/‘ōhi‘a wet forests share many of the same species, the ‘ōhi‘a/hāpu‘u wet forest contains a higher overall diversity due its larger area and expanded elevational range.

Carex alligata Montane Wet Grassland is scattered in small distinct patches throughout the Reserve, occupying low lying water-saturated areas such as cinder cone pits or depressions in the forest. These grasslands may consist entirely of *Carex* but may also include scattered shrubs of ‘ōhi‘a and patches of wawae’iole (*Lycopodium*). The largest examples in the NAR occupy cinder cone craters on Kūlani Cone and Na Lua Mahoe.

Montane mesic plant communities are found in the Kūlani portion of the NAR.

Koa/‘Ōhi‘a Montane Mesic Forest - Portions of Kūlani contain tall stature koa/‘ōhi‘a forest with other native trees and a hāpu‘u, native shrubs and ground fern understory. This forest type differs from the wet koa/‘ōhi‘a in that wet forest tends to have higher densities of hāpu‘u than mesic areas, which have more native trees and shrubs in the understory. Unless disturbed, both forest types have a diverse ground cover dominated by ferns.

‘Ōhi‘a Montane Mesic Forest - Portions of Kūlani contain plant communities composed primarily of open to closed canopy /‘ōhi‘a and an understory of native trees, shrubs, ferns and grasses without the prominent hāpu‘u component. This community can be found on intermediate aged lava flows as well as on young lava flows in association with other pioneer vegetation.

‘Ōhi‘a Woodland - This plant community consists of open canopy ‘ōhi‘a with mixed native trees and a native shrub and native grass (*Deschampsia nubigena*) understory. This community is found on young to intermediate aged lava flows in the higher elevation, drier parts of Kūlani. Some areas within this community have depressions in the lava flow surface that collect water and have formed perennial wetlands containing native grasses and sedges.

A diversity of native plants is found within the natural communities of Pu‘u Maka‘ala, including over 160 plant and fern species endemic to Hawai‘i (Appendix A contains a list of native and introduced plant species currently known from the NAR, including endemic species). Fifteen species of federally listed endangered plants occur in or near Pu‘u Maka‘ala NAR, and Pu‘u Maka‘ala contains federally designated critical habitat for seven endangered plants: *Argyroxiphum kauense*, *Clermontia lindseyana*, *Cyanea shipmanii*, *Sicyos alba*, *Cyrtandra*

giffardii, *Cyanea stictophylla*, and *Phyllostegia velutina*. Pu‘u Maka‘ala provides habitat for another twenty plant species that are Candidates for listing or considered Species of Concern (SOC) (Table 1).

Numerous other plant species historically and/or currently found in or near the NAR have no official status but are considered rare by NAR staff, other land managers and/or scientists. These species include: *Dubautia* sp. (unknown species), *Embilina pacifica* (kilioe), *Nothoctrum longifolium* (‘aiea), *Phyllostegia vestita*, *Phytolacca sandwicensis*, *Plantago pachyphylla*, *Platydesma spathulata*, *Stenogyne scrophularioides* (mā‘ohi‘ohi), *Tetraplasandra kavaiensis* (‘ohe ‘ohe), *Tetraplasandra oahuensis* (‘ohe mauka) and *Urera glabra* (ōpuhe).

Figure 4. Pu‘u Maka‘ala NAR Vegetation

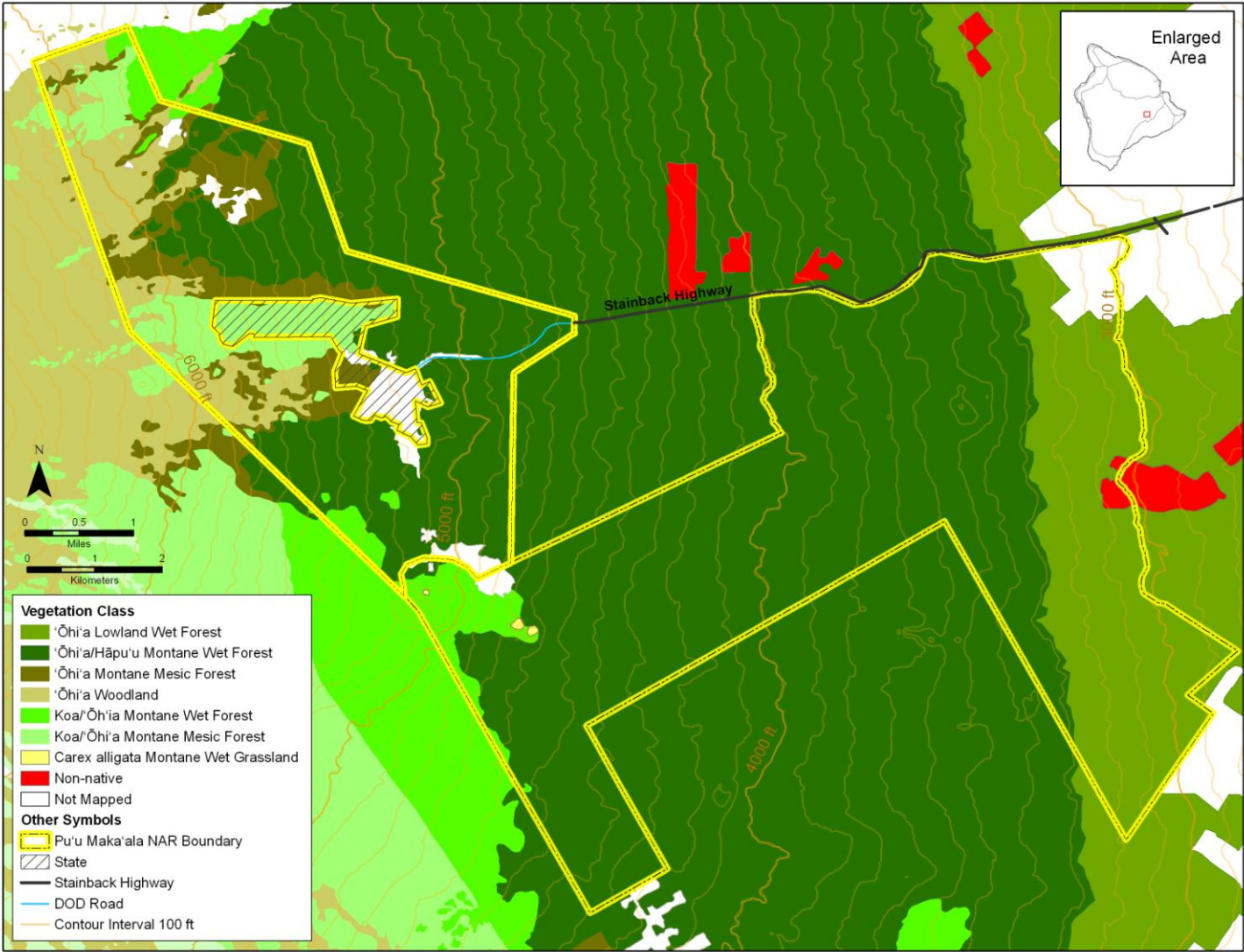


Table 1. Endangered and rare plant species historically and/or currently found in or near Pu‘u Maka‘ala NAR.

Taxon	Common name	Status*	NAR Critical Habitat	Location**
<i>Adenophorus periens</i>	palai la‘aū	E		‘Ōla‘a Tract
<i>Anoectochilus sandwicensis</i>	jewel orchid	SOC		‘Ōla‘a Tract
<i>Argyroxiphum kauense</i>	Mauna Loa silversword	E	Yes	Pu‘u Maka‘ala (Kūlani)
<i>Asplenium schizophyllum</i>		SOC		Pu‘u Maka‘ala
<i>Asplenium peruvianum</i> var. <i>insulare</i>		E		Kīlauea, Pu‘u Maka‘ala
<i>Clermontia lindseyana</i>	‘oha wai	E	Yes	Pu‘u Maka‘ala (Kūlani), Kīlauea
<i>Clermontia peleana</i>	‘oha wai	E		‘Ōla‘a FR, Pu‘u Maka‘ala
<i>Cyanea coplandii</i>	hāhā	E (X)		660-1,600 m wet forest
<i>Cyanea giffardii</i>	hāhā	SOC(X)		725-800 m wet forest
<i>Cyanea platyphylla</i>	‘akū‘akū	E		Pu‘u Maka‘ala
<i>Cyanea shipmanii</i>	hāhā	E	Yes	Pu‘u Maka‘ala (Kūlani), Kīlauea
<i>Cyanea stictophylla</i>	hāhā	E	Yes	Pu‘u Maka‘ala (Kūlani), Kīlauea, Pu‘u Maka‘ala
<i>Cyanea tritomantha</i>	‘akū	C		Pu‘u Maka‘ala
<i>Cyrtandra giffardii</i>	ha‘iwale	E	Yes	Pu‘u Maka‘ala
<i>Cyrtandra tintinnabula</i>	ha‘iwale	E		‘Ōla‘a Tract
<i>Eurya sandwicensis</i>	ānini	SOC		Pu‘u Maka‘ala
<i>Fragaria chiloensis</i> ssp. <i>sandwicensis</i>	‘ōhelo papa	SOC		Keauhou
<i>Gardenia remyi</i>	nānū	C		Upper Waiakea FR
<i>Joinvillea ascendens</i> ssp. <i>ascendens</i>	‘ohe	C		Pu‘u Maka‘ala
<i>Liparis hawaiiensis</i>	‘awapuhiakanaloa	SOC		‘Ōla‘a Tract
<i>Pittosporum hawaiiense</i>	hō ‘awa	SOC		Pu‘u Maka‘ala (Kūlani)
<i>Phyllostegia ambigua</i>		SOC		Pu‘u Maka‘ala
<i>Phyllostegis floribunda</i>		C		Pu‘u Maka‘ala, ‘Ōla‘a Tract Upper Waiakea FR

Taxon	Common name	Status*	NAR Critical Habitat	Location**
<i>Phyllostegia macrophylla</i>		SOC		Pu'u Maka'ala, Kīlauea
<i>Phyllostegia racemosa</i>	kīponapona	E		Keauhou
<i>Phyllostegia velutina</i>		E	Yes	Pu'u Maka'ala
<i>Pritchardia beccariana</i>	loulu	SOC		Pu'u Maka'ala
<i>Rubus macraei</i>	'ākala	SOC		Pu'u Maka'ala (Kūlani), Keauhou
<i>Schieda diffusa</i>		SOC		'Ōla'a Tract
<i>Sicyos alba</i>	'ānunu	E	Yes	Pu'u Maka'ala
<i>Sisyrinchium acre</i>	mau'u lā'ili	SOC		Pu'u Maka'ala (Kūlani)
<i>Stenogyne macrantha</i>	mā'ohi'ohi	SOC		Pu'u Maka'ala
<i>Trematolobelia grandifolia</i>	koli'i	SOC		Pu'u Maka'ala
<i>Vicia menziesii</i>	Hawaiian vetch	E		Kīlauea, Keauhou
<i>Zanthoxylum kauaense</i>	a'e, mānele, hea'e	SOC		Upper Waiakea and 'Ōla'a FR
* E = endangered; T = threatened; C = candidate for listing; SOC = species of concern; (X) = possibly extinct				
** Species with populations historically/currently known from Pu'u Maka'ala NAR or nearby locations are noted.				

Wildlife

The project area provides habitat for seven honeycreepers (Subfamily Drepanidinae) endemic to the Hawaiian Islands. These include four endangered species: Hawai‘i creeper (*Oreomystis mana*), Hawai‘i ‘ākepa (*Loxops coccineus*), ‘akiapōlā‘au (*Hemignathus munroi*) and ‘ō‘ū (*Psittirostra psittacea*), a species which has not been sighted in the area since the mid-1980’s and may be extinct. The non-endangered honeycreepers found in the project area include: ‘apapane (*Himatione sanguinea*), Hawai‘i ‘amakihi (*Hemignathus virens*), and ‘i‘iwi (*Vestiaria coccinea*). Other native forest birds reported from the project area include, ‘elepaio (*Chasiempis sandwichensis*), and ‘ōma‘o or Hawaiian thrush (*Myadestes obscurus*). Native forest birds are primarily found in the upper elevations of the NAR (above 4,000 ft (1,219 m)) elevation where lower numbers of mosquitoes reduce the incidence of diseases such as avian malaria and pox.

The Kūlani portion of the NAR is identified as a recovery area for Hawai‘i creeper, Hawai‘i ‘ākepa, and ‘akiapōlā‘au in the U.S. Fish and Wildlife Service (FWS) forest bird recovery plan and in the State Comprehensive Wildlife Strategy. Recovery areas are habitat that will allow for the long-term survival and recovery of endangered Hawaiian forest birds. The Kūlani area has some of the highest densities of native forest birds on the island. This relative abundance is due to large tracts of intact, upper elevation native forest. Kūlani may also be considered as a potential future release site for captively-raised Hawaiian crow, or ‘alalā (*Corvus hawaiiensis*). Although this species is not historically known from this area, ‘alalā are known historically from nearby (Hawaii Volcanoes National Park) and neighboring Keauhou is being considered as a possible release site. Other native birds known from the area include the endangered Hawaiian hawk or ‘io (*Buteo solitarius*), nēnē (*Branta sandvicensis*), Hawaiian owl or pueo (*Asio flammeus sandwichensis*) and Pacific golden-plover or kōlea (*Pluvialis fulva*). Additionally, the ‘ua‘u or Hawaiian petrel (*Pterodroma sandwichensis*) and the ‘akē‘akē or band-rumped storm petrel (*Oceanodroma castro*) may overfly the NAR going to nesting areas on the upper, eastern slopes of Mauna Loa.

Table 2. Native birds historically and/or currently found in or near Pu‘u Maka‘ala NAR.

Taxon	Common Name	Status
<i>Corvus hawaiiensis</i>	‘alalā, Hawaiian crow	endemic - endangered
<i>Asio flammeus sandwichensis</i>	pueo, Hawaiian owl	endemic
<i>Branta sandvicensis</i>	nēnē, Hawaiian goose	endemic - endangered
<i>Buteo solitarius</i>	‘io, Hawaiian hawk	endemic - endangered
<i>Chasiempis sandwichensis</i>	‘elepaio	endemic
<i>Hemignathus munroi</i>	‘akiapōlā‘au	endemic - endangered
<i>Hemignathus virens</i>	‘amakihi	endemic
<i>Himatione sanguinea</i>	‘apapane	endemic
<i>Loxops coccineus</i>	Hawai‘i ‘ākepa	endemic - endangered
<i>Oceanodroma castro</i>	‘akē‘akē, band-rumped storm petrel	indigenous - candidate
<i>Oreomystis mana</i>	Hawai‘i creeper	endemic - endangered
<i>Myadestes obscurus</i>	‘ōma‘o	endemic
<i>Pluvialis fulva</i>	kōlea, Pacific golden plover	indigenous
<i>Psittirostra psittacea</i>	‘ō‘ū	endemic – endangered

<i>Pterodroma sandwichensis</i>	‘ua‘u or Hawaiian petrel	endemic - endangered
<i>Vestiaria coccinea</i>	‘i‘iwi	endemic

Non-native birds including Japanese white-eye (*Zosterops japonicus*), red-billed leiothrix (*Leiothrix lutea*), northern cardinal (*Cardinalis cardinalis*) and kalij pheasant (*Lophura leucomelanos*) are common in the NAR.

Appendix B provides a list of native and non-native bird species currently and/or historically known from Pu‘u Maka‘ala.

Although native invertebrates were only incidentally noted during 1989 surveys, a high diversity of representative insects, spiders and snails, particularly *Succinia* spp. was observed. An arthropod survey conducted in 1995 using malaise traps, pitfall and pan traps, general collecting using an aerial sweep net, and visual searching collected and recorded 217 species of insects, related arthropods and land snails from the Wright Road unit of Pu‘u Maka‘ala. Of those identified, 58% were native species. Appendix C provides a list of invertebrates collected from the Pu‘u Maka‘ala section of the NAR during a 1995 survey, including non-native invertebrates and land snails. Table 3 summarizes notable insects found during the 1995 survey including: three species of picture wing flies (*Drosophila* spp.), three endemic genera of leaf hoppers (*Leialoha*, *Nesodyne*, and *Nesothoe*), and one species of endemic damselfly (*Megalagrion hawaiiense*). Portions of the NAR were surveyed for an endemic lineage of spiders: the genus *Tetragnatha*. Although spiders are one of the most important groups of predators in the Hawaiian forests, they are virtually unknown; perhaps because of they are almost exclusively nocturnal (Gillespie 1992). The NAR is federally designated as critical habitat for *Drosophila mulli*, a listed endangered picture wing fly which is dependant on the native loulu (*Pritchardia beccariana*). In 2011, the NARS Invertebrate Program organized a four-day invertebrate Bioblitz in the Kūlani section of the Reserve. This effort will result in an updated invertebrate species list for the Reserve as well as provide information for future management actions targeting native invertebrates.

Although the lava tube caves in the area have not been investigated, research in adjacent areas has documented a well-preserved cave fauna. Lava tube caves harbor specialized invertebrate species dependent on native forests above the caves (Mueller-Dombois et al. 1981).

Hawai‘i’s only endemic land mammal, the ‘ōpe‘ape‘a or endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), also uses the area but the Reserve has not been sampled for bat activity.

A variety of non-native animals such as feral pigs, rats (*Rattus* spp.), mice (*Mus musculus*), cats (*Felis catus*), and mongoose (*Herpestes auro punctatus*) are present in the Reserve. Coqui frogs (*Eleutherodactylus coqui*) have been found at Kūlani, at the facility complex, and in areas adjacent to the NAR such as along Stainback Highway.

Table 3. Notable Native Insects in Pu‘u Maka‘ala NAR (summarized from Preston 1995).

TAXA	DESCRIPTION
COLEOPTERA Aglycyderidae (Proterinid Weevils)	These tiny (less than 3 mm long) primitive weevils are remarkably diverse in Hawai‘i. About 175 species are known only from Hawai‘i; these constitute more than 90% of the world’s fauna in the family. The larvae are wood borers, mostly in twigs and stems of native plants, and most species are host specific. Unidentified species were collected in the NAR
DIPTERA Drosophilidae (Pomace Flies) <i>Drosophila</i> spp. (picture wing group)	Hawaiian Drosophilidae are one of the best studied examples of adaptive radiation. Over 600 species have been described, and another 200 species are known but not yet named. The existence of such a diverse fauna in Hawai‘i provides an ideal natural laboratory for comparative studies in evolutionary biology. At least 3 species belonging to the large "picture wing" group were collected. The NAR is critical habitat for the listed endangered species <i>Drosophila mulli</i> (not detected in the 1995 surveys by Preston).
Muscidae (House Flies and relatives) <i>Lispocephala confluens</i> (Malloch, 1928) <i>Lispocephala dexioides</i> (Grimshaw, 1901) <i>Lispocephala ingens</i> (Grimshaw, 1901)	The endemic genus <i>Lispocephala</i> contains over 100 known species, which are all predatory on other insects. Thirty species are known from the Big Island, and of these only 3 species were collected: <i>Lispocephala confluens</i> previously only known from Moloka‘i and Maui, <i>L. dexioides</i> , known only from Maui and the Big Island, and <i>L. ingens</i> , known from Oahu, Moloka‘i, Maui and the Big Island.
HETEROPTERA Miridae (Plant Bugs) <i>Hyalopeplus pellucidus</i> (Stål, 1859) <i>Orthotylus</i> spp. <i>Sarona</i> sp.	Hawaiian plant bugs remain poorly known (about 50 species have been named, but at least another 100 species are in collections). Most species are plant feeders, but many are predaceous or omnivorous. Many species are found only in a small geographical area and feed on a single species of plant. Three native species were identified: <i>Hyalopeplus pellucidus</i> is a common species with a wide host range, including guava and other alien plant species; <i>Orthotylus</i> , a widespread genus; and the endemic genus <i>Sarona</i> .
Nabidae (Damsel Bugs) <i>Nabis oscillans</i> Blackburn, 1888	The damsel bugs are all predatory on other insects. There are 30 Hawaiian species, but new species continue to be discovered. <i>Nabis oscillans</i> Blackburn, 1888 was collected.
Pentatomidae (Stink Bugs and Shield Bugs)	<i>Coleotichus blackburniae</i> , the koa bug, is the largest and most conspicuous native true bug (nearly an inch long and iridescent blue, green, maroon, and yellow). Once common on koa and a‘alii throughout Hawai‘i, it is now rare due to the introduction of several parasites for biological control of the pestiferous southern green stink bug in the 1960’s. Historically known from the NAR, but none were seen during this survey.
HOMOPTERA Cicadellidae <i>Nesophrosyne</i> spp.	Seven endemic genera of leaf hoppers, plant hoppers, and psyllids were collected. Several species in the native genus <i>Nesophrosyne</i> (Cicadellidae) were abundant.
Cixiidae <i>Iolania perkinsi</i> Kirkaldy, 1902 <i>Oliarus</i> (2 species)	<i>Iolania perkinsi</i> Kirkaldy, 1902 a native cixiid restricted to Hawai‘i island and associated with native ferns, was common. Specimens of two species in the other native genus <i>Oliarus</i> were also collected.
Delphacidae <i>Leialoha</i> sp. <i>Nesosydne</i> (2 species) <i>Nesothoe</i> sp.	Three endemic genera of leaf hoppers were common in Pu‘u Maka‘ala: <i>Leialoha</i> , <i>Nesosydne</i> , and <i>Nesothoe</i> .
HYMENOPTERA Ichneumonidae (Ichneumon wasps)	These wasps are parasites of other insects; the adult female searches for, and lays eggs in, suitable hosts. Individuals of several species were collected sporadically as expected. In addition, on one occasion, dozens

<p><i>Enicospilus nigrolineatus</i> Ashmead, 1901 <i>Enicospilus</i> (2 species) <i>Spolas</i> nr. <i>hawaiiensis</i> (Ashmead, 1901) <i>Spolas</i> (2 species)</p>	<p>of individuals of the native genus, <i>Enicospilus</i>, were collected. <i>Enicospilus nigrolineatus</i> (Ashmead, 1901), a very large and showy species was collected in every Malaise trap sample. Two undetermined <i>Enicospilus</i> spp. were also present in the trap in larger numbers. Three species in the native genus <i>Spolas</i> were also found as well as the ever abundant and purposely introduced parasite, <i>Ichneumon purpuripennis</i> Cresson, 1877. Other native species of wasps were collected in and around the trap sites, but identification will have to wait for specialists.</p>
<p>LEPIDOPTERA Crambidae (Crambid Moths) <i>Eudonia</i> (5 species) <i>Mestolobes minuscula</i> (Butler, 1881) <i>Mestolobes</i> sp.</p>	<p>The crambids are a diverse group of mostly small moths, which are exceptionally well-represented in Hawai'i (206 named species). The genus <i>Mestolobes</i> with 33 species is endemic to Hawai'i. <i>Mestolobes minuscula</i> (Butler, 1881) is a common moth in the lowlands yet nothing is known of its biology. Adults of many <i>Eudonia</i> species resemble the lichens upon which they rest, and the larvae are probably associated with lichens. There are over 100 species in the genus, but many remain undescribed.</p>
<p>Geometridae (Inchworms) <i>Eupithecia monticolens</i> Butler, 1881 <i>Scotorythra artemidora</i> Meyrick, 1899 <i>Scotorythra brunnea</i> (Warren, 1896) <i>Scotorythra euryphaea</i> Meyrick, 1899 <i>Scotorythra pachyspila</i> Meyrick, 1899</p>	<p>The genus <i>Scotorythra</i> contains 38 species, all endemic to the Hawaiian Islands. Two species, <i>S. diceraunia</i> Meyrick, 1928 and <i>S. euryphaea</i> Meyrick, 1899 are new records for the island of Hawai'i. Specimens of the predatory inchworm <i>Eupithecia monticolans</i> Butler, 1881 were also trapped.</p>
<p>Lycanidae and Nymphalidae (Blue and Brush-footed Butterflies) <i>Vanessa tameamea</i> Eschscholtz, 1821</p>	<p>Only two species of butterflies are native to Hawai'i, a blue (Blackburn's butterfly, or <i>Udara blackburni</i> (Tuely, 1878), which feeds on koa, a'alii and other legumes) and an admiral or brush-footed butterfly (Kamehameha butterfly or <i>Vanessa tameamea</i> Eschscholtz, 1821, which feeds on mamaki and other Urticaceae). Both species are locally common where their hosts are found. Only the Kamehameha butterfly was observed flying near both trapping sites.</p>
<p>ODONATA Coenagrionidae (Damselflies) <i>Megalagrion hawaiiense</i> (McLachlan, 1883)</p>	<p>There are 29 species in the endemic genus <i>Megalagrion</i>. <i>M. hawaiiense</i> (McLachlan, 1883) was frequently encountered in rain puddles throughout the Reserve. The historic record yielded 5 other species of damselflies known to inhabit the Reserve. <i>M. calliphya microdemas</i> (Perkins, 1899), <i>M. peles</i> (Perkins, 1899) and two alien species: <i>Enallagma civile</i> (Hagen, 1862) and <i>Ischnura ramburii</i> (Selys-Longchamps).</p>
<p>ORTHOPTERA Gryllidae (Crickets) <i>Laupala</i> spp. <i>Paratrigonidium</i> sp.</p>	<p>There are 243 native species of crickets known from Hawaii (Otte 1994), which is more than twice as many as the total number known from the rest of the United States. Most native species have restricted ranges; some are known from only small areas within single islands. Their great diversity makes them ideal for evolutionary studies (Otte, 1994). Hawaiian crickets live mostly in trees and shrubs, but some forage in the leaf litter. Most are omnivores, feeding on both plant and animal material. Two native genera of swordtail crickets (<i>Trigonidium</i> and <i>Laupala</i>) were collected in Pu'u Maka'ala.</p>

PU‘U MAKA‘ALA NAR: SOCIOCULTURAL RESOURCES***Land Use***

All of Pu‘u Maka‘ala NAR is located within the State Conservation District. The Reserve includes both the Protective and Resource Subzones. Conservation District Use Permit no. SH-3/9/81-1340 approves the creation and management of the NAR as a permitted use of the Conservation District. Under the 2005 Hawai‘i County General Plan, all of Pu‘u Maka‘ala is designated as Conservation by the Land Use Pattern Allocation Guide. The area is not within the County’s Special Management Area. The Pu‘u Maka‘ala Management Plan is consistent with or implements portions of numerous existing plans and cooperative efforts (Table 4).

In July 2009, the Division of Public Safety announced the closure of the 7,244 acre (2,932 ha) Kūlani Correctional Facility. In May 2010, The NARS Commission recommended the addition of portions of Kūlani to Pu‘u Maka‘ala NAR, which was approved by the Board of Land and Natural Resources (BLNR) in September 2010. In November 2010, the Governor signed Executive Order 4338 adding 6,600 ac (2,671 ha) of Kūlani to Pu‘u Maka‘ala NAR.

The NAR surrounds approximately 600 ac (243 ha) of state lands formerly used by Kūlani Correctional Facility. The main campus of the former Kūlani Correctional Facility (approximately 280 ac (113 ha)) is being used by DOD-YCA under a revocable permit from DLNR (Figure 15). DOFAW has access, utility and conservation easements over this area, and DOD-YCA and DOFAW are required to develop a memorandum of agreement regarding access by DOFAW over the internal roads, conservation management, road maintenance, and conditions under which public access will be permitted, etc. The memorandum of agreement will be presented to the BLNR by January 28, 2011. DOD-YCA is planning to use these lands until they find a new location for their program and/or the State Division of Public Safety decides to reopen Kūlani Correctional Facility. DOFAW will be requesting approximately 342 ac (138 ha) of former pasture as an addition to Pu‘u Maka‘ala NAR (Figure 15). DOFAW currently has a right of entry permit for this area for data collection, survey and conservation management while this request is processed. This area is a high priority for addition to the NAR due to the recovery of ‘ōhi‘a - koa forests following the removal of cattle in 2005 and the presence of rare and endangered plants and animals.

Public access is allowed in the NAR for recreational and cultural uses. Current public use of Pu‘u Maka‘ala primarily includes hiking, bird watching, and hunting. Hunting in portions of the NAR is regulated by Chapter 13-123, Hawaii Administrative Rules (Rules Regulating Game Mammal Hunting), and areas where hunting is allowed are designated as part of Hunting Unit K. Some uses, including hiking or nature study with groups larger than ten, research, scientific collecting, gathering (including Native Hawaiian religious and customary gathering rights) and commercial uses require a Special Use Permit from the Executive Secretary of the NARS Program in Honolulu (808-587-0063) (Hawai‘i Administrative Rules 13-209).

Table 4. Consistency with other plans and cooperative efforts.

Plan/Cooperative Effort	Comment
The Rain Follows the Forest - A Plan to Replenish Hawaii's Source of Water (DLNR, November 2011)	The Reserve is identified as a priority watershed area on the island of Hawai'i
DOFAW Statewide Assessment and Resource Strategy (SWARS) 2010	Identifies areas of greatest need and opportunity for forests in Hawaii and develops a long-term strategy for management. Objectives include: 1.1. Identify and conserve high-priority forest ecosystems and landscapes; 2.2. Identify, manage and reduce threats to forest and ecosystem health; 3. 3. Enhance public benefits from trees and forests; 3.1. Protect and enhance water quality and quantity; 3.5. Protect, conserve and enhance wildlife and fish habitat; 3.7. Manage and restore trees/forests to mitigate and adapt to global climate change.
U.S. Fish and Wildlife Designation of Critical Habitat for 12 Species of Picture-Wing Flies From the Hawaiian Islands (2009)	Supports recommendations for habitat management for <i>Drosophila mulli</i>
Three Mountain Alliance (TMA) Management Plan (2008) and TMA Weed Management Plan (2009)	Supports mission and goals of the TMA watershed partnership and TMA weed management
Puna Community Development Plan (2008)	Mentions Pu'u Maka'ala NAR and discusses the importance of preserving native forests and species.
U.S. Fish and Wildlife Revised Recovery Plan for Hawaiian Forest Birds (2006)	Supports recovery actions 1 and 2: protect and manage ecosystems for the benefit and recovery of native forest birds.
Hawai'i Comprehensive Wildlife Conservation Strategy (2005)	Implements objectives 1, 2, 3, 4, and 5
County of Hawai'i General Plan (2005)	8.2(c) Protect and promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources. 8.2 (d) Protect rare or endangered species and habitats native to Hawai'i. 8.3 (b) Encourage a program of collection and dissemination of basic data concerning natural resources. 8.3 (e) Encourage an overall conservation ethic in the use of Hawai'i resources by protecting, preserving, and conserving the critical and significant natural resources of the County. 8.3 (o) Encourage the continued identification and inclusion of unique wildlife habitat areas of native Hawaiian flora and fauna with the NARS.
U.S. Fish and Wildlife Final Designation and Nondesignation of Critical Habitat for 46 Plant Species From the Island of Hawaii, HI (2003)	Supports recommendations for habitat management for <i>Sicyos alba</i> , <i>Cyrtandra giffardii</i> , <i>Cyanea stictophylla</i> , and <i>Phyllostegia velutina</i>
U.S. Fish and Wildlife Service Recovery Plan for the Multi-Island Plants (1999)	Supports objective 1: protect habitat and control threats for <i>Adenopherus periens</i>
U.S. Fish and Wildlife Service. Big Island II: Addendum to the Recovery Plan for the Big Island Plant Cluster (1998a)	Supports objective 1: protect current populations and manage threats for <i>Phyllostegia racemosa</i> , <i>Phyllostegia velutina</i> and <i>Sicyos alba</i> .
U.S. Fish and Wildlife Service Final Recovery Plan for Four Species of Hawaiian Ferns (1998b)	Supports objective 1: protect current populations and manage threats for <i>Asplenium peruvianum</i> var. <i>insulare</i>
U.S. Fish and Wildlife Recovery Plan for the Hawaiian Hoary Bat (1998c)	Supports objective 2: protect and manage current populations and identify and manage threats
U.S. Fish and Wildlife Recovery Plan for the Big Island Plant Cluster (1996)	Supports objective 1: protect current populations and manage threats for <i>Clermontia lindseyana</i> , <i>Clermontia peleana</i> , <i>Cyanea copelandii</i> , <i>Cyanea stictophylla</i> ,

<i>Cyrtandra giffardii</i> , and <i>Cyrtandra tintinnabula</i> .
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Cultural Resources

In 2004, Kumu Pono Associates prepared *He Mo'olelo 'Āina: A Cultural Study of the Pu'u Maka'ala Natural Area Reserve, District of Hilo and Puna, Island of Hawai'i*, a detailed study of historical and archival literature and limited oral history interviews and consultation with kama'aina and others with knowledge of the land. This document is an important reference for cultural resources management in the NAR. Excerpts from the study are included below. The complete study is available at <http://hawaii.gov/dlnr/dofaw/nars/reserves/big-island/puumakaala>.

“The Natural Area Reserve takes its name from Pu'u Maka'ala, literally, Stay-alert Hill—named by State Forester, Ralph Daelher in the early 1960s—the summit of which is situated a little more than 3,600 feet above sea level. While the name of the *pu'u* is of recent origin, no older name identifiable with the hill was located. Many *pu'u* on the uplands slopes of the Hilo and Puna Districts are named, and it is likely that in traditional times this hill too had a name or names, depending on the area it was viewed from.

The native traditions and historical accounts associated with the neighboring lands of the upper Hilo-Puna forests span many centuries, from Hawaiian antiquity to the later period following western contact. The narratives describe customs and practices of the native people who resided on these lands, walked the trails, and who were sustained by the wealth of the forest lands.

Among the most detailed descriptions of the Hilo-Puna forest lands, including documentation of traditional and customary rights, are those found in the Kingdom collections, documenting the history of land tenure, and defining the boundaries of *ahupua'a* of Waiākea and 'Ōla'a. Detailed oral testimonies from elder native tenants were taken in court proceedings of the mid to late 1800s, document the occurrence of traditional and customary practices, and nature of the resources within given *ahupua'a*. In those records, we learn of the traditional knowledge and occurrence of native practices in the lands which today are a part of, and adjoin the Pu'u Maka'ala NAR.

Because the lands of the upper 'Ōla'a and Waiākea region were remote, it appears that access was most frequently made by specialists in the collection of bird feathers, the makers of canoes, and collectors of other unique items for which the region may have been known. Except for the detailed narratives of the tradition of Pikoi-a-ka-'alalā, most other traditions, and early historical accounts by native Hawaiians, seem to place the routes of travel beyond the limits of the lands within the Pu'u Maka'ala NAR. The main routes being out of Hilo through 'Ōla'a, *mauka*, near its boundary with Kea'au, or *mauka* between Kīlauea, across Keauhou (of Kapāpala in Ka'ū), within view of the boundary between 'Ōla'a (Pu'u Kūlani), and out across the Waiākea and Humu'ula lands of the Hilo District. Thus, there appears to be little specific reference in the historical record to the immediate study area lands.

From the journals, letters, and articles of historic visitors traveling the routes mentioned above, we are given a glimpse into the nature of the landscape, and a record of changes

thereon, with the passing of time. As outlying lands were changed—resulting from the impacts of introduced grazing animals, and in some instances from lava flows of Mauna Loa—we develop a sense of why the Pu‘u Maka‘ala NAR is important to the future well-being of the Hawaiian natural environment. The NAR is a remnant of the unique cultural and natural landscape as described in the traditional accounts.

In Hawai‘i prior to western contact, all land, ocean and natural resources were held in trust by the high chiefs (*ali‘i ‘ai ahupua‘a* or *ali‘i ‘ai moku*). The use of land, fisheries and other resources was given to the *hoa‘āina* (native tenants) at the prerogative of the *ali‘i* and their representatives or land agents (*konohiki*), who were generally lesser chiefs as well. By 1845, the Hawaiian system of land tenure was being radically altered, and the foundation for implementing the *Māhele ‘Āina* (a fee simple right of ownership) was set in place by Kamehameha III. Following implementation of the *Māhele*, the King also initiated a land grant program, issuing fee simple “Royal Patents” on granted land. In addition to the sale of fee-simple interests in land, the Crown and Government lands were also made available for leases and, in some cases, for sale. Together, these three land programs opened the door for the development of the large ranching interests in the lowlands below ‘Ōla‘a and Waiākea, and on the Keauhou-Kapāpala forest lands. Because of the remote nature of the lands and dense forests of the ‘Ōla‘a-Waiākea lands that make up the Pu‘u Maka‘ala NAR, no leases or conveyances were recorded for those lands. This said, it is likely that Hawaiian visitation collection of resources associated with traditional and customary practices continued in the Pu‘u Maka‘ala NAR lands for some time through the middle to late 1800s.

In 1862, a Commission of Boundaries (the Boundary Commission) was established in the Kingdom of Hawai‘i to legally set the boundaries of *ahupua‘a* that had been awarded to *Ali‘i*, *Konohiki*, and foreigners during the *Māhele*. In 1874, the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them (W.D. Alexander in Thrum 1891:117-118). The primary informants for the boundary descriptions were old native residents of the areas being discussed (generally born between the 1780s to 1820s).

Native testimonies describe a wide range of traditional practices in the uplands of Waiākea, ‘Ōla‘a, and in adjoining lands. The types of usage includes: travel on native trails, land use in a wide range of elevational zones; collection of resources; the collection of, or “hunting” of birds; canoe making; and the subsequent practices associated with hunting introduced ungulates—all under the control of *Konohiki*. In regards to hunting, it will be noted that descriptions of traditional hunting practices are limited to native species of birds, including the *ua‘u*, *nēnē*, *mamo* and *‘ō‘ō*; while description of historical hunting practices are limited to goats, which were hunted under contract of *Konohiki*, the Crown, or the Government. The testimonies also record that changes had occurred on the landscape during the lifetime of the witnesses. It is of importance to note that the boundaries were known by the native tenants, and the rights to take or hunt resources in traditional times were fiercely protected—individuals without chiefly, genealogical claims, or residency ties to given lands were not allowed to trespass and take resources from the *ahupua‘a*.

Our review of more than 60,000 native Hawaiian land documents dating from 1846 to 1910

revealed many references to *pua‘a* (pigs), but nearly every reference was in the context of them being near-home and as being cared for (raised), not hunted. In the same review of the native Hawaiian land documents and a large collection of writings from native authors (e.g., D. Malo, 1951; J.P. Ii, 1959, S.M. Kamakau 1961, 1964 & 1976), every reference to traditional collection or “hunting” (a word seldom used in the historical records), was in the context of native birds—those used either for food or from which feathers were collected for royal ornaments and symbolic dress.

After ca. 1815, we find that when native Hawaiians went hunting in the uplands—as described in testimonies and historical texts of the time—they were hunting bullocks, goats and other introduced grazers, and this was generally done on the demand of their landlords, and later for the growing ranches being established in the islands. The first full-scale efforts of western-style hunting in the Humu‘ula-Waiākea and Keauhou (Ka‘ū) region does not appear in reference until around 1840 (cf. Kamakau, 1961; Government Communications in this study). Those early outings were focused on collection of hides and tallow; and controlling wild herds of animals that were a threat to travelers, agricultural fields, residences, and forest resources.

Because of the remote nature of the ‘Ōla‘a and Waiākea forest lands which comprise the present-day Pu‘u Maka‘ala NAR, no government communications pertaining to historic trails or government road projects exist for the region. Boundary Commission testimonies describe trails through the forest lands, rising from the lowlands of Waiākea, ‘Ōla‘a, Keauhou and Humu‘ula. Based on the native traditions and *kama‘āina* testimonies, it is likely that “practitioner” trails existed throughout the forest region. Features such as “*kauhale manu*” (bird-catcher’s shelters), “*kahua kalaiwaa*” (canoe-makers clearings), “*oioina*” (trailside resting places and shelters), the “*ala hele*” (trails), and other features associated with traditional and customary accesses, would leave little evidence in the present-day, as the traditional features and uses generally had minimal impact on the natural landscape. Those things left behind, not cared for or maintained, were simply reabsorbed into the landscape.

In the early 1900s, the Hilo and ‘Ōla‘a forest lands were determined to be of significance, and worthy of protection. In between 1905 to 1928, the lands of the ‘Ōla‘a and Waiākea Forest Reserves, and the neighboring Kīlauea Forest Reserve were dedicated to the public interest as unique natural resources.

It appears that it was not until the late 1940s, that a road was cut up through the Waiākea-‘Ōla‘a forest lands, and this in conjunction with the opening of the Kūlani Prison Farm.

Hawaiian traditions and beliefs, shared spiritual and familial relationships with the natural resources around them. Each aspect of nature from the stars in the heavens, to the winds, clouds, rains, growth of the forests and life therein, and everything in the land and in the ocean, was believed to be alive. Indeed, every form of nature was a body-from of some god or lesser deity. As an example, in this context, and in association with lands which are now included in a part of the landscape of the Pu‘u Maka‘ala NAR, we find the Kū-ka-‘ōhi‘a-Laka, is a defied guardian of the ‘*ōhi‘a* growth of ‘Ōla‘a; *Ua-kuahine*, is the body form of a

goddess of the rains in ‘Ōla‘a; and *Kū-lili-ka-ua* is the god of the thick mists that envelop the forests of the upper Puna, Waiākea, and Keauhou lands. Indeed, tradition also tells us that the gods and goddesses of these forest lands were very protective of them. In olden times, travel through them was accompanied by prayer, and care. Traditions tell us that many a careless traveler, or collector of resources, found themselves lost in a maze of overgrowth and dense mists, for disrespectful and careless actions.

In the Hawaiian mind, care for each aspect of nature, the *kino lau* (myriad body-forms) of the elder life forms, was a way of life. This concept is expressed by Hawaiian *kūpuna* (elders) through the present day, and is passed on many native families. When discussing the relationship of native families with the lands and resources around them, it is not uncommon to hear *kūpuna* express the thought — “*E mālama i ka ‘āina, a e mālama ho ‘i ka ‘āina iā ‘oe! E mālama i ke kai, a e mālama ho ‘i ke kai iā ‘oe!*” (Care for the land, and the land will care for you! Care for the sea, and the sea will care for you!). This concept is one that is centuries old and is rooted the spirituality of the Hawaiian people. Importantly, the converse is that when one fails to care for, or damages nature—the *kino lau*—around them, they are in-turn punished. This is expressed in many traditional sayings, one being, “*Hana ‘ino ka lima, ‘ai ‘ino ka waha!*” (When the hands do dirty-defiling work, the mouth eats dirty-defiled food!). In this cultural context, anything which damages the native nature of the land, forests, ocean, and *kino lau* therein, damages the integrity of the whole.

Writing in the late 1860s and early 1870s, native historian, S.M. Kamakau, related to readers some aspects of the Hawaiian association and understanding of the mountain lands and forests. While describing traditional knowledge of the divisions of land, Kamakau wrote:

Here are some other divisions of the islands, together with their descriptive names.

Heights in the center or toward the side of a land, or island, are called *mauna*, mountains, or *kuahiwi*, “ridge backs.” The highest places, which cover over with fog and have great “flanks” behind and in front (*kaha kua, kaha alo*)—like Mauna Kea—are called *mauna*; the place below the summit, above where the forests grow is the *kuahiwi*. The peak of the mountain is called *pane po ‘o* or *piko*; if there is a sharp point on the peak it is called *pu ‘u pane po ‘o*; if there is no hill, *pu ‘u*, and the peak of the mountain spreads out like the roof of a house, the mountain is described as a *kauhuhu mauna* (house ridgetop mountain); and if there is a precipitous descent, *kaolo* [from the peak] to the *kauhuhu mauna* below this is called a *kualo* (“block”). If there are deep ravines (‘*alu ha ‘aha ‘a*) in the sides of the mountain it is called a *kihi po ‘ohiwi mauna* (“shoulder edge” mountain). A place that slopes down gradually (*hamo iho ana*) is called a *ho ‘oku ‘u* (a “letting down”); a sheer place is called a *pali lele koa ‘e* (cliff where *koa ‘e* birds soar), or a *holo* (“slide”), or a *waihi* (a “flowing down”). Rounded ridges that extend from the mountains or “ridge backs” or hills are called *lapa* or *kualapa* or *mo ‘o*—and, if they are large, ‘*olapalapa* or ‘*omo ‘omo ‘o*. Depressions between *lapa* or *mo ‘o* are *awawa*, valleys.

Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi*. A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (*'ano*). The part directly in back and in front of the summit [Kamakau 1976:8] proper is called the *kuamauna*, mountaintop; below the *kuamauna* is the *kuahea*, and *makai* of the *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele*. *Makai* of this region the trees are tall, and this is the *wao lipo*. *Makai* of the *wao lipo* is the *wao 'eiwa*, and *makai* of that the *wao ma'ukele*. *Makai* of the *wao ma'ukele* is the *wao akua*, and *makai* of there the *wao kanaka*, the area that people cultivate. *Makai* of the *wao kanaka* is the *'ama'u*, fern belt, and *makai* of the *'ama'u* the *'apa'a*, grasslands.

A solitary group of trees is a *moku la'au* (a “stand” of trees) or an *ulu la'au*, grove. Thickets that extend to the *kuahiwi* are *ulunahela*, wild growth. An area where *koa* trees suitable for canoes (*koa wa'a*) grow is a *wao koa* and *mauka* of there is a *wao la'au*, timber land. These are dry forest growths from the *'apa'a* up to the *kuahiwi*. The places that are “spongy” (*naele*) are found in the *wao ma'ukele*, the wet forest.

Makai of the *'apa'a* are the *pahe'e* [*pili* grass] and *'ilima* growths and *makai* of them the *kula*, open country, and the *'apoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the *'ae kai*, the water's edge.

That is the way *ka po'e kahiko* named the land from mountain peak to sea. [Kamakau 1976:9]

Among the native terms listed by Kamakau above, is one which stands out in reference to the Waiākea-‘Ōla‘a forest lands of the Pu‘u Maka‘ala NAR—this zone is the *wao akua* (zone or region of the gods and deities). The *wao akua* is so named because of the pattern of cloud cover and precipitation which settles upon the mountain slope—this covering was interpreted as concealing from view the activities of the gods and deities therein (cf. David Malo 1959:16-18; and M.K. Pukui, pers. comm. 1975).

In the traditional context above, we find that the mountain landscape, its' native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property. Its protection, and the continued exercise of traditional and customary practices, in a traditional and customary manner, are mandated by native custom, and State and Federal Laws (as those establishing the ‘Ōla‘a and Waiākea Forest Reserves, the Pu‘u Maka‘ala NAR, and the Endangered Species Act).

In this discussion, protection does not mean the exclusion, or extinguishing of traditional and customary practices, it simply means that such practices are done in a manner consistent with cultural subsistence, where each form of native life is treasured and protected. *Kūpuna* express this thought in the words, “*Ho'ohana aku, a ho'ōla aku!*” (Use it, and let it live!).”

Additional information on the cultural resources of the Reserve is contained in cultural study for Keauhou, an adjacent area (Maly 2005). This study contains boundary commission testimonies for Keauhou and includes descriptions of adjacent areas, including Kūlani (Kūlani Cone and Pu‘u Kipu); the history of the establishment of the ‘Ōla‘a, Waiākea and Kīlauea Forest Reserves; and a description of Kūlani Cone by Joseph Rock in 1919.

Archaeological and Historic Sites

The State Historic Preservation Division has no records of historic properties or archeological sites from Pu‘u Maka‘ala NAR. Most of this dense forest area has not been surveyed for sites. Previous archeological surveys for fence construction projects did not identify any archeological sites. Trails, small forest shrines, burial caves and lava tube shelters are the types of features that may be present, as the greater area was used historically by Hawaiians for activities such as bird hunting, harvesting timber for canoe-making and gathering forest plants for medicinal uses.

In a study for a sewage treatment plant for Kūlani Correctional Facility, Rechman (2001) reported that project site falls within the rainforest zone as defined by McEldowney (1979). The archeological expectations for the general area are very limited. Pre-contact period bird catchers may have ventured into the forest seasonally and established temporary residences. Such sites would have been constructed of perishable materials.

Rechman’s report (2001) noted that the summit of Pu‘u Kūlani or Kūlani Cone marks the traditional land divisions of South Hilo, Puna and Kā‘u and this Pu‘u should be considered a cultural property due to references in chant and legend.

The Puu ‘Ō‘ō trail, a historic cattle crossing route from Keauhou to Humu‘ula, is just above the Kūlani portion of the Reserve.

The Kūlani portion of the Reserve was used since 1946 as a prison camp, and certain areas were used for logging, ranching and other activities. Hawai‘i Tribune Herald newspaper printed a series of articles on the history of Kūlani Correctional Facility and Kūlani Rd by Kent Warshauer in 2001. The Kūlani road was completed in 1945 by prison work crews from Waiākea prison camp, which was moved to Kūlani in 1946. The road from the main facility complex to an area that would become Mauna Loa Boys School, a home for delinquent boys, was completed in 1946. Construction of the Boy’s School was completed in 1952 and the facility opened as Mauna Loa Forestry Camp - modeled after the Civilian Conservation Corps camps. One proposed activity for the boys would be to plant koa and naio to replace timber cut by Kūlani inmates. The Camp had numerous issues with boys escaping, including the fatality of one boy. When Territorial House members toured the camp in 1953 they called the project “one of the most expensive and impractical projects ever constructed in the Territory of Hawai‘i,” and they closed the facility later that year. Since closure the facility was used intermittently by Kūlani Correctional Facility and by the military for training.

Warshauer (2002) also wrote about the history of the Army Rd area of the Reserve, which was used by the military from 1964 - 1970 for the testing of chemical and biological weapons.

Infrastructure

Infrastructure within Pu‘u Maka‘ala NAR primarily consists of roads, unimproved trails, and fencing. No recreational facilities (e.g., bathrooms, freshwater sources, improved campsites) exist within Pu‘u Maka‘ala NAR.

Public access into the NAR is primarily via Wright Road or Stainback Highway (Figure 11).

DOFAW has an access, utility and conservation easement for staff management purposes through the internal roads of the Kūlani Facility (area under revocable permit to DOD-YCA).

The Reserve contains the Mauna Loa Boy’s School facility which has not been maintained and is in currently in severe disrepair. Other former correctional facility infrastructure is also present in the Reserve (e.g. old ranch fencing, water tanks, water catchments, and roads).

Regional Partnerships

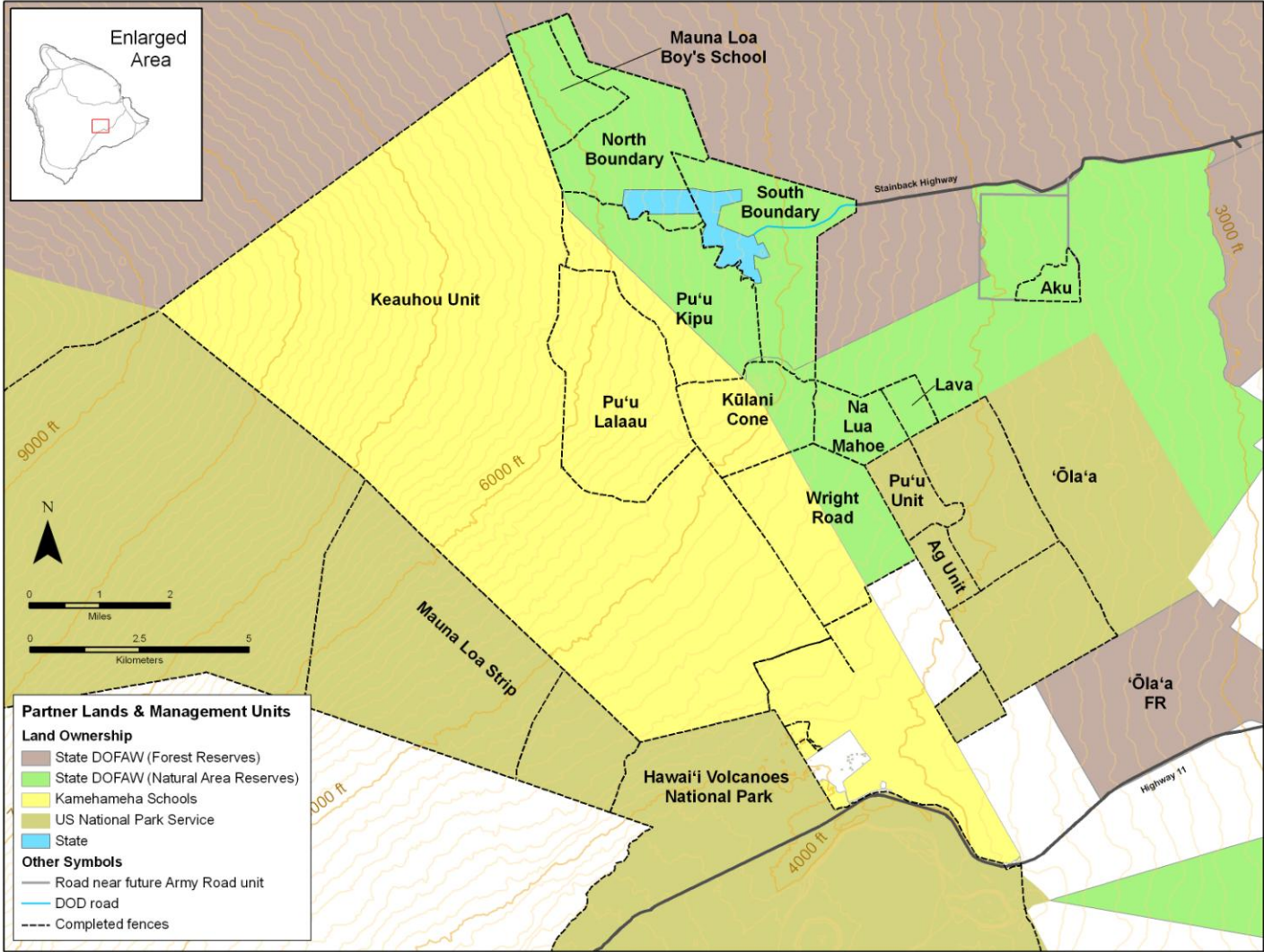
Existing management of Pu‘u Maka‘ala NAR has significantly benefited from cooperation with adjacent landowners, particularly the ‘Ōla‘a -Kīlauea Partnership (now called the Three Mountain Alliance (TMA)) (Figure 5). The TMA is a voluntary public-private partnership of landowners and agencies with a management interest in the landscape and a goal to coordinate conservation management on a landscape level. The overall management goal of TMA is to sustain the multiple ecosystem benefits, provided by the three mountains of Kīlauea, Mauna Loa, and Hualālai, by responsibly managing its watershed areas, native habitat and species, historical, cultural, and socio-economic resources for all who benefit from the continued health of the three mountains.

The intact montane native forest area including Pu‘u Maka‘ala was the initial focus of the TMA and forms the core of conservation management in the region. The TMA assisted with the construction and maintenance of existing fencing, including fencing at Kūlani, and collaboration with the TMA has increased the effectiveness of monitoring, weed and ungulate control efforts in the NAR. Fencing at Pu‘u Maka‘ala is linked to fencing in adjacent areas (Kamehameha Schools lands and Hawai‘i Volcanoes National Park) to make a much larger protected area, enhancing joint management for conservation across the larger landscape. Three fenced units in the NAR cross ownership boundaries and include both NAR and Kamehameha Schools lands (Pu‘u Kipu, Kūlani Cone and Wright Rd. units) (Figure 5). These units were constructed to take advantage of existing roads and cleared areas and protect native forest on an ecosystem level rather than by land ownership.

The TMA has fenced and removed ungulates from over 14,000 ac (5,666 ha), and ungulate control work is underway in an additional 20,000 ac (8,094 ha) that has already been fenced. These units on Pu‘u Maka‘ala NAR and Kamehameha Schools lands (Keauhou and Kīlauea) are adjacent to an additional 15,000 ac (6,070 ha) of existing fenced management units in Hawai‘i Volcanoes National Park (‘Ōla‘a Tract and Mauna Loa Strip Road) (Figure 5). The fenced units include some of the best quality native forest in Hawai‘i, and they are now being used as recovery areas for native ecosystems and rare and endangered species.

TMA members are collaborating on numerous management initiatives in addition to fencing and ungulate control including weed control, rare plant reintroduction, forest bird monitoring, reforestation and educational programs.

Figure 5. Three Mountain Alliance Land Ownership and Management Units.



SUMMARY OF MAJOR THREATS

Invasive Species - Ungulates

The primary ungulates of concern in Pu‘u Maka‘ala are feral pigs, although feral goats (*Capra hircus*), feral sheep (*Ovis aries*) and mouflon sheep (*Ovis musimon*) are known from adjacent lands and could potentially become a threat to the NAR in the future. Feral pigs destroy native vegetation and prevent its regeneration by eating, trampling, and digging up plants, and may accelerate the invasion of weed species by dispersing seeds on their coats and in their droppings. Pig disturbance of native ground cover through rooting and wallowing facilitates the invasion and establishment of weeds. In addition, pig wallows and pig-hollowed out hāpu`u trunks provide mosquito-breeding sites that can promote the spread of avian diseases such as avian malaria and pox – the two most deadly diseases for native forest birds. The continued presence of feral pigs contributes to loss of native plants and loss of ground cover that adversely affects groundwater retention.

Portions of Pu‘u Maka‘ala NAR are designated as part of Hunting Unit K under Chapter 13-123, Hawaii Administrative Rules (Rules Regulating Game Mammal Hunting). Hunters should check with the DOFAW office (19 East Kawili Ave., Hilo, HI 96720) to get current information on hunting rules and any changes in special conditions, bag limits, seasons and open areas.

Invasive Species - Plants

Invasive non-native plants, or weeds, constitute a severe threat to the native ecosystems in the NAR. Certain priority weeds are problematic because they can establish and survive in undisturbed native forest; disperse long distances via wind or birds; affect large portions of land; displace native vegetation; grow and reproduce rapidly; convert diverse assemblages of native plants to monocultures of alien species; and encourage fire by increasing fuels on formerly natural fire breaks (i.e. lava flows). These weeds can displace distinctive native flora, resulting in a loss of species diversity and eventually in more pronounced and permanent changes to ecosystem function such as alteration of primary productivity and nutrient cycling. Many invasive weed species completely replace native vegetation resulting in total loss of native habitats thereby negatively affecting native bird, arthropod and snail communities.

Invasive weeds with great potential for spreading and causing habitat modification are identified in this plan as high priority for control or eradication. Weed species were prioritized based on observed invasiveness and other criteria including growth form, dispersal mechanisms, ability to displace native vegetation and ability to alter ecosystem cycles (water, nutrients and succession). High priority invasive weeds currently present in Pu‘u Maka‘ala include:

- Strawberry guava (*Psidium cattleianum*)
- Banana poka (*Passiflora tarminiana*)
- Himalayan raspberry (*Rubus ellipticus*)
- Cane tibouchina (*Tibouchina herbacea*)
- Kāhili ginger (*Hedychium gardnerianum*)
- Palm grass (*Setaria palmifolia*)

- Australian tree fern (*Sphaeropteris cooperi*)
- Clidemia or Koster's curse (*Clidemia hirta*)
- Tropical ash (*Fraxinus uhdei*)
- Silver-leaf cotoneaster (*Cotoneaster pannosus*)

Other weed species are not considered as highly threatening in the NAR as those listed above but are still a problem in localized areas. These weeds will be controlled during weed control work (e.g. Japanese anemone (*Anemone hupehensis*), *Selaginella kraussiana*, blackberry (*Rubus argutus*) and thimbleberry (*Rubus rosifolius*)) but are not generally a target of management.

Additional weed species that are a serious concern to land managers are present in adjoining areas and have not yet been detected in the NAR. It is a high priority to prevent the establishment of these species in the NAR. Species of concern include but are not limited to miconia (*Miconia calvescens*) and night-blooming jasmine (*Cestrum nocturnum*). Other weed species may be added to the NAR priority weed list if monitoring shows their range and abundance increasing in native ecosystems targeted for management.

‘Ōhi‘a dieback has been observed in Pu‘u Maka‘ala, particularly at lower elevations. Dieback is a natural successional phenomenon in which old stands of trees die synchronously, leaving gaps in the forest canopy. The gaps created in the forest canopy by dieback provide an opportunity for the invasion of non-native weeds which prevents regeneration by ‘ōhi‘a and other native plants.

Invasive Species - Other Animals

A variety of non-native small animals have the potential to become serious pests to the biodiversity found in Pu‘u Maka‘ala. Feral cats, rats, mice, mongoose, dogs, birds, amphibians and reptiles are known to consume or compete with native species and may contribute the spread of invasive weeds. Feral cats kill birds, which nest, feed, and roost in trees, as well as native sea birds and other species that nest on the ground or in burrows. Rats prey on native birds (particularly females on the nest), eggs, nestlings, native land snails and are also known to eat the seeds, fruits and/or strip the bark of native plants. The NAR has been invaded by non-native forest birds (e.g. Japanese white-eye, northern cardinal, Japanese bush warbler (*Cettia diphone*) and other species). Non-native birds may compete with native forest birds for food and other resources and act as reservoirs for avian diseases. Non-native birds also contribute to the spread of weeds by eating the fruits of weedy species (e.g. yellow Himalayan raspberry, banana poka and kāhili ginger) and spreading seeds. Both Jackson’s chameleon (*Chamaeleo jacksonii*) and coqui frogs (*Eleutherodactylus coqui*) have growing populations in areas adjacent to the NAR, and these species can consume native invertebrates, such as insects, spiders, and small snails.

Non-native invertebrates are present, but largely undocumented, and can consume native plants, interfere with plant reproduction, predate or act as parasites on native species, transmit disease, affect food availability for native birds, and disrupt ecosystem processes. The invasion of the yellowjacket wasp (*Vespula pennsylvanica*), voracious predators of numerous species of native invertebrates, is of concern, and these wasps have been implicated in the local extinction of two species of endemic *Drosophila* in the adjacent ‘Ōla‘a Tract. Slugs (*Milax gagates*, *Limax*

maximus, *Veronicella* spp.) consume fruit from native plants and prey on seedlings and mature plants. The two-spotted leafhopper (*Sophonia rufofascia*) is a major concern for the *uluhe* fern, which is particularly sensitive to leafhopper feeding. Mosquitoes (*Aedes albopictus* and *Culex quinquefasciatus*) transmit deadly diseases to native birds.

Fire

Due to the high rainfall in most portions of Pu‘u Maka‘ala, fire is not normally a concern in the NAR. However, fire does pose a threat to the NAR, particularly in the drier portions of Kūlani during times of drought and in roadside areas accessible to human activity. Continued feral ungulate damage to native ecosystems can convert native forest to non-native grasses and shrubs, which are more vulnerable to fires caused by lightning strikes or humans. Wildfires leave the landscape bare and vulnerable to erosion and non-native weed invasions. Hawaii’s flora evolved with infrequent, naturally-occurring episodes of fire, so most native species are not fire-adapted and are unable to recover well after wildfires. Alien plants, particularly grasses, are often more fire-adapted than native species and will quickly exploit suitable habitat after a fire. The principal human-caused ignition threats are catalytic converters and other hot surfaces of vehicles or heavy equipment. Careless disposal of cigarettes also presents a very real threat. The principal natural ignition sources are lava flows and lightning.

Additional Threats - Disease, Climate Change, Volcanic Activity, Illegal Human Activity

Introduced diseases and pathogens can threaten both native animals and plants. The introduction of new diseases and pathogens, in addition to those currently known, is possible. Avian pox and avian malaria are mosquito-transmitted diseases that currently affect native Hawaiian birds. In the extreme isolation of the Hawaiian Islands, birds evolved in the absence of these diseases and lost their natural immunity. Avian pox is caused by a virus (*Avipoxvirus*) and avian malaria by a single-celled parasite (*Plasmodium relictum*). For some bird species infection with these diseases is almost always fatal.

Introduced plant diseases such as ‘ōhi‘a rust (*Puccinia psidii*) and koa wilt have the potential to impact the major components of the forest throughout the NAR. ‘Ōhi‘a rust affects other Myrtaceae taxa. In severe infections, growing tips wither and die back. Koa wilt is a serious, often fatal disease of the native tree koa. Trees affected with the disease rapidly lose their canopies and may die within a few months.

Climate change may affect the NAR through altering rainfall patterns and amounts. Changing climate may affect the abundance and seasonality of precipitation, thereby altering forest composition, growth and structure. Rare ecosystems and species may be affected by relatively rapid changes in precipitation, temperature, and humidity that result from a rapid and drastic change in regional or local climate patterns. Detrimental invasive species may change their distribution and abundance due to changes in the climate (e.g. mosquitoes may be more frequently found at higher elevations due to warming temperatures). Increases in mosquito populations in the upper elevations would increase the incidence of avian disease, negatively affecting remaining native forest bird populations.

Volcanic activity has the potential to impact the NAR as the Reserve is situated on Mauna Loa, an active volcano. The Reserve is on the northwest rift zone and is vulnerable to eruptions originating at vents on that flank. The Reserve is classified by USGS as being within lava hazard Zones 2 and 3. About 20 percent of the Zone 2 area has been covered by lava in historical time, 5 percent since 1950. The 1984 Mauna Loa flow came within a mile of Kūlani. Volcanic gases from nearby vents can cause high concentrations of gases that affect native plants, animals and people.

Illegal human activity occurs on a small scale, primarily in the form of illegal harvesting (maile, hāpu‘u, and other native trees and plants), vandalizing signs and fences and occasional illegal motorized vehicle use. Marijuana cultivation may also occur. These activities destroy infrastructure and native species. Some illegal activities create openings in the forest that can be invaded by weeds.

OVERVIEW OF EXISTING MANAGEMENT

In general, management at Pu‘u Maka‘ala has primarily included ungulate management (construction and maintenance of fencing and ungulate control), weed control and habitat protection, and rare species restoration. Major accomplishments from these management programs are summarized below. NAR staff also work on monitoring, education and outreach, and review special use permits for certain activities proposed in the NAR. A cultural study for the Reserve was completed in 2004.

Ungulate Management

Between 1991 and 2003, NAR staff and partners constructed nine fenced ungulate-proof management units totaling approximately 9,600 ac (3,885 ha) in the Kūlani and Pu‘u Maka‘ala sections of the Reserve, to protect the NAR from feral ungulates (Figure 5).

The Kūlani units (Mauna Loa Boys School, Pu‘u Kipu, South Boundary and North Boundary) as well as Wright Road unit and the Kūlani Cone unit were constructed as projects of the ‘Ōla‘a - Kīlauea Partnership (now known as the TMA). The Wright Road unit, Pu‘u Kipu unit and the Kūlani Cone unit each encloses a portion of the western edge of the NAR as well as a portion of adjacent Kamehameha Schools property in Kīlauea forest. These fenced areas are jointly managed by NARS staff and the TMA. Two additional fenced units (Na Lua Mahoe and Lava Flow units) are adjoining the Wright Road and Kūlani Cone units to the east. Finally, the ‘Akū unit, in the Army Road area, protects the endangered ‘ānunu (*Sicyos alba*).

NAR and TMA staff completed feral pig control in these nine units (Lava Flow, Na Lua Mahoe, Kūlani Cone, Pu‘u Kipu, Wright Road, ‘Akū, Mauna Loa Boys School, South Boundary and North Boundary). These units have had all feral pigs removed and are currently pig-free.

Fence inspection and maintenance is a critical ongoing management activity. All fences are inspected and maintained on a monthly basis to monitor for and prevent pig ingress.

Weed Management

NAR staff and partners have monitored all species of non-native plants along four different sets of transects since 1988. Initially, 7.7 miles (12.4 kilometers (km)) of transect were monitored for weeds by the Hawai'i Heritage Program to gather information to support the development of a comprehensive management plan. In 1995, 17 miles (27 km) of new transects were installed across the higher elevation portions of the Reserve above 3,281 ft (1,000 m). As fenced units were built, additional finer scale transects were installed and monitored within specific units to document vegetation changes following ungulate removal including 2.5 miles (4.1 km) in 'Akū Unit (2000, 2008) and 6.6 miles (10.6 km) in the NAR portion of the Wright Rd Unit (2003, 2006 and 2008). Na Lua Mahoe and Lava units were monitored for weeds in 2000. Figures 6 - 8 show weed presence for certain priority weed species along monitoring transects.

In the Kūlani portion of the Reserve, USGS monitored weeds along transects in Pu'u Kipu and Kūlani Cone and Mauna Loa Boy's School units for three years (1999-2001). These data provide a valuable baseline for weed distribution and abundance. USGS monitored each transect for presence or absence of 80 different weed species divided into three different priority groups and did cover estimates of weeds encountered. USGS staff also took incidental data on the presence of priority weeds during other survey and research work. Maps of priority weed distribution along the Kūlani transects are included in the TMA weed management plan http://hawp.org/_library/documents/three-mountain-alliance/tmaweedplanjune2009.pdf. The North and South Boundary units of the Kūlani portion of the NAR have never been systematically monitored for weeds.

NARS and USGS monitoring results indicate target weed densities are generally low (<5%) in the higher elevation (>4,199 ft (1,280 m)) fenced units (Pu'u Kipu, Mauna Loa Boys School, Kūlani Cone, Wright Rd, Na Lua Mahoe, and Lava Units) except localized populations of Himalayan yellow raspberry and banana poka, and weeds in open wetland sites and previously disturbed areas. Isolated individuals of kāhili ginger, strawberry guava, palm grass and Australian tree fern have been identified and controlled within these fenced units. Weed densities increase in lower elevations, particularly for banana poka, Himalayan yellow raspberry, strawberry guava, palm grass and cane tibouchina. Within the 'Akū unit weed cover values are typically low, but many target weeds including strawberry guava are widely distributed throughout the unit.

Weed surveys and management are a critical second step following the removal of pigs. Weed management within Pu'u Maka'ala NAR is focused on the ungulate-free fenced units. The lowest elevation portion of the Reserve, where fencing has not been proposed is highly weedy and is not currently managed for weeds unless high priority incipient weeds are detected (e.g. miconia). Early detection and rapid response weed monitoring/control is conducted quarterly along invasion corridors (e.g., roads, trails, and fence lines) in and adjacent to fenced management units. NAR staff also does weed control sweeps in the 'Akū and Wright Road units. With weed sweeps, all target non-native species are mechanically and/or chemically controlled within fenced units by ground crews. Units are divided into management blocks, which are systematically swept on 3 – 5 year intervals with the exception of high infestation sites, which are revisited annually. Blocks are prioritized for control based on weed density, proximity to managed sites, logistical feasibility and staff resources.

NARS and TMA staff has controlled priority weeds within Kūlani with a focus of areas along roads to prevent weed invasion into forested areas. High quality native forest in the Kūlani portion of the Reserve is adjacent to highly disturbed areas with former prison infrastructure (e.g. buildings, pastures, reservoir, cinder pit, sewage treatment facility and roads) that contain larger populations of high priority weeds.

Figure 6. Pu'u Maka'ala NAR Priority Weed Distribution (Kāhili Ginger, Palm Grass and Cane Tibouchina).

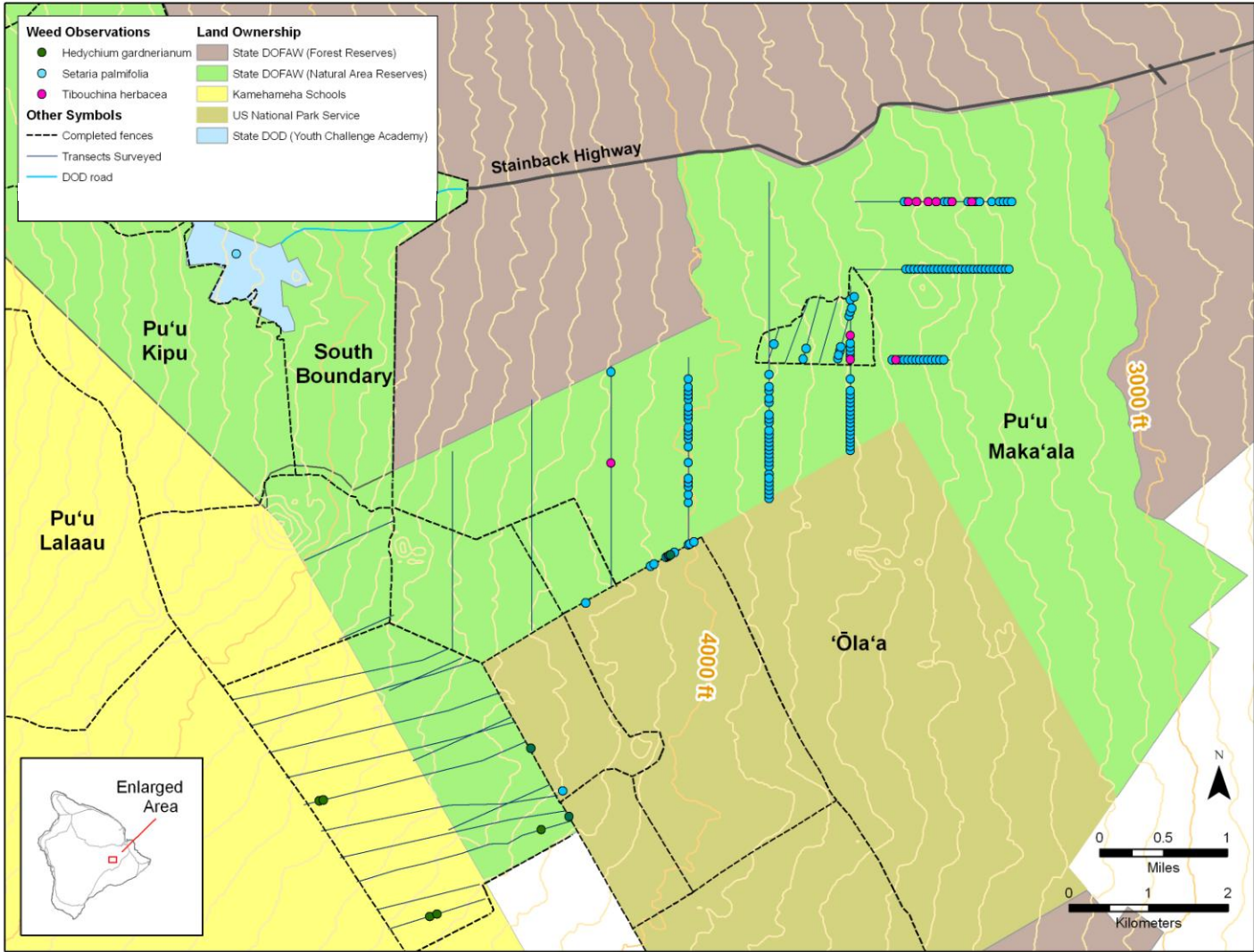


Figure 7. Pu'u Maka'ala NAR Priority Weed Distribution (Banana Poka and Strawberry Guava).

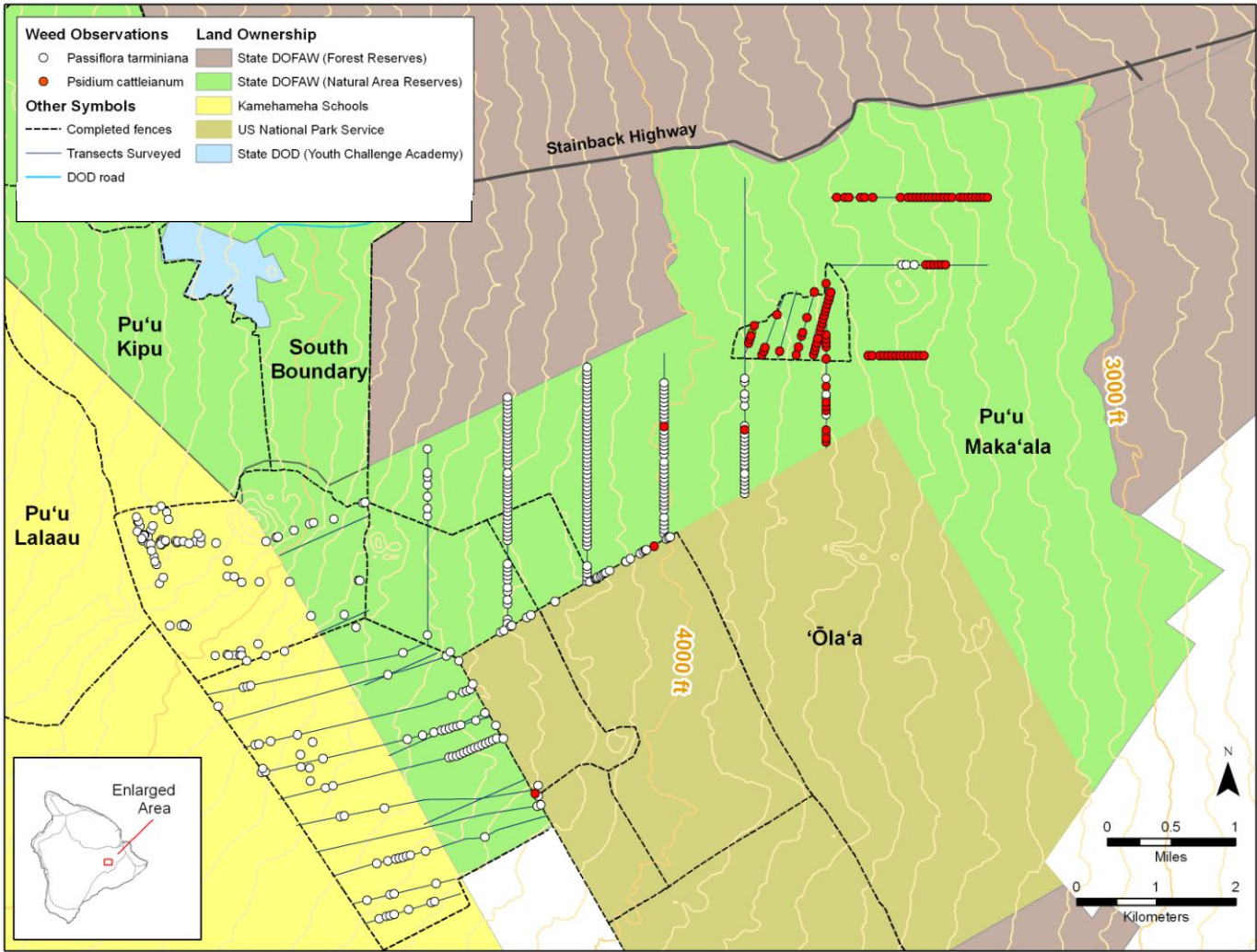
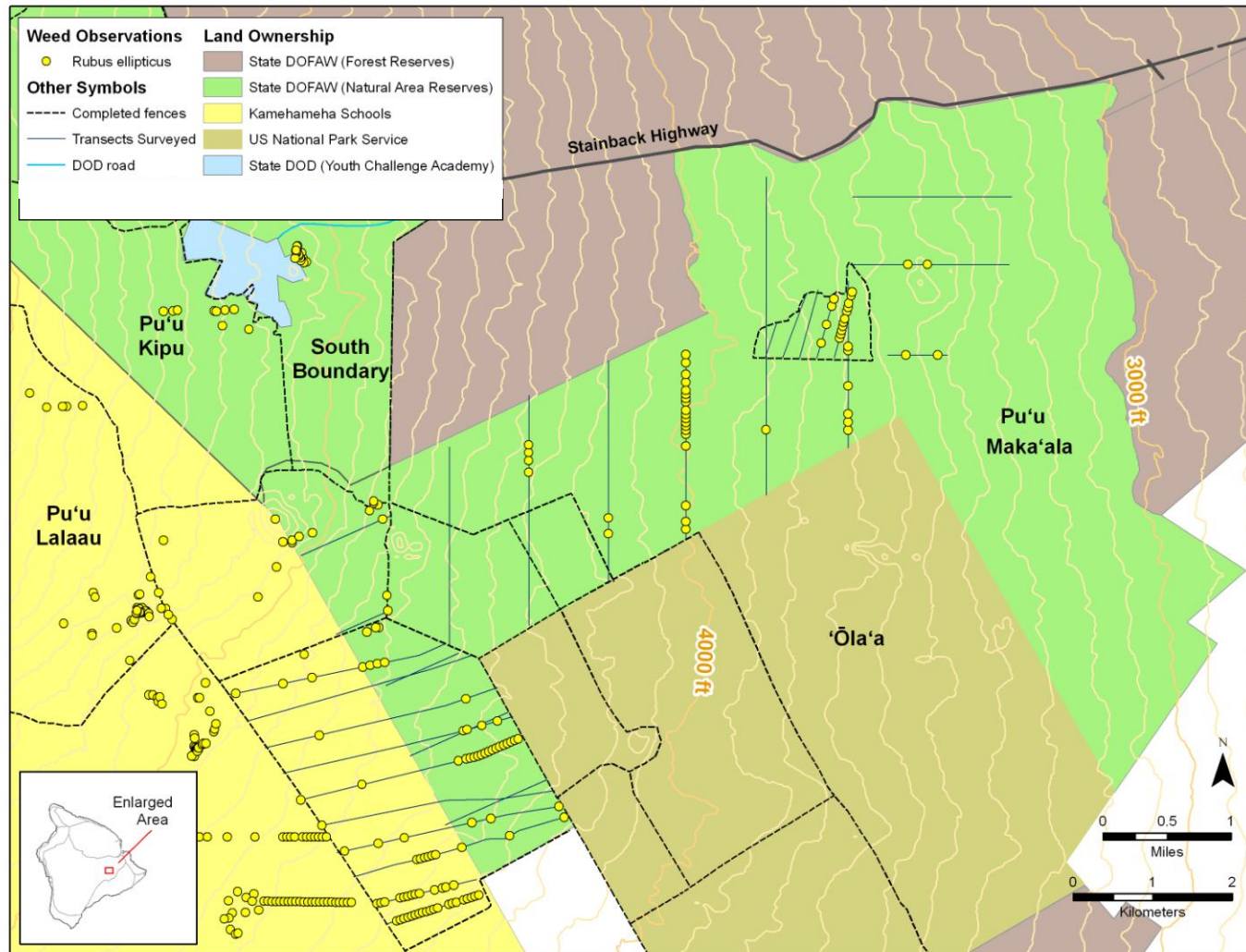


Figure 8. Pu‘u Maka‘ala NAR Priority Weed Distribution (Yellow Himalayan Raspberry).



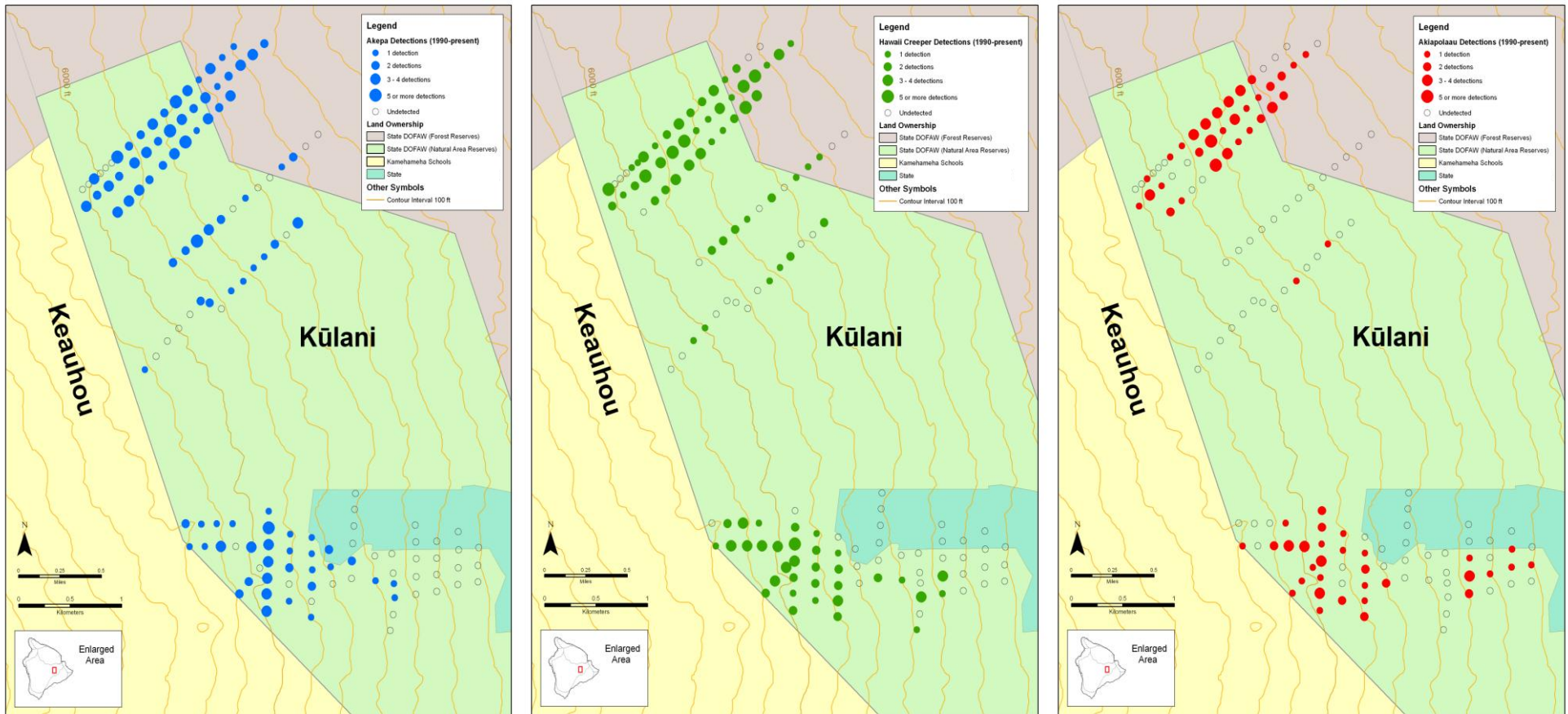
Habitat Protection and Rare Species Restoration

In 2001 and 2008 NAR staff quantified ground cover, select target native species frequency and density, and nonnative species frequency and cover along transects in the 'Akū unit to monitor changes in the forest as a result of ungulate control. Plant cover in the understory changed dramatically following eight years of feral pig exclusion. The frequency of exposed soil decreased from >50 percent in 2000 to only 11 percent in 2008, largely due to increases in herb and grass/sedge cover. In addition, the density and/or frequency of five native target understory species increased significantly following pig exclusion. Data from this study indicates that past pig activity in the NAR limited the establishment and spread of native understory species, and that pig removal results in native understory species recovery.

Numerous species of rare and endangered plants have been outplanted in Pu'u Maka'ala NAR to assist with recovery efforts for these species. Rare plants reintroduced into the NAR through outplanting include *Argyroxiphum kauense*, *Anoectochilus sandvicensis*, *Clermontia lindseyana*, *Clermontia peleana*, *Cyanea shipmanii*, *Cyanea stictophylla*, *Joinvillea ascendens ssp. ascendens*, *Phyllostegia velutina*, *Phyllostegia floribunda*, *Platydesma spathulata*, *Pritchardia beccariana*, *Sicyos alba*, *Schieda diffusa*, and *Stenogone scrophularioides*. NAR staff tag and map all rare outplanted plants as well as regularly monitor their survival and growth.

TMA has conducted surveys of endangered, native, and alien bird species once per year in the Kūlani portion of the Reserve as well as the adjacent Kīlauea Forest. Detections of endangered birds along transects in this area is shown in Figure 9. Bird population trend information allows for an evaluation of changes in distribution and abundance over time which can be evaluated relative to active or inactive management programs. A sharp decline in native species or an increase in alien bird species can be detected by this method, and may be an important indicator of need for additional management response to a new threat (e.g., increase in avian disease or predation) in an area. The Hawai'i Forest Bird Interagency Database Project analyzes the monitoring data every five years and produces reports on forest bird densities and population trends. The most recent analysis was completed in 2005, and is available at: http://biology.usgs.gov/pierc/HFBIDPSite/Central_Windward_OFR_2005-1441.pdf.

Figure 9. Endangered Forest Bird Occurrence along monitoring transects in the Kūlani portion of the Reserve



MANAGEMENT PROGRAM

The overall management goal is to manage threats to the integrity, diversity and functioning of Pu‘u Maka‘ala NAR ecosystems so that the unique natural and cultural resources are protected, maintained, and enhanced.

Management programs that support this overall goal include the following:

1. Ungulate Management
2. Weed Management
3. Habitat Protection and Rare Species Restoration
4. Fire Prevention and Response
5. Monitoring
6. Public Access, Outreach and Education
7. Enforcement
8. Partnership Collaboration
9. Infrastructure and Other Actions

Cultural resources are addressed through the protection of the natural resources through the programs above. According to Maly (2004), "...the mountain landscape, its' native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property."

Ungulate Management

Objective: Preserve and protect native forest and watershed from feral ungulate damage by maintaining existing fenced units, increasing the total acreage of ungulate-free areas through the construction of four new fenced management units, and completely removing ungulates from all fenced management areas.

Actions:

1. Maintain integrity of nine existing fenced units (Kūlani Cone, Wright Rd, ‘Akū, Na Lua Mahoe, Lava, Pu‘u Kipu, Mauna Loa Boys School, North Boundary and South Boundary) and new fenced units through regular inspection, maintenance and replacement of existing fencing.
2. Monitor existing nine fenced ungulate-free units for ungulate ingress, and control ungulates, if necessary.
3. Construct approximately 17 miles (27 km) of new fencing within the NAR to subdivide an existing management unit in the Kūlani section of the NAR and create four new fenced management units between the existing fenced units of the Kūlani and Pu‘u Maka‘ala sections of the NAR, and Hawai‘i Volcanoes National Park.
4. Install pedestrian walkovers and gates for pedestrian access into fenced units.
5. Implement feral ungulate control using a variety of methods that may include special public hunts, trapping, staff control, and snaring to completely remove animals from fenced units after fence construction.
6. Monitor new units for ungulate presence following complete removal and control ingress ungulates, if necessary.

Ungulate management, primarily for feral pigs, is the highest priority management program in the NAR. Although public hunting currently accounts for some pigs taken from the Reserve, more animals need to be removed in order to protect the biological and water resources of the Reserve and limit damage to native Hawaiian ecosystems. To reduce feral pig numbers sufficiently to protect the resources of the NAR, a combination of fencing and animal removal from fenced units is needed. Without fencing, ungulate control requires ongoing effort, due to reproduction of existing populations and continued ingress from adjacent properties.

Maintenance of existing fences and monitoring for ungulate presence is necessary to prevent reinvasion of currently ungulate-free areas. Construction of new fencing, when completed, will protect an additional approximately 5,000 ac (2,023 ha) of the NAR from damage by ungulates (Figure 10). Fencing will be completed based upon the availability of funding for labor and materials. NAR and/or TMA staff and/or contractors will implement fence construction in phases. Proposed new fenced management units have been prioritized based on quality of native ecosystems and presence of existing fencing from adjacent units. Other considerations in the design of the fenced units include logistics, accessibility, delineation of NAR boundary, and feasibility for effective feral ungulate control. Initial field surveys have been conducted to identify approximate locations for the planned fence alignments, and final fence alignments will be sited to avoid any impacts to botanical, faunal, and archaeological resources. Approximately 17 miles (27 km) of new fencing is needed to construct the four planned management units, at an estimated average cost of approximately \$100,000 per mile (labor, materials and helicopter).

As fence construction is completed, various methods will be used to remove ungulates from the fenced units. Public hunting will be encouraged during the first phase of ungulate removal, but additional control methods including drives, trapping, staff control with dogs, and snaring, may be needed to remove all the ungulates. Upon completion of proposed new fencing and ungulate control, approximately 14,600 ac (5,908 ha) or 78% of Pu‘u Maka‘ala will be ungulate free.

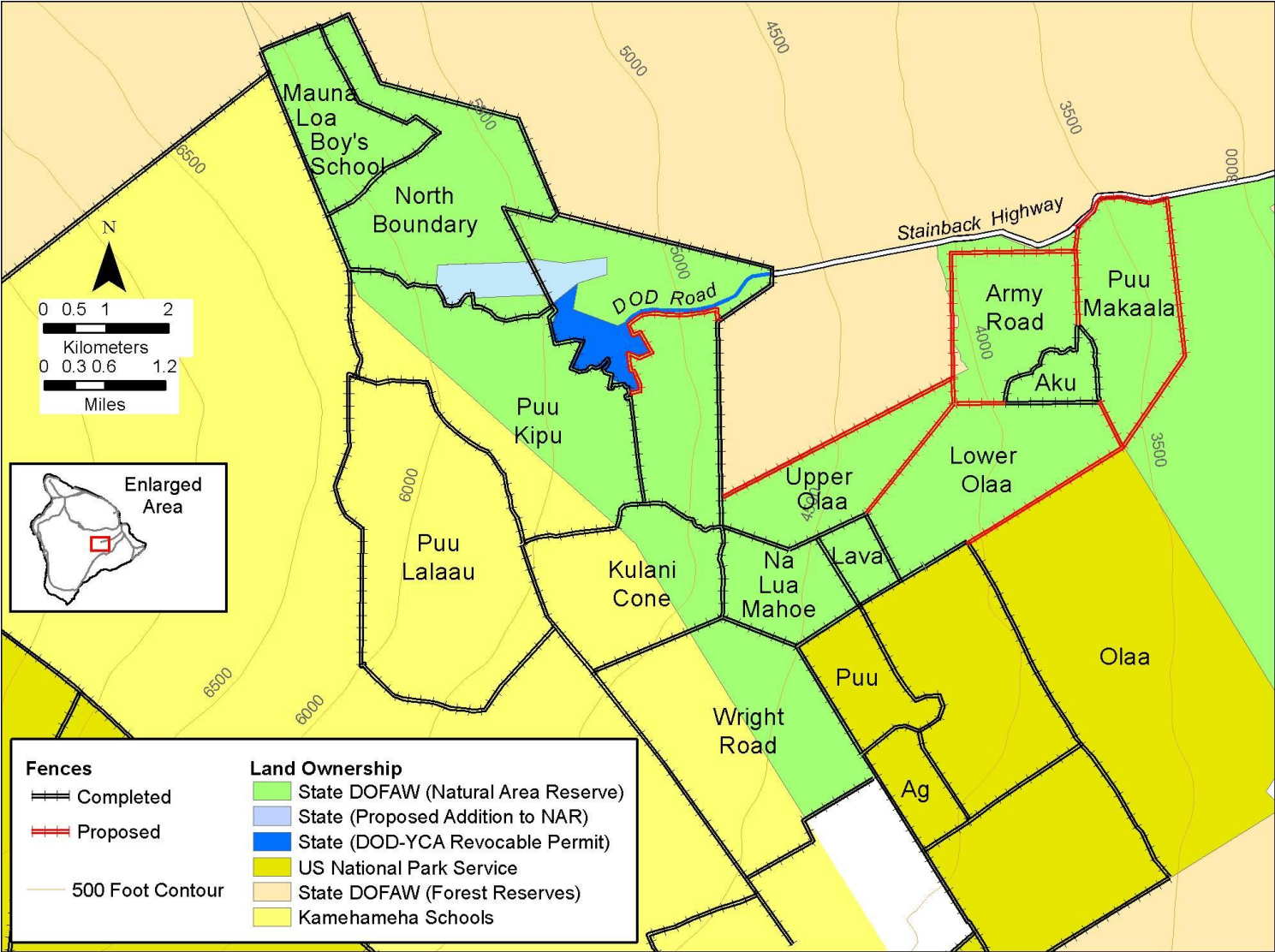
The lower, eastern portion of the NAR (including the Ihope road region adjacent to the National Park ‘Ōla‘a tract up to the 3,400 feet (1,036 meters) elevation) is not currently a priority for fencing. While still native-dominated, high densities of weeds make this section a lower priority for fencing and animal removal.

Proposed New Fencing (in order of priority) (Figure 10):

- Kūlani South Boundary Unit - Subdivide the existing unit by fencing 2 miles (3,219 m) around the perimeter of the Facility and along Stainback Highway. Subdividing this large unit will help with management, should ingress of ungulates occur.
- Upper ‘Ōla‘a Unit - 1,000 ac (405 ha) will require 4.3 miles (6,900 m) of new fencing. This unit will tie into existing fenced units (Kūlani Cone, South Boundary, Na Lua Mahoe and Lava).
- Army Road Unit - 1,000 ac (405 ha) will require 4 miles (6,400 m) of new fencing. This unit will tie into existing fencing of Upper ‘Ōla‘a unit and the ‘Akū unit. Fencing will follow the existing road corridor. When fencing of this unit is completed Army Road will be converted to a public, pedestrian trail.

- Lower 'Ōla'a Unit - 1,570 Ac (635 ha) will require 2.5 miles (4,100 m) of new fencing. This unit will tie into existing fencing (Lava unit as well as a portion of Hawai'i Volcanoes National Park 'Ōla'a tract fencing).
- Pu'u Maka'ala Unit - 1,215 ac (492 ha) will require 4 miles (6,400 m) of new fencing. This unit will be the lowest elevation unit currently proposed for the NAR, and will include the pu'u known as Pu'u Maka'ala.

Figure 10. Pu'u Maka'ala NAR Existing Management Units and Proposed Fencing



Weed Management

Objective: Protect intact native areas within the NAR by eradicating incipient weeds along common invasion corridors (e.g. roads, trails, fences), and if possible, eradicate or contain select high priority weeds in fenced units within the NAR.

Actions:

1. Identify highest priority intact native areas for intensive weed control. The highest priority areas are generally fenced, ungulate-free management units.
2. Monitor and map the distribution of high priority weeds and develop a control strategy.
3. Control weeds along invasion corridors (e.g., roads, trails, fences) and within management units using approved methods (chemical, manual and/or biocontrol).
4. Maintain procedures to prevent introduction of new weeds (i.e., sanitation protocols).
5. Support state-wide weed early detection and prevention programs and weed control research including new chemical, mechanical and biological control techniques, and participate, where appropriate, in experimental weed control management methods.
6. Monitor management efficacy in intact native areas to determine if weed control measures are effective and whether re-visitation intervals can be lengthened.
7. Monitor weeds to detect changes in long term distribution and abundance.

NAR priority areas for weed management are generally fenced, ungulate-free management units. Removal of ungulates from fenced units is a critical first step in weed control because it allows for the recovery of native vegetation by minimizing ground disturbance and reducing the spread of weeds by ungulates. Certain incipient weeds (high priority weeds that are just beginning to invade the area) may be targeted in unfenced areas to prevent their establishment and spread within the NAR.

The NAR has an ongoing weed monitoring and mapping program, and this data provides a valuable baseline for weed distribution and abundance. Weed mapping is essential to developing a comprehensive control strategy. Distribution mapping includes compiling transect monitoring data, incidental observations and reconnaissance surveys to map the distribution and abundance of weeds. Results from surveys will then be used to better delineate the weed populations core extent and outlying individuals, and permit the development of an effective control strategy. NAR staff monitor weed control areas to evaluate the effectiveness of control efforts.

Weed control goals for the existing Pu‘u Maka‘ala management units and proposed new fenced units include early detection and preventing the establishment of incipient, habitat modifying weeds that are not currently present in the NAR (e.g. miconia) or are still localized. For priority weeds already present in the NAR, the goal is to eliminate all known occurrences within targeted control areas and/or to contain the spread of priority species. Due to limited resources for monitoring and control throughout these dense rainforest areas, NAR staff will focus control efforts in disturbed areas such as roads, trails, and fence lines as these often serve as corridors for weed establishment and spread. Prevention is a critical component of the weed management program, and it is important to avoid and/or reduce the inadvertent introduction and spread of

weeds by researchers, managers and students working in and visiting the area. NARS staff and volunteers will follow protocols for cleaning of boots, equipment and vehicles prior to entry into the NAR.

NAR staff will also completely sweep fenced management units as funding and resources become available. Units are divided into management blocks, and these blocks are prioritized for control based on weed density, proximity to managed sites, and logistical feasibility. Blocks are systematically swept at 3 – 5 year intervals, although highly weed infested sites may be re-visited annually for follow-up control. Staff will focus on removing all priority species within fenced units but will also remove other non-native weeds encountered.

A combination of control techniques including manual, mechanical and herbicides are used to remove weeds. The technique used is based on the characteristics of the target species, the sensitivity of the area in which the species is found, and the effectiveness of the control technique. Weed control research into new monitoring, mapping (including remote sensing) and control methods will be integrated into the weed management program over the course of this plan as appropriate. Due to widespread and heavy infestations of certain weeds (e.g. banana poka and strawberry guava) and limited resources, NARS staff and partners intend to test the efficacy of approved biocontrol agents within the Reserve, when available. The banana poka fungal biological control agent (*Septoria passiflorae*) has been approved and shown to be successful in tests elsewhere on the island, and the effectiveness of this agent needs to be determined for the NAR.

Proposed Weed Control Projects (in priority order):

- Early detection and rapid response weed monitoring and control on a quarterly basis along invasion corridors in and adjacent to fenced management units.
- ‘Akū Unit – Complete sweeps for priority weeds including palm grass, strawberry guava, selaginella, banana poka, and yellow Himalayan raspberry. Palm grass will be targeted initially because this species is relatively localized in the southeast portion of the unit. All priority species will be targeted in subsequent sweeps.
- Wright Rd Unit – This unit is too large for complete control sweeps with currently available resources so staff will focus on sweeps in weed hot spots for priority species including banana poka, kāhili ginger, and yellow Himalayan raspberry. More complete sweeps of the unit will be made as additional resources are available.
- Pu‘u Kipu, South Boundary, North Boundary, Mauna Loa Boys School, Kūlani Cone, Na Lua Mahoe, and Lava units - These higher elevation units have relatively low densities of weeds, and the focus of control in these areas will continue to be weed invasion corridors and known weed hotspots, until resources are available for more complete weed control sweeps. Priority weeds in these areas are primarily banana poka and yellow Himalayan raspberry.
- New fenced units – These lower elevation units have more weed problems than the existing units currently targeted for weed control. As new fenced units are completed and ungulates are removed, these areas will become a higher priority for weed management. NARS staff will follow a similar strategy for weed control in these areas (e.g. installation of weed monitoring transects, control in invasion corridors and more complete sweeps if resources are available).

- Weed monitoring and mapping will be conducted every five years along transects in fenced management units and every 10 years in the unfenced sections of the NAR to detect changes in weed distribution and abundance over time as well as detect incipient invaders.

Habitat Protection and Rare Species Restoration Program

Objective: Manage high quality forest habitats, rare, threatened and endangered plant and animal species at sustainable community and population levels.

Actions:

1. Maintain the integrity of high quality forest habitats to the extent possible through the maintenance and expansion of fencing, feral ungulate control and weed control programs.
2. Prevent the introduction of incipient habitat-modifying species and new threats (e.g. new weed species, coqui frogs etc) and remove them before they become established.
3. Map, monitor and protect existing wild populations of rare and endangered species to contribute to their population stabilization and recovery.
4. Re-introduce certain species of rare and endangered plants in appropriate protected habitat through outplanting, and coordinate outplanting and other management actions with the PEPP and other agencies and organizations working on rare plant recovery.
5. Enhance habitats for forest birds, nēnē, and ‘ua‘u or Hawaiian petrel through small mammalian predator removal and other habitat management (reducing larval habitat for mosquitoes and controlling yellow-jacket wasps).
6. Release ‘alalā (Hawaiian crow) and other endangered birds in appropriate habitat.
7. Implement native habitat restoration projects (e.g. forest restoration in disturbed areas, *Carex* wetland restoration) and monitor the results of management activities.

Fencing and ungulate removal is discussed in the section on the Ungulate Management program. Fencing and the creation of ungulate-free areas is critical to the long-term health and recovery of native ecosystems including rare plants, forest birds and other native species. These management actions, along with weed management and the prevention of new habitat-modifying species are the most critical actions needed to protect existing native habitat and rare species. NAR staff may need to implement other habitat restoration and species management, as necessary.

In some instances, large scale habitat protection and restoration through the implementation of priority management actions is not enough to recover certain rare and endangered plants. These species may have wild populations that are so low that the species cannot survive and recover without additional management. Over the past decade, numerous species of rare plants have been propagated and reintroduced into fenced, ungulate-free areas of the NAR to contribute to their overall recovery in the wild. These species (Table 1) will continue to be a focus for the NAR rare species program. The goal of NAR rare plant management is to remove threats to these species and ensure their long-term survival in secure and self-sustaining wild populations.

NAR staff work will work cooperatively with other organizations and agencies on rare plant recovery including FWS, TMA, The Hawai‘i State Plant Extinction Prevention Program (PEPP) and the Volcano Rare Plant Facility (VRPF) of the University of Hawai‘i. Management actions

specific to rare plant recovery includes rare plant surveys to locate wild individuals, collection of propagation and genetic storage materials and reintroduction through outplanting. PEPP is focused on preventing the extinction of taxa with fewer than 50 individuals in the wild. The VRPF propagates all rare plants used in the NAR program.

NAR staff will follow rare plant collection and reintroduction guidelines recommended by the Hawaii Rare Plant Restoration Group (interagency group of rare plant experts) <http://www.hear.org/hrprg/>. Rare plants reintroduced into the NAR include *Argyroxiphum kauense*, *Anoectochilus sandvicensis*, *Clermontia lindseyana*, *Clermontia peleana*, *Cyanea shipmanii*, *Cyanea stictophylla*, *Joinvillea ascendens ssp. ascendens*, *Phyllostegia velutina*, *Phyllostegia floribunda*, *Platydesma spathulata*, *Pritchardia beccariana*, *Sicyos alba*, *Schieda diffusa*, and *Stenogone scrophularioides*. Additional rare and endangered species historically known from the NAR and/or nearby will be reintroduced to the Reserve, as appropriate (Table 1). NAR staff will tag and map the locations of all outplanted plants and monitor their survival and growth. They will do additional management of wild and/or reintroduced populations if needed (e.g. fencing wild plants that are not within fenced management units, control of damaging weeds, insects, slugs, plant disease and/or mammalian predators).

Small mammalian predator removal (e.g., removal of rats, mongoose, cats) may provide significant benefits to endangered birds and plants, but is extremely difficult and costly to implement on a large-scale using currently existing methods. NAR staff may implement predator removal in certain high priority areas (e.g. upper elevation, fenced management units, bird nesting sites) using existing, approved methods (trapping and application of rodenticides using bait stations). New methods for widespread control of these species across large conservation areas are currently being developed and will be implemented if they are approved and offer a cost-effective way to remove predators.

Other management may also benefit forest birds and will be implemented, as feasible. Upper elevations of the NAR in the Kūlani area will be targeted for these actions as these areas provide the most important habitat for native forest birds. NARS staff will work with adjacent landowners (e.g. Kamehameha Schools and State DOD YCA) to eliminate or treat larval habitats for mosquitoes (standing water associated with cattle troughs, water catchment and stock ponds that are located within or adjacent to forest bird recovery areas. Larval habitats associated with residential and agricultural development may be primary sources for mosquitoes responsible for seasonal epizootics of pox and malaria. Reducing or eliminating vespulid wasps (yellow jackets) may also provide benefits to forest birds, as these wasps prey on insects that provide food for forest birds.

The current captive population of ‘alalā is at the point where restoration of a wild population can proceed. The Kūlani portion of the Reserve has been identified as a high priority release site for re-establishment of this species in the wild due to the high quality of native forest and its ungulate-free status. The restoration of a wild population of ‘alalā will require minimizing threats, including implementing control of non-native mammalian predators. Releases and managing (e.g., providing supplemental food) will require semi-permanent infrastructure and a constant, long-term human presence. Holding or release aviaries will need to be erected at release sites. These will most likely be placed on scaffolding to minimize predator access.

DOFAW will attempt to place aviaries in natural openings in the forest; however, some clearing of native vegetation may be necessary. Given the need to have staff on site at all times, the construction of a remote cabin or weatherport will be needed. The release and monitoring team (3 – 5 individuals) will care for, feed, monitor, and track released birds. This team will need to maintain a constant presence at the release site for an undetermined length of time. It is difficult to estimate the length of time that the release and monitoring team will have to remain on site. Much will depend on the availability and use of wild foods by the ‘alalā, their dependence on supplementary food, their health, and how they adjust to their new environment. Other management actions involved with ‘alala release may require additional staff to control predators, monitor ‘io abundance, restore food plants, monitor vegetation recovery, track and control invasive species and check and repair fence.

Nēnē are present in the Kūlani portion of the Reserve and in adjacent areas. NARS staff will assist DOFAW Wildlife Staff in banding and monitoring nēnē in the general area and working with adjacent landowners, particularly DOD-YCA, to enhance overall nēnē efforts across the island of Hawai‘i. Other actions such as small mammalian predator control and habitat improvement may be implemented in localized areas to protect and manage nēnē.

NARS staff will also implement targeted habitat restoration projects as resources allow. Although the forest canopy in the Reserve is largely intact, certain localized areas that have been disturbed or invaded by weeds may require more intensive management. Non-native pasture grasses will be targeted for control in certain areas to enhance the natural regeneration of native trees and shrubs and prevent fire. *Carex* wetlands are also targeted for restoration as these areas were more disturbed by past feral pig activity and are subsequently more highly invaded by weeds. NAR staff and volunteers will eradicate invasive weeds and reintroduce native plant species to restore these wetlands.

Fire Prevention and Response

Objective: Employ appropriate fire management strategies including pre-suppression, suppression, and post-suppression rehabilitation to reduce wildfire occurrence and minimize wildfire impacts.

Actions:

1. Work with Hawai‘i island Protection Forester (DOFAW) to update fire response maps to show the Kūlani portion of the NAR to be a DOFAW primary response area.
2. Implement fire prevention measures, including educational outreach to neighbors and signage along roads.
3. Suppress fires safely and aggressively using appropriate means.
4. Continue NAR staff training and certifications for effective and safe fire response.

Due to the high rainfall at Pu‘u Maka‘ala, fire is not normally a concern for the project area. However, fire management is incorporated as part of this management plan because of the impact fire can have on native communities. It is recognized that, though unlikely, fire may be a risk in the project area, particularly in the drier Kūlani portion of the Reserve. Thus, strategies to prevent and minimize the impacts of fire are incorporated into this plan.

Many fires are caused by humans, so fire prevention measures will include increased educational efforts for those accessing the property, road or area closures in the event of extreme fire danger and suppression of non-native grasses in fire prone areas. Weed control and planting of common native species will be used to restore certain disturbed areas to prevent fire and/or following damage from fire.

In the event of fire, DOFAW will respond to fires in the Reserve. The most effective control of a fire will be through measures that result in the least amount of impact or disturbance to natural and archeological resources. The method of suppression will be determined by the on-site situation, with special regard to the potential expansion of fire damage to the resources within the Reserve. Minimum impact methods of suppression will be applied whenever such methods are sufficient. Bulldozing or other extreme fire control measures are justified when a fire cannot be otherwise controlled and the bulldozing damage is outweighed by a probable greater loss of natural and archeological resources. NARS staff will maintain current fire response certifications by attending regular required staff trainings.

Monitoring

Objective: Monitor current status and trends of natural resources throughout the NAR as part of a long-term monitoring program.

Actions:

1. Continue ongoing monitoring programs for ungulates, weeds and rare plants to measure the success of management and detect changes in abundance and distribution.
2. Continue ongoing monitoring program for forest birds in the Kūlani portion of the Reserve in cooperation with TMA and the Hawai‘i Forest Bird Interagency Database Project.
3. Develop improved monitoring protocols, data management and analysis for existing monitoring programs.
4. Review and summarize past monitoring data and inventories.
5. Identify critical gaps in natural resource inventories for the NAR and initiate additional surveys.
6. Develop and/or identify appropriate monitoring protocols and implement monitoring for key community indicators that are not currently being monitored (e.g., native vegetation communities, invertebrates etc).

NAR staff regularly monitors ungulates, weeds and rare plants and are planning on continuing these monitoring programs. Ungulate monitoring is used in fenced units that are being managed for ungulates to detect the presence or absence of ungulates. Units that are free of ungulates are regularly monitored to detect ingress animals. Units with active ungulate control programs are monitored to assess the success of and/or direct control efforts.

Weed monitoring will continue to be conducted every five years along transects in fenced management units and every 10 years in the unfenced sections of the NAR to detect changes in

weed distribution and abundance over time as well as detect incipient invaders. Weed control areas are monitored to determine the success of management efforts.

Rare plant monitoring is conducted to assess the survival and growth of wild and re-introduced rare plants. NAR and PEPP program staff monitor rare plants to assess their survival and reproduction, collect propagation materials, search for additional wild individuals and determine whether additional management is necessary.

NAR staff has also monitored changes in native understory diversity and nonnative invasive plant distribution to assess the results of pig removal. This type of monitoring will be continued, as resources permit, to assess the long-term results of management actions.

The TMA has monitored forest birds in the Kūlani portion of the NAR as well as on adjacent Kamehameha Schools land and NARS is planning on working with the TMA to continue these annual surveys. Monitoring transects in the Mauna Loa Boy's School Unit, Pu'u Kipu Unit and Kūlani Cone unit have been monitored annually since the early 1990's. Monitoring data will be provided to the Hawai'i Forest Bird Interagency Database Project for analysis of bird population densities and trends.

NAR staff will refine and modify existing inventory and monitoring programs (monitoring protocols, data management and analysis) for ungulates, birds, weeds and rare plants in order to make the program more effective. It would be valuable to expand the monitoring program as time and resources permit to include surveys and monitoring of invertebrates as well as native plant communities. Establishing and implementing new long-term monitoring programs for key community indicators, especially in the face of new threats such as climate change and the introduction of new diseases and pathogens will be critical to informing future management of native ecosystems and species in the NAR. Collaboration with partners such as researchers, students and adjoining landowners may help improve and expand inventory and monitoring programs if NAR staff time and resources are limited.

Public Access, Outreach and Education

Objective: Provide public access to the Reserve and build public understanding and support for the NAR and the state's unique native resources through outreach and education.

Actions:

1. Enhance public access, hiking opportunities and interpretation of NAR resources by providing public access into the Kūlani portion of the Reserve as well as improving the Wright Road and Army Road trails for pedestrian use.
2. Hire Outreach Specialist to provide periodic interpretive trips to the Reserve for the general public as well as other outreach and educational activities listed below.
3. Maintain and expand opportunities for volunteer service trips, student internships and teacher workshops.
4. Maintain and expand NAR staff presentations and outreach to schools and community groups.

Public access to all portions of the Reserve is allowed for recreational and cultural uses. Recommended public access points are shown in Figure 11; however the public is allowed to access the Reserve in other areas as well (e.g. along Stainback Highway). Current public use of Pu‘u Maka‘ala primarily includes hiking, bird watching, and hunting. Hunting in portions of the NAR is regulated by Chapter 13-123, Hawaii Administrative Rules (Rules Regulating Game Mammal Hunting), and areas where hunting is allowed are designated as part of Hunting Unit K. Hunters should check with the DOFAW office (19 East Kawili Ave., Hilo, HI 96720) to get current information on hunting rules and any changes in special conditions, bag limits, seasons and open areas. Some public uses of the Reserve, including groups larger than ten individuals, research, scientific collecting, gathering (including Native Hawaiian religious and customary gathering rights) and commercial uses require a Special Use Permit from the Executive Secretary of the NARS Program in Honolulu (808-587-0063) (HAR§ 13-209-4).

Public access to all parts of the Kūlani portion of the NAR will be open for pedestrian use. The primary recommended access points are along Stainback Highway. NAR staff will improve trails into the area by clearing old trails and adding additional directional and interpretive signage along recommended routes (Figure 12). NARS staff and volunteers will also provide periodic guided educational tours of the Kūlani portion of the NAR for community groups and/or the general public. DOFAW will be developing a Memorandum of Agreement with with DOD-YCA to address public pedestrian access.

New proposed interpretive hiking opportunities within Pu‘u Maka‘ala will provide opportunities for the public to learn more about the NAR, its unique native species and ecosystems, threats to the NAR, and ongoing management activities. The two areas proposed for improvement (Army Rd. and Wright Rd) already have existing unimproved trails or roads and are the most accessible portions of the Reserve. In addition, trail improvements such as rest areas/benches, viewing platforms, and boardwalks over particularly wet areas of trail and the installation of interpretive signs at points of interest (e.g. significant trees, geologic features, wetlands and lookout areas) will improve the outdoor experience for general users and provide an enjoyable opportunity to learn about Hawaii’s native forests.

Proposed Interpretive Trail Development Projects (Figures 13 and 14):

- At Wright Road, the current unimproved trail runs perpendicular to a management access road. Constructing a 1-2 mile (1.6 -3.2 km) new connector trail between the existing management access road and unimproved trail and would create a 3-4 mile (4.8-6.3 km) loop trail, located entirely within the fenced Wright Road unit. The newly constructed portion of trail will be located entirely on State land. In addition, the existing management access road and unimproved trail portions of the loop will be improved for public pedestrian use. This loop trail will provide new opportunities for public recreation in the NAR and will also enhance NAR management of the Wright Rd. unit by providing management access.
- At Army Road, an existing four-wheel drive road is currently open for public vehicular access in two sections (mauka and makai). Vehicle access between these two sections is blocked due to existing ‘Akū unit fencing (although public access is allowed on foot). This area is proposed to be fenced and become an ungulate-free management area (Army Rd. Unit). Proposed fencing will follow the road corridor. When the Army Rd. Unit is fenced, the existing road will be converted to a public trail with improvements such as rest areas,

covered picnic tables and interpretive signs. Access will be restricted to pedestrian use. Conversion of the road into a pedestrian trail will provide enhanced opportunities for the general public to learn about and enjoy the native forest.

At Pu‘u Maka‘ala, volunteer service trips are currently used to promote public understanding and support for conservation. Volunteer groups have regularly assisted with weed control; trail maintenance and restoration projects planting native species. Additionally, local students spend a week every year assisting with management efforts at Pu‘u Maka‘ala NAR through the Youth Conservation Corps summer program. The NAR program also regularly hires interns to assist with management and provide educational and training opportunities for students. NAR staff will continue these types of programs because they provide educational opportunities for interested groups and individuals to learn more about the Reserve and Reserve management programs. In addition, volunteers and interns contribute useful assistance in labor-intensive activities.

Beginning in 2008, NARS staff partnered with the TMA education program to jointly host standards-based teacher workshops to provide outdoor learning opportunities and lesson plans to local teachers. NAR staff also regularly provides slide shows, presentations and outreach to schools, local groups and at community events. NAR staff is planning on continuing all these activities, and expanding them as resources allow.

Figure 11 - Pu'u Maka'ala NAR Access

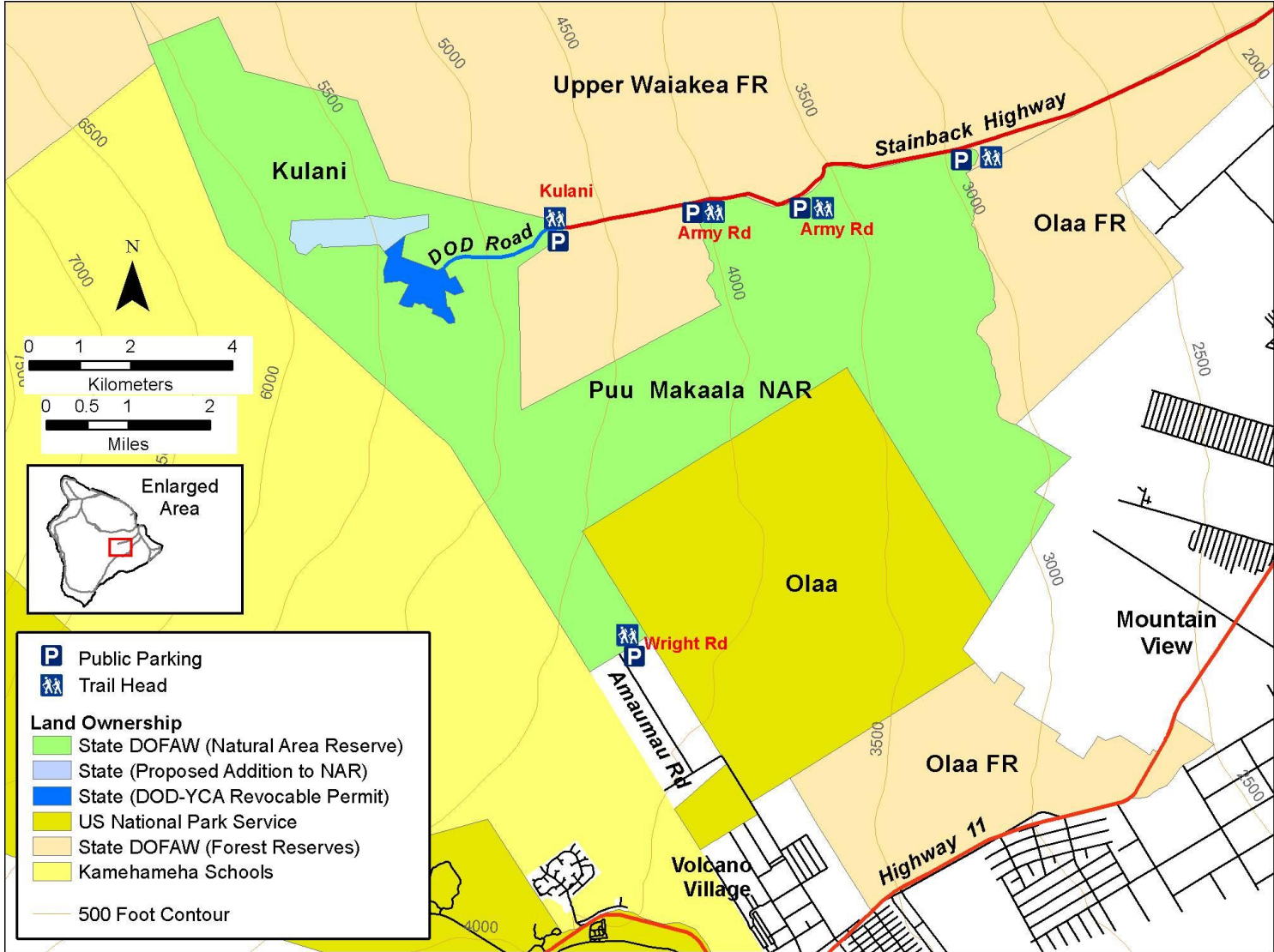


Figure 12. Kulani Access and Proposed Trail Improvement

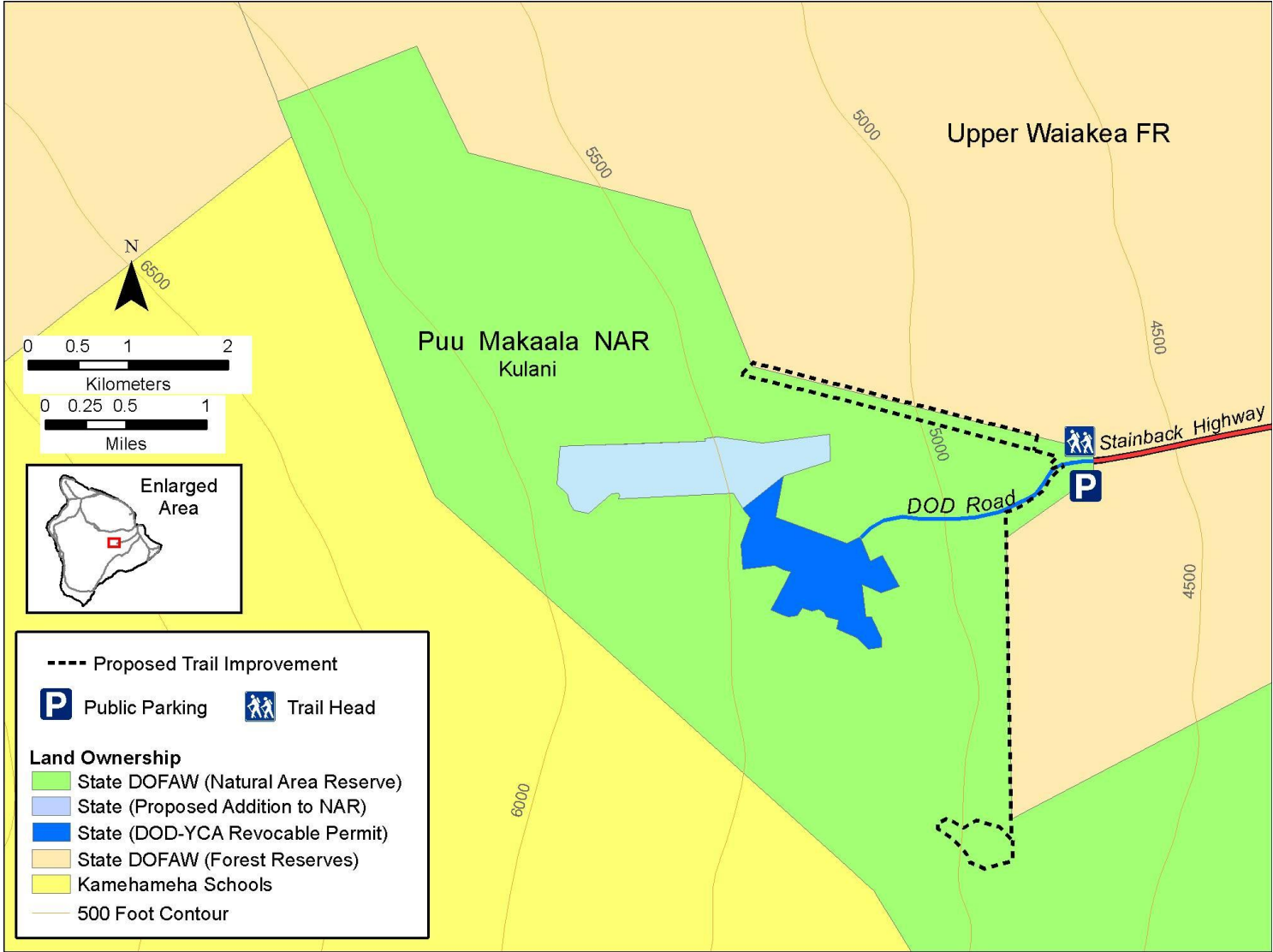


Figure 13. Wright Rd Proposed Trail and Trail Improvement.

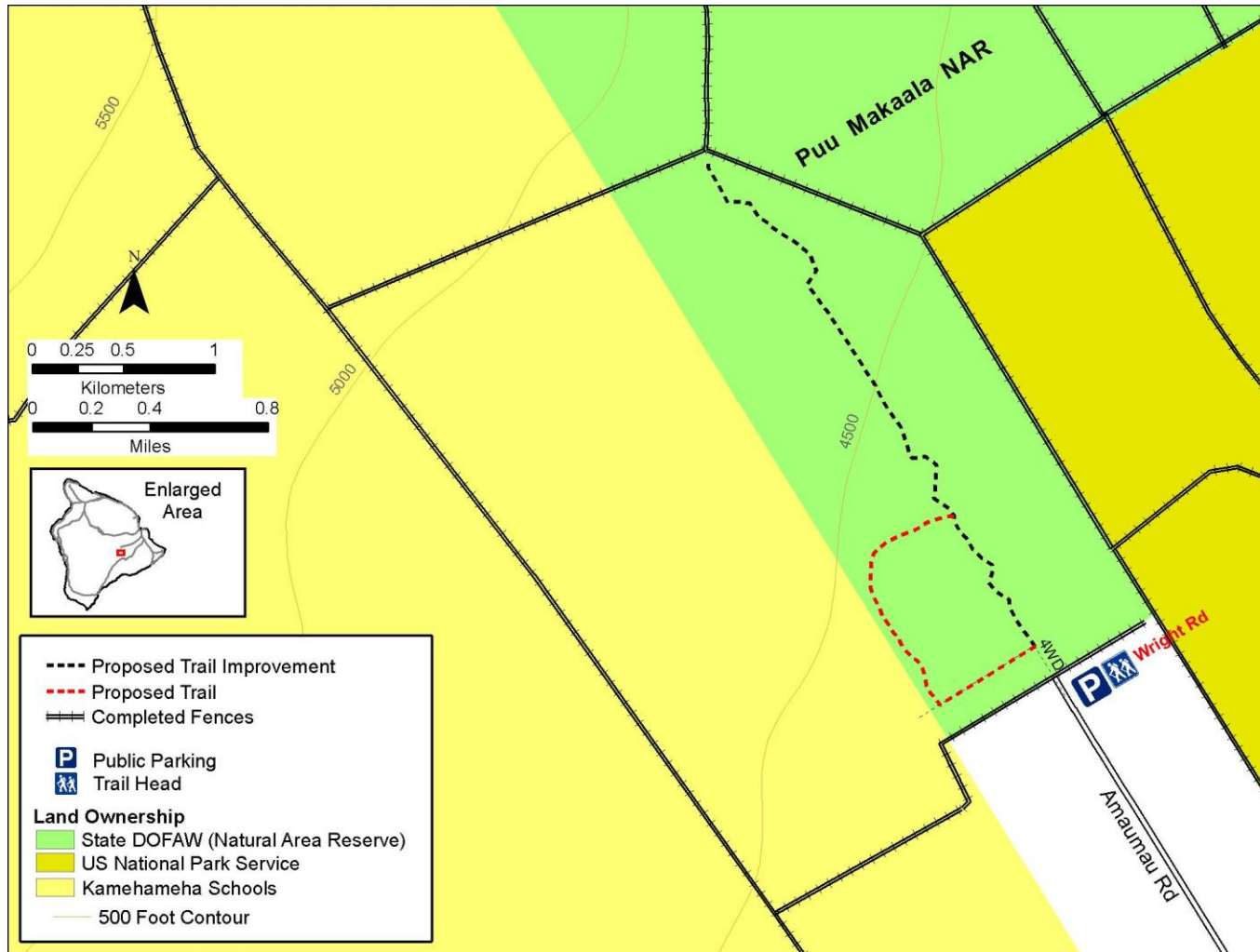
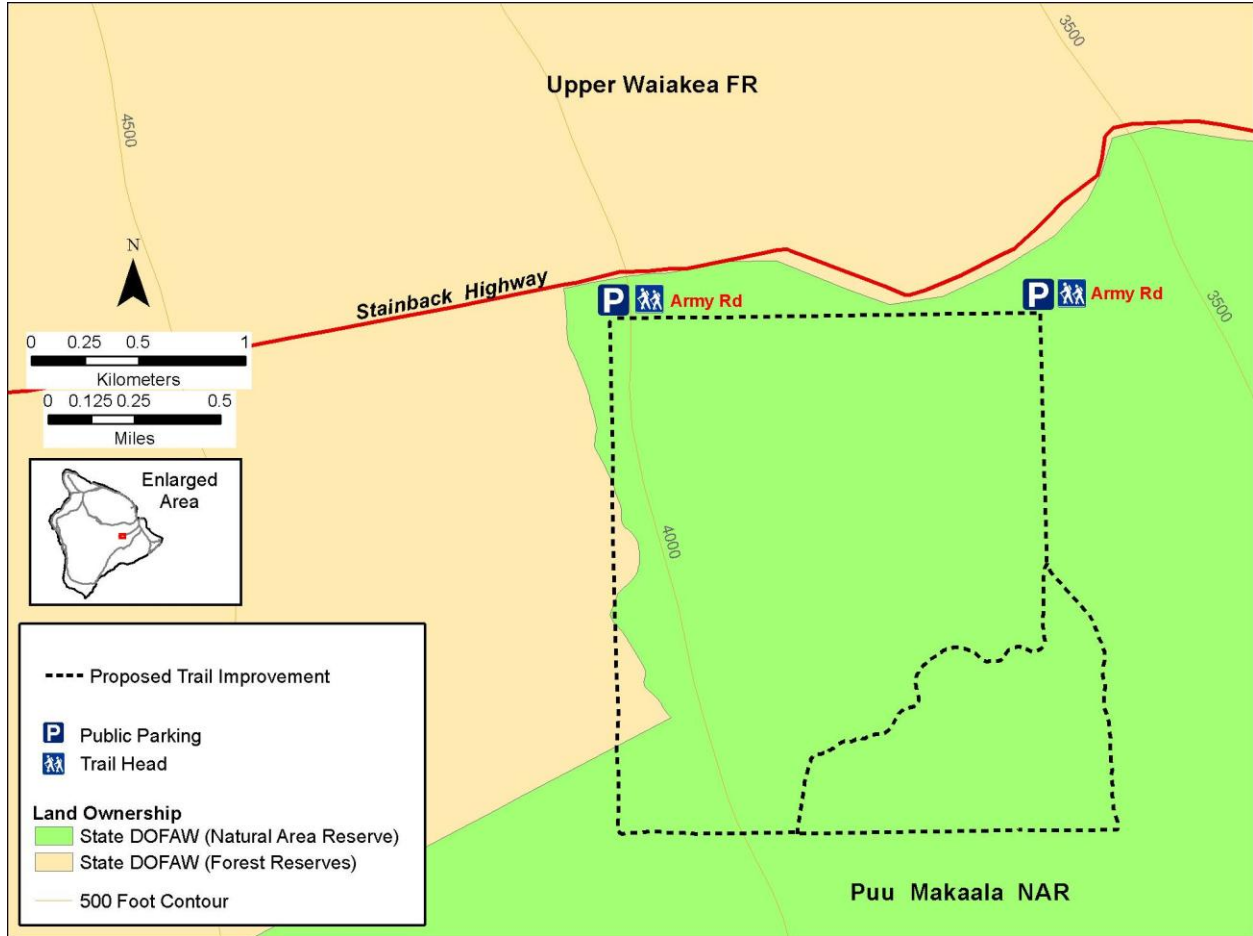


Figure 14. Army Rd. Proposed Trail Improvement.



Enforcement

Objective: Ensure effective enforcement of laws that protect Pu‘u Maka‘ala NAR.

Actions:

1. Explore opportunities to collaborate with DLNR’s Division of Conservation and Resource Enforcement (DOCARE) to improve voluntary compliance with laws and strategies to improve the effectiveness of enforcement.
2. Encourage DOCARE to focus on illegal taking of natural resources and vandalism.

The DLNR’s DOCARE is responsible for enforcement of state laws at Pu‘u Maka‘ala, including laws regulating hunting and protection of resources (e.g. illegal harvesting, vandalism etc). Improved collaboration between the NAR program and DOCARE will improve the effective enforcement of laws that protect the Reserve.

Partnership Collaboration

Objective: Collaborate with external partners to support NARS mission and goals.

Actions:

1. Continue partnerships with adjacent landowners through the TMA to address threats and management needs on a regional basis.
2. Develop a memorandum of agreement with DOD-YCA to address access by DOFAW over the internal roads at Kūlani included in the the DOD-YCA revocable permit area, conservation management within the permit area, the parties' maintenance obligations for the internal roads, and conditions under which public access will be permitted, etc.
3. Work with the DOD-YCA to cooperatively address endangered species issues on the DOD-YCA area, joint threats (e.g. invasive species) and to provide environmental service-learning and educational programs for YCA students.
4. Partner with Hawaii County Fire Department to familiarize their staff with locations of management access roads and important resources for protection in case there is an emergency such as fire or rescue.
5. Continue working with other groups collaboratively to address joint management needs (e.g. invasive species management, rare plant management, education, monitoring and research).

Many of the threats to Hawaii's natural resources, such as feral ungulates, invasive weeds, fire, invasive insects, and introduced plant and animal diseases, occur across land ownership boundaries. Working with partners can increase the effectiveness and efficiency of management with limited resources. Continued collaboration with the TMA and TMA members, particularly adjacent landowners (e.g. National Park Service and Kamehameha Schools) will enhance the effectiveness of response to regional threats like feral ungulates, weeds and fire.

NARS participation in TMA initiatives for weed control work with adjacent communities, landowners and community organizations will help protect the NAR by providing a better weed buffer and reducing the spread of harmful weeds. TMA members are also collaborating on new weed mapping and monitoring technologies such as remote sensing. Involvement in the TMA will also provide opportunities for sharing of monitoring protocols and/or joint long-term monitoring of natural resources and threats (e.g. bird monitoring across a larger landscape, intensive monitoring of National Park Service resources through the NPS Inventory and Monitoring Program). The NAR will also work with the TMA increase joint educational and outreach efforts in order to reach a larger audience.

NARS staff will also work closely with the DOD-YCA on numerous issues including staff and public access, management of native species and educational opportunities for YCA students. NARS will also encourage DOD to join and participate in the TMA. NARS staff can assist DOD with management of native species, including endangered species present on DOD-YCA managed lands adjacent to the Reserve. It will also be critical to collaborate on the management of threats to the Reserve such as preventing the establishment of coqui frogs at the YCA and the removal of invasive weeds. In addition, NARS can provide environmental education, service learning and work training for YCA students on NARS lands, which will benefit both the

students and the land. NARS staff will work with DOD-YCA to develop a Memorandum of Agreement for various issues at the former Kūlani Correctional Facility area, including protocols for staff and public access over internal roads and conservation management in the DOD-YCA revocable permit area.

Continued collaboration with other groups in addition to the TMA will also assist NAR management in various areas. NAR staff will continue to work closely with the Big Island Invasive Species Committee (BIISC) to jointly address incipient invasive species of plants and animals that threaten the Reserve. NAR staff will continue to work closely with two organizations focused on rare plant recovery (VRPF and PEPP). NAR staff will also work with community groups and volunteers to assist with initial animal control in fenced units, prevent the spread of introduced species (e.g. invasive weeds and coqui), and to restore native habitat and species.

Pu‘u Maka‘ala NAR offers unique opportunities for research, and NAR staff review all research permits before they are approved. NARS staff will work with interested researchers in the academic community as well as scientists so their research can better address critical management needs.

Infrastructure and Other Actions

Objective: Manage existing infrastructure within the NAR and take other actions necessary to protect and effectively manage the NAR.

Actions:

1. Add 342 ac (138 ha) of former Kūlani pasture areas to the NAR to protect and enhance endangered species habitat (Figure 15).
2. Block off access to Mauna Loa Boy’s School structure through fencing and signage to reduce the safety hazard to the public.
3. Investigate the feasibility of renovating or demolishing of Mauna Loa Boy’s School structure to prevent safety hazard to the public.
4. Maintain water infrastructure (e.g. water tanks) in the Kūlani portion of the NAR for fire fighting and weed control activities.
5. Maintain management access roads to support management and educational programs.
6. Develop utility and access easements for entities requiring access through the NAR.

NARS will be pursuing the administrative process to add 342 ac (138 ha) of state lands to the NAR, including approval of the BLNR and an executive order from the Governor (Figure 15). DOFAW currently has a Right-of-Entry permit over this area for data collection, surveys and conservation activities. This area was formerly used for cattle ranching by the Kūlani Correctional Facility. These former pastures have not been used for cattle since 2005 and ranching is not an environmentally appropriate use of this land as it the native forest is naturally recovering and the area is known habitat for endangered plants and animals. This proposed addition is particularly important for endangered forest birds, as it provides high elevation forest habitat above the mosquito line. This area provides excellent opportunities for public service

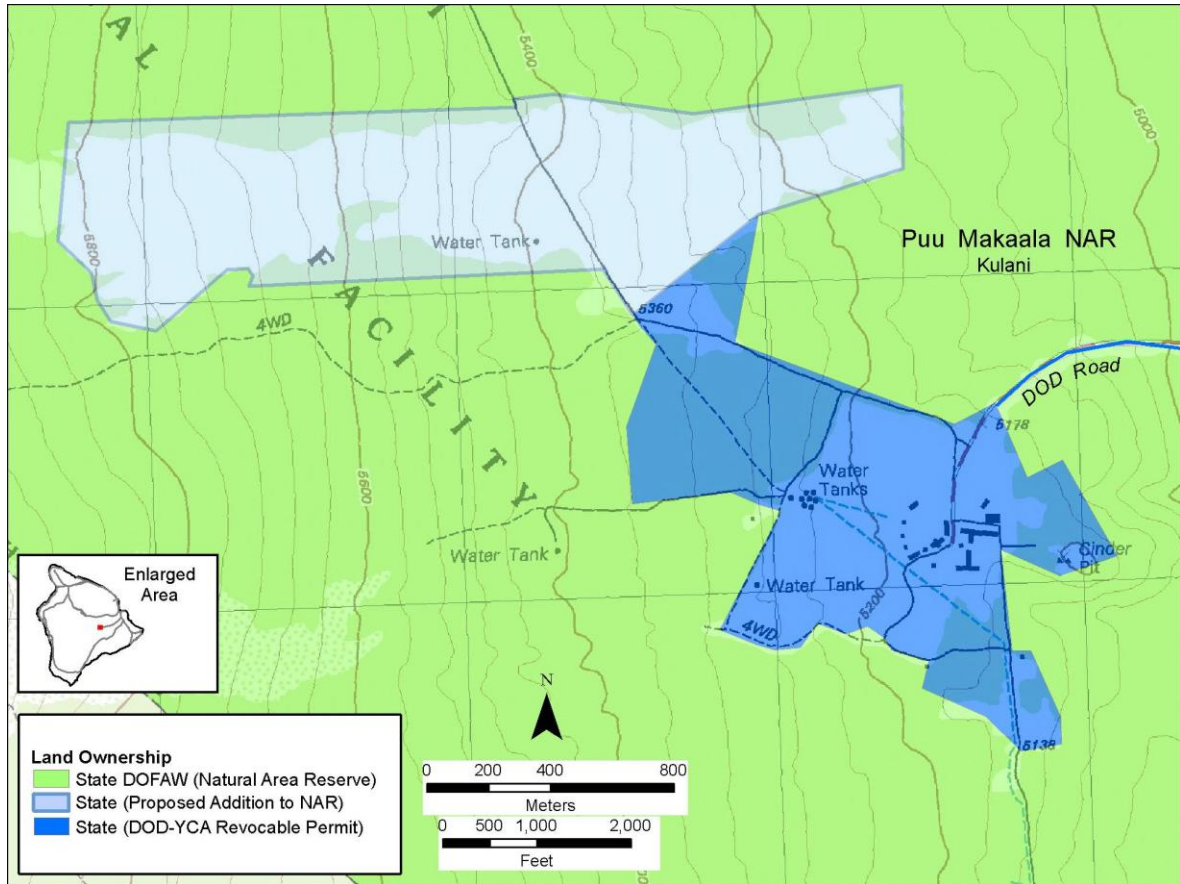
trips to work on tree planting and other restoration actions, and restoration of this area with koa-‘ōhi‘a forest will provide a critical link to connect surrounding intact forests.

The Reserve contains the Mauna Loa Boy’s School facility which has not been maintained and is in currently in severe disrepair. In the short-term, this structure may need to be blocked off with fencing and signage to reduce public safety hazard. NAR staff will investigate the cost and feasibility of renovating or demolishing this structure to remove it as a public safety hazard and implement the most feasible option. The Mauna Loa Boy’s School area was also previously used for military training and was investigated in 2010 by the U.S. Army following the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The Army’s report concludes that the majority of the area does not pose a significant threat to public health or the environment. However, a small burn pile area near the Boys’ School structure does contain levels of copper that exceed the US Environmental Protection Agency and the Hawaii Department of Health guidelines. The Army will be doing a follow-up study on the feasibility of remediating the 0.25 acre burn pile site. The burn pile site will be blocked from public access until the area is remediated and determined safe for public access.

Other former correctional facility infrastructure is also present in the Reserve (e.g. old ranch fencing, water tanks, water catchments, and roads). NAR staff would like to maintain some of this infrastructure; particularly management roads and water catchment for resources management purposes (e.g. fire fighting and weed control).

Various entities using Kūlani Cone as well as portions of the NAR for communications and utilities purposes do not have a utility and/or access easement through the NAR and other adjacent state lands. NAR staff will request that these entities work with DLNR Land Division to develop utility and access easements.

Figure 15. Proposed Addition to Pu‘u Maka‘ala NAR



BUDGET

NAR staff for the island of Hawai‘i work on all eight NAR on the island, including Pu‘u Maka‘ala. In 2009, NAR staff include five DOFAW staff, four University of Hawai‘i contractors (Pacific Cooperative Studies Unit) and 1-3 interns. The budget below assumes current budget levels/existing staff will provide labor, materials and supplies for many of the ongoing and proposed management actions. New funding will be required to hire additional NAR staff and/or contractors to complete major new proposed projects including new fence construction and the expansion of weed management into these new fenced units.

Item	Estimated Cost (15 years)	Comments (annual cost)	Existing or New cost
Ungulate Management Program			
Fence Inspection/Maintenance and Ungulate Monitoring (existing fenced units)	\$225,000	\$15K/year for staff, supplies/materials	existing budget
New Fence Construction	\$1,500,000	labor (additional staff and/or	new cost

(17 miles)		contractors), materials and helicopter @ 100K/mile	\$1,700,000
Animal Control/Monitoring (new fenced units)	\$225,000	\$15K/year for staff, supplies and materials	existing budget
Weed Management program			
Weed Management (existing fenced units)	\$900,000	\$60K/year for staff, supplies and materials	existing budget
Weed Management (new fenced units)	\$300,000	5 years @\$60K/year for staff, supplies/ materials	new cost \$300,000
Habitat Protection and Rare Species Restoration Program	\$75,000	\$5K/year for staff, supplies (outplanting rare plants)	existing budget
Fire Prevention and Response	\$75,000	\$5K/year for staff, training/equipment	existing budget
Monitoring (weeds/rare plants)	\$75,000	\$5K/year for staff	existing budget
Outreach and Education			
Volunteer service trips , teacher workshops, general education	\$150,000	\$10K/year for staff, supplies/outreach materials	existing budget
Interpretive Trail Development	\$75,000	\$5K/year staff, trail materials (e.g. (signs)	existing budget
Enforcement	-----	minimal cost	existing budget
Partnership Collaboration	\$150,000	\$10K/year for staff, supplies, materials	existing budget
Infrastructure	\$150,000	\$10K/year for staff, supplies, materials	existing budget
Estimated Total	\$3,900,000	\$2,100,000 (\$140,000/year existing budget)	\$2,000,000 new cost

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Appendix A – Plant Species List

These species lists (native plants, non-native plants are ferns) were compiled by updating the plant species list from the previous management plan (1989), consulting available literature sources to update names and consulting with NAR staff. Some species included on the list (particularly rare species and high priority weed species) may not be present in the NAR, however they are historically and/or currently known from adjacent areas.

Status: Federal and State endangered species list
 END Endangered
 T Threatened
 C Candidate species
 SOC Species of Concern (unofficial)

Affinity: N Non-native
 P Polynesian introduction
 I Indigenous
 E Endemic

Native Plants (Endemic and Indigenous)

Taxon	Common/Hawaiian name	Family	Affinity	Status
Acacia koa	koa	Fabaceae	E	
Agrostis avenacea	he'upueo	Poaceae	I	
Alyxia oliviformis	maile	Apocynaceae	E	
Anoectochilus sandvicensis	jewel orchid	Orchidaceae	E	SOC
Antidesma platyphyllum	hame	Euphorbiaceae	E	
Argyroxiphum kauense	Mauna Loa silversword	Asteraceae	E	END
Astelia menziesiana	pa'iniu, kakuaha	Liliaceae	E	
Broussaisia arguta	kanawao	Hydrangeaceae	E	
Carex alligata		Cyperaceae	E	
Carex echinata		Cyperaceae	I	
Carex macloviana		Cyperaceae	I	
Carex montis-eeka		Cyperaceae	E	
Carex thunbergii		Cyperaceae	I?	
Carex wahuensis		Cyperaceae	E	
Charpentiera obovata	pāpala	Amaranthaceae	E	
Cheirodendron trigynum	'ōlapa	Araliaceae	E	
Clermontia hawaiiensis	'ōhā kēpau, 'ōhā wai nui	Campanulaceae	E	
Clermontia lindseyana	'ōhā wai	Campanulaceae	E	END
Clermontia montis-loa	'ōhā wai	Campanulaceae	E	
Clermontia parviflora	'ōhā wai	Campanulaceae	E	
Clermontia peleana	'ōhā wai	Campanulaceae	E	END
Coprosma ernodeoides	kūkaenēnē	Rubiaceae	E	
Coprosma granadensis	mākole	Rubiaceae	E	
Coprosma montana	pilo	Rubiaceae	E	
Coprosma ochracea	pilo	Rubiaceae	E	
Coprosma pubens		Rubiaceae	E	

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<i>Coprosma rhynchocarpa</i>	pilo	Rubiaceae	E	
<i>Cryptandra tintinnabula</i>	ha'iwale	Gesneriaceae	E	END
<i>Cyane shipmanii</i>	hāhā	Campanulaceae	E	END
<i>Cyanea copelandii</i>	hāhā	Campanulaceae	E	END
<i>Cyanea floribunda</i>	hāhā	Campanulaceae	E	
<i>Cyanea giffardii</i>	hāhā	Campanulaceae	E	SOC
<i>Cyanea pilosa</i> var. <i>longipedunculata</i>	hāhā	Campanulaceae	E	
<i>Cyanea platyphylla</i>	'akū'akū	Campanulaceae	E	END
<i>Cyanea stictophylla</i>	hāhā	Campanulaceae	E	END
<i>Cyanea tritomantha</i>	'akū	Campanulaceae	E	
<i>Cyrtandra giffardii</i>	ha'iwale	Gesneriaceae	E	END
<i>Cyrtandra lysiosepala</i>	ha'iwale	Gesneriaceae	E	
<i>Cyrtandra paludosa</i>	moa, hahala	Gesneriaceae	E	
<i>Cyrtandra platyphylla</i>	'ilihia	Gesneriaceae	E	
<i>Deschampsia nubigena</i>		Poaceae	E	
<i>Dianella sandwicensis</i>	'uki'uki	Liliaceae	I	
<i>Dichanthelium hillebrandianum</i>		Poaceae	E	
<i>Dubautia scabra</i>	na'ena'e	Asteraceae	E	
<i>Eleocharis obtusa</i>	spikerush, kohekohe, pīpīwai	Cyperaceae	I	
<i>Embelia pacifica</i>	kilioe	Myrsinaceae	E	
<i>Eurya sandwicensis</i>	ānini	Theaceae	E	SOC
<i>Fimbristylis dichotoma</i>		Cyperaceae	I	
<i>Fragaria chiloensis</i> var. <i>sandwicensis</i>	'ōhelo papa	Rosaceae	E	
<i>Freycinetia arborea</i>	'ie'ie	Pandanaceae	I	
<i>Gardenia remyi</i>		Rubiaceae	E	C
<i>Hedyotis accuminata</i>	au, pilo	Rubiaceae	E	
<i>Hedyotis centranthoides</i>		Rubiaceae	E	
<i>Hedyotis terminalis</i>	manono	Rubiaceae	E	
<i>Ilex anomala</i>	kāwa'u	Aquifoliaceae	I	
<i>Joinvillea ascendens</i> ssp. <i>ascendens</i>	'ohe	Joinvilleaceae	E	C
<i>Korthalsella complanata</i>	hulumoa, kaumahana	Viscaceae	I	
<i>Labordia hedyosmifolia</i>	kāmakahala	Loganiaceae	E	
<i>Leptecophylla tameiameia</i>	pūkiawe	Ericaceae	I	
<i>Liparis hawaiiensis</i>	'awapuhiakanaloa	Orchidaceae	E	SOC
<i>Ludwigia octovalvis</i>	primrose willow, kāmole	Onagraceae	Pol?	
<i>Luzula hawaiiensis</i>	wood rush	Juncaceae	E	
<i>Machaerina angustifolia</i>	'uki	Cyperaceae	I	
<i>Melicope clusiifolia</i>	kolokolo mokihana	Rutaceae	E	
<i>Melicope hawaiiensis</i>	mokihana kūkae moa	Rutaceae	E	
<i>Melicope pseudoanisata</i>	ālani	Rutaceae	E	
<i>Melicope radiata</i>	ālani	Rutaceae	E	
<i>Melicope volcanica</i>	ālani	Rutaceae	E	
<i>Metrosideros polymorpha</i>	'ōhi'a, 'ōhi'a lehua	Myrtaceae	E	

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Morelotia gahniiformis		Cyperaceae	I	
Myoporum sandwicense	naio	Myoporaceae	I	
Myrsine lessertiana	kōlea lau nui	Myrsinaceae	E	
Myrsine sandwicensis	kōlea lau li`i	Myrsinaceae	E	
Nothoecstrum longifolium	`aiea	Solanaceae	E	
Oreobolus furcatus		Cyperaceae	E	
Peperomia cookiana	'ala'ala wai nui	Piperaceae	E	
Peperomia hypoleuca	'ala'ala wai nui	Piperaceae	E	
Peperomia latifolia	'ala'ala wai nui	Piperaceae	E	
Peperomia macraeana	'ala'ala wai nui	Piperaceae	E	
Peperomia membranacea	'ala'ala wai nui	Piperaceae	E	
Perrottetia sandwicensis	olomea	Celastraceae	E	
Phyllostegia ambigua		Lamiaceae	E	SOC
Phyllostegia brevidens		Lamiaceae	E	SOC
Phyllostegia floribunda		Lamiaceae	E	C
Phyllostegia macrophylla		Lamiaceae	E	SOC
Phyllostegia racemosa	kīponapona	Lamiaceae	E	E
Phyllostegia velutina		Lamiaceae	E	E
Phyllostegia vestita		Lamiaceae	E	
Phytolacca sandwicensis	pōpolo kū mai	Phytolaccaceae	E	
Pipturus albidus	māmaki	Urticaceae	E	
Pittosporum confertiflorum	hō'awa	Pittosporaceae	E	
Pittosporum hawaiiense	hō'awa	Pittosporaceae	E	SOC
Pittosporum terminalioides	hō'awa	Pittosporaceae	E	
Plantago pachyphylla	laukahi kuahiwi	Plantaginaceae	E	
Platydesma spathulata	pilo kea	Rutaceae	E	
Psychotria hawaiiensis	kōpiko 'ula, 'opiko	Rubiaceae	E	
Pycreus polystachyos		Cyperaceae	I	
Rubus hawaiiensis	'ākala	Rosaceae	E	
Rubus macrei	'ākala	Rosaceae	E	
Rumex giganteus	pāwale, uhauhakō	Polygonaceae	E	
Rhynchospora chinensis	kuolohia	Cyperaceae	I	
Rhynchospora rugosa	pu'uko'a	Cyperaceae	I	
Santalum paniculatum		Santalaceae	E	
Scaevola chamissoniana	naupaka, naupaka kuahiwi	Goodeniaceae	E	
Schiedea diffusa		Caryophyllaceae	E	SOC
Sicyos alba	'ānunu	Cucurbitaceae	E	E
Sisyrinchium acre	mau'u lā'ili	Iridaceae	E	SOC
Smilax melastomifolia	hoi kuahiwi, aka'awa	Smilacaceae	E	
Solanum americanum	pōpolo, glossy nightshade	Solanaceae	I	
Sophora chrysophylla	māmane	Fabaceae	E	
Stenogyne calaminthoides		Lamiaceae	E	
Stenogyne macrantha		Lamiaceae	E	SOC
Stenogyne scrophularioides	mōihi	Lamiaceae	E	
Stenogyne sessilis		Lamiaceae	E	
Tetraplasandra kavaiensis	'ohe 'ohe	Araliaceae	E	

<i>Tetraplasandra oahuensis</i>	'ohe mauka	Araliaceae	E	
<i>Touchardia latifolia</i>	olonā	Urticaceae	E	
<i>Trematolobelia grandifolia</i>		Campanulaceae	E	SOC
<i>Uncinia uncinata</i>		Cyperaceae	I	
<i>Urera glabra</i>	ōpuhe	Urticaceae	E	
<i>Vaccinium calycinum</i>	ōhelo kau lā'au	Ericaceae	E	
<i>Vaccinium reticulatum</i>	ōhelo	Ericaceae	E	
<i>Vicia menziesii</i>		Fabaceae	E	E
<i>Viola maviensis</i>		Violaceae	E	
<i>Wikstroemia sandwicensis</i>	'ākia	Thymelaeaceae	E	
<i>Xylosma hawaiiense</i>	maua	Flocourtiaceae	E	
<i>Zanthoxylum kauaense</i>	a'e, mānele	Rutaceae	E	SOC

Non- Native Plants

Taxon	Common/Hawaiian name	Family
<i>Ageratina riparia</i>	Hamakua pamakani, mist flower	Asteraceae
<i>Ageratum conyzoides</i>	maile hohono	Asteraceae
<i>Agrostis stolonifera</i>	redtop, creeping bentgrass	Poaceae
<i>Amaranthus spinosus</i>	spiny pigweed, pakai kuku	Amaranthaceae
<i>Anagallis arvensis</i>	scarlet pimpernel	Primulaceae
<i>Andropogon virginicus</i>	broomsedge	Poaceae
<i>Anemone hupehensis</i>	Japanese anemone	Ranunculaceae
<i>Anthoxanthum odoratum</i>	sweet vernalgrass	Poaceae
<i>Arenaria serpyllifolia</i>	thyme-leaved sandwort	Caryophyllaceae
<i>Arundina graminifolia</i>	bamboo orchid	Orchidaceae
<i>Axonopus fissifolius</i>	narrow-leaved carpetgrass	Poaceae
<i>Bidens alba</i>	Spanish needle	Asteraceae
<i>Bidens pilosa</i>	Spanish needle	Asteraceae
<i>Brassica rapa</i>	radish	Brassicaceae
<i>Brugmansia candida</i>	angel's trumpet	Solanaceae
<i>Buddleja asiatica</i>	dog tail, Asiatic butterfly bush	Buddlejaceae
<i>Buddleja davidii</i>	butterfly bush	Buddlejaceae
<i>Bulbostylis capillaris</i>		Cyperaceae
<i>Cannabis sativa</i>	pakalolo, marijuana	Cannabaceae
<i>Cardamine flexuosa</i>	bittercress	Brassicaceae
<i>Castilleja arvensis</i>	indian paintbrush	Scrophulariaceae
<i>Centaurium erythraea</i>	bitter herb, European centaur	Gentianaceae
<i>Centella asiatica</i>	Asiatic pennywort, pohe kula	Apiaceae
<i>Cerastium fontanum</i>	chickweed	Gentianaceae
<i>Cestrum nocturnum</i>	night blooming jasmine	Solanaceae
<i>Cirsium vulgare</i>	bull thistle	Asteraceae
<i>Clidemia hirta</i>	Koster's curse	Melastomataceae
<i>Commelina diffusa</i>	honohono, makolokolo	Commelinaceae
<i>Conyza bonariensis</i>	hairy horseweed	Asteraceae
<i>Conyza canadensis</i>	Canada fleabane	Asteraceae
<i>Cotoneaster pannosus</i>		Rosaceae

<i>Crassocephalum crepidioides</i>		Asteraceae
<i>Crocoshia x crocosmiiflora</i>	montbretia	Iridaceae
<i>Cuphea carthagenensis</i>	tarweed	Lythraceae
<i>Cyperus halpan</i>		Cyperaceae
<i>Cyperus trinervous</i>		Cyperaceae
<i>Dactylis glomerata</i>	orchardgrass, cocksfoot	Poaceae
<i>Desmodium incanum</i>	Spanish clover, ka'imi	Fabaceae
<i>Digitaria ciliaris</i>	Henry's crabgrass	Poaceae
<i>Digitaria eriantha</i>	pangola grass	Poaceae
<i>Digitaria pentzii</i>		Poaceae
<i>Digitaria violascens</i>	smooth or violet crabgrass	Poaceae
<i>Dissotis rotundifolia</i>		Melastomataceae
<i>Drymaria cordata</i>	pipili	Caryophyllaceae
<i>Ehrharta stipoides</i>	meadow ricegrass	Poaceae
<i>Emilia sonchifolia</i>	Flora's paintbrush	Asteraceae
<i>Epilobium billardierianum</i>	willow herb	Onagraceae
<i>Epilobium ciliatum</i>		Onagraceae
<i>Eragrostis brownii</i>	sheepgrass	Poaceae
<i>Eragrostis elongata</i>	lovegrass	Poaceae
<i>Erechtites valerianifolia</i>	fireweed	Asteraceae
<i>Erigeron karvinskianus</i>	daisy fleabane	Asteraceae
<i>Euchiton sphaericus</i>	Japanese cudweed	Asteraceae
<i>Festuca rubra</i>	red fescue	Poaceae
<i>Fragaria vesca</i>	European strawberry	Rosaceae
<i>Fraxinus uhdei</i>	tropical ash	Oleaceae
<i>Fuchsia magellanica</i>	hardy fuchsia, earring flower	Onagraceae
<i>Geranium homeanum</i>		Geraniaceae
<i>Gnaphalium japonicum</i>		Asteraceae
<i>Gnaphalium purpureum</i>	purple cudweed	Asteraceae
<i>Hedychium coronarium</i>	white ginger	Zingiberaceae
<i>Hedychium flavescens</i>	yellow giner	Zingiberaceae
<i>Hedychium gardnerianum</i>	kāhili ginger	Zingiberaceae
<i>Holcus lanatus</i>	velvetgrass	Poaceae
<i>Hydrocotyle bowlesioides</i>	marsh pennywort	Apiaceae
<i>Hydrocotyle verticillata</i>	pohe	Apiaceae
<i>Hyparrhenia rufa</i>	thatching grass, jaragua	Poaceae
<i>Hypericum kouytchense</i>	St. John's wort	Clusiaceae
<i>Hypericum mutilum</i>	St. John's wort	Clusiaceae
<i>Hypericum parvulum</i>	St. John's wort	Clusiaceae
<i>Hypochoeris radicata</i>	hairy cat's ear	Asteraceae
<i>Juncus acuminatus</i>	rush	Juncaceae
<i>Juncus bufonius</i>	common or toad rush	Juncaceae
<i>Juncus effusus</i>	Japanese mat rush	Juncaceae
<i>Juncus ensifolius</i>	rush	Juncaceae
<i>Juncus planifolius</i>	rush	Juncaceae
<i>Juncus polyanthemos</i>	rush	Juncaceae

<i>Juncus tenuis</i>	path rush	Juncaceae
<i>Kyllinga brevifolia</i>	kili'o'opu	Cyperaceae
<i>Leucanthemum vulgare</i>	ox-eye, white, or field daisy	Asteraceae
<i>Lonicera japonica</i>	honeysuckle	Caprifoliaceae
<i>Lotus subbiflorus</i>		Fabaceae
<i>Lotus uliginosus</i>		Fabaceae
<i>Ludwigia palustris</i>	marsh purslane	Onagraceae
<i>Lythrum maritimum</i>	loosestrife	Lythraceae
<i>Melinis minutiflora</i>	molasses grass	Poaceae
<i>Melinis repens</i>	Natal redtop	Poaceae
<i>Morella faya</i>	faya	Myrsinaceae
<i>Myosotis discolor</i>	forget me not	Borginaceae
<i>Oenothera stricta</i>	evening primrose	Onagraceae
<i>Oxalis corniculata</i>	yellow wood sorrel	Oxalidaceae
<i>Panicum repens</i>	torpedo grass, quack grass	Poaceae
<i>Paspalum conjugatum</i>	Hilo grass	Poaceae
<i>Paspalum dilatatum</i>	dallis grass	Poaceae
<i>Paspalum urvillei</i>	vasey grass	Poaceae
<i>Passiflora edulis</i>	liliko`i, passion fruit	Passifloraceae
<i>Passiflora ligularis</i>	sweet granadilla	Passifloraceae
<i>Passiflora tarminiana</i>	banana poka	Passifloraceae
<i>Pennisetum clandestinum</i>	kikuyu grass	Poaceae
<i>Persicaria capitatum</i>	knotweed	Polygonaceae
<i>Persicaria punctatum</i>	water smartweed	Polygonaceae
<i>Phaius tankarvilleae</i>	Chinese ground orchid	Orchidaceae
<i>Physalis peruviana</i>	poha, cape gooseberry	Solanaceae
<i>Phytolacca octandra</i>	southern pokeberry	Phytolaccaceae
<i>Pinus spp.</i>		Pinaceae
<i>Plantago australis</i>	dwarf plantain	Plantaginaceae
<i>Plantago lanceolata</i>	narrow-leafed plantain	Plantaginaceae
<i>Plantago major</i>	laukahi, broad-leafed plantain	Plantaginaceae
<i>Pluchea symphytifolia</i>	sourbush	Asteraceae
<i>Poa annua</i>	annual bluegrass	Poaceae
<i>Poa pratensis</i>	Kentucky bluegrass	Poaceae
<i>Polygala paniculata</i>	milkwort	Polygalaceae
<i>Pritchardia beccariana</i>	loulou	Areaceae
<i>Prunella vulgaris</i>	selfheal, heal-all	Lamiaceae
<i>Prunus cerasifer x salicina</i>		Rosaceae
<i>Psidium cattleianum</i>	strawberry guava	Myrtaceae
<i>Psidium guajava</i>	common guava	Myrtaceae
<i>Pycreus sanguinolentus</i>		Cyperaceae
<i>Pyrocantha angustifolia</i>	firethorn	Rosaceae
<i>Ranunculus plebeius</i>	common Australian buttercup	Ranunculaceae
<i>Ranunculus repens</i>	creeping buttercup, butter daisy	Ranunculaceae
<i>Rhynchospora caduca</i>	beak rush	Cyperaceae
<i>Rubus argutus</i>	blackberry	Rosaceae

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Rubus ellipticus	yellow Himalayan raspberry	Rosaceae
Rubus glaucus		Rosaceae
Rubus niveus	hill or mysore raspberry	Rosaceae
Rubus rosifolius	thimbleberry	Rosaceae
Rumex acetosella	sheep sorrel	Polygonaceae
Rumex crispus	curly or yellow dock	Polygonaceae
Sacciolepis indica	Glenwood grass	Poaceae
Salvia spp.		Lamiaceae
Schizachyrium condensatum	beardgrass	Poaceae
Senecio madagascariensis	fireweed	Asteraceae
Senecio sylvaticus	wood groundsel	Asteraceae
Sequoia sempervirens		Taxiodaceae
Setaria gracilis	yellow or perennial foxtail	Poaceae
Setaria palmifolia	palmgrass	Poaceae
Sonchus asper	prickly sow thistle	Asteraceae
Sonchus oleraceus	sow thistle	Asteraceae
Spermacoce mauritiana		Rubiaceae
Sporobolus africanus	smutgrass, African dropseed	Poaceae
Sporobolus indicus	West Indian dropseed	Poaceae
Stachytarpheta dichotoma	ōwi, ōi	Verbenaceae
Stenotaphrum secundatum	St. Augustine grass, buffalo grass	Poaceae
Taraxacum officinale	dandelion	Asteraceae
Themeda villosa	Lyon's grass	Poaceae
Tibouchina herbacea	Cane tibouchina	Melastomataceae
Tibouchina longifolia	glorybush	Melastomataceae
Tibouchina urvilleana	Lasiandra, princess flower	Melastomataceae
Trifolium dubium	small hop clover	Fabaceae
Trifolium repens	white clover	Fabaceae
Tropaeolum majus	nasturtium	Tropaeolaceae
Verbascum thapsus	common mullein	Scrophulariaceae
Verbena litoralis	hau'owi, ōwi, ōi	Verbenaceae
Veronica plebeia	trailing or common speedwell	Scrophulariaceae
Veronica serpyllifolia	thyme-leaved speedwell	Scrophulariaceae
Vulpia bromoides	brome fescue	Poaceae
Vulpia myuros	rat tail fescue	Poaceae
Xyris platyleis	yellow eyed grass	Xyridaceae
Youngia japonica	oriental hawksbeard	Asteraceae

Ferns (native and non-native)

Taxon	Common/Hawaiian name	Family	Affinity	Status
Adenophorus hymenophylloides	pai, palai huna	Grammitidaceae	E	
Adenophorus periens	palai la'aū	Grammitidaceae	E	END
Adenophorus pinnatifidus		Grammitidaceae	E	
Adenophorus tamariscinus	wahine noho mauna	Grammitidaceae	E	
Adenophorus tripinnatifidus		Grammitidaceae	E	
Adiantum hispidulum		Pteridaceae	N	

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<i>Adiantum raddianum</i>	rough maidenhair fern	Pteridaceae	N	
<i>Amauropelta globulifera</i>	palapalai a Kamapua'a	Thelypteridaceae	E	
<i>Angiopteris evecta</i>	mule's-foot fern	Marattiaceae	N	
<i>Asplenium acuminatum</i>	lola	Aspleniaceae	E	
<i>Asplenium adiantum-nigrum</i>	'iwa'iwa	Aspleniaceae	I	
<i>Asplenium aethiopicum</i>	'iwa'iwa a Kāne	Aspleniaceae	I	
<i>Asplenium contiguum</i>		Aspleniaceae	E	
<i>Asplenium horridum</i>	'iwa, 'alae	Aspleniaceae	I	
<i>Asplenium insiticium</i>	pī'ipī'i lau manamana, 'anali'i	Aspleniaceae	I	
<i>Asplenium lobulatum</i>	pī'ipī'i lau manamana	Aspleniaceae	I	
<i>Asplenium macraei</i>	'iwa'iwa lau li'i	Aspleniaceae	E	
<i>Asplenium monanthes</i>		Aspleniaceae	I	
<i>Asplenium normale</i>		Aspleniaceae	I	
<i>Asplenium peruvianum</i> var. <i>insulare</i>		Aspleniaceae	E	END
<i>Asplenium polyodon</i>	pūnana manu	Aspleniaceae	I	
<i>Asplenium schizophyllum</i>		Aspleniaceae	E	
<i>Asplenium sphenotomum</i>		Aspleniaceae	E	
<i>Asplenium</i> spp.		Aspleniaceae	E	
<i>Asplenium trichomanes</i>	'oāl'i	Aspleniaceae	E	
<i>Asplenium unilaterale</i>	pāmoho	Aspleniaceae	I	
<i>Athyrium microphyllum</i>	'ākōlea	Athyriaceae	E	
<i>Botrychium subbifoliatum</i>	makou	Ophioglossaceae	E	
<i>Christella cyatheoides</i>	kakawaiō, kikawaioa, pakikawaiō	Thelypteridaceae	E	
<i>Christella dentata</i>	pai'i'hā	Thelypteridaceae	N	
<i>Christella parasitica</i>		Thelypteridaceae	N	
<i>Cibotium chamissoi</i>	hapu'u, meu	Dicksoniaceae	E	
<i>Cibotium glaucum</i>	hapu'u, hapu'u pulu	Dicksoniaceae	E	
<i>Cibotium menziesii</i>	hapu'u 'i'i	Dicksoniaceae	E	
<i>Coniogramme pilosa</i>	lo'ulu	Pteridaceae	E	
<i>Ctenitis latifrons</i>	'ākōlea	Dryopteridaceae	E	
<i>Cyrtomium caryotideum</i>	kā'ape'ape, āhina kuahiwi	Dryopteridaceae	I	
<i>Deparia petersonii</i>		Athyriaceae	N	
<i>Dicranopteris linearis</i>	uluhe	Athyriaceae	I	
<i>Diplazium sandwichianum</i>	hō'i'o	Athyriaceae	E	
<i>Diplopterygium pinnatum</i>	uluhe lau nui	Gleicheniaceae	E	
<i>Dryopteris fusco-atra</i>	'i'i	Dryopteridaceae	E	
<i>Dryopteris glabra</i>	kīlau, hohiu	Dryopteridaceae	E	
<i>Dryopteris hawaiiensis</i>		Dryopteridaceae	E	
<i>Dryopteris sandwicensis</i>		Dryopteridaceae	E	
<i>Dryopteris unidentata</i> var. <i>paleacea</i>	'akole	Dryopteridaceae	E	
<i>Dryopteris unidentata</i> var. <i>unidentata</i>	'akole	Dryopteridaceae	E	
<i>Dryopteris wallichiana</i>	'i'o nui, laukahi	Dryopteridaceae	E	
<i>Elaphoglossum crassifolium</i>	hoe a Maui, 'ekaha	Lomariopsidaceae	E	
<i>Elaphoglossum paleaceum</i>	māku'e	Lomariopsidaceae	I	

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<i>Elaphoglossum pellucidum</i>	hoe a Maui, 'ekaha 'ula	Lomariaopsidaceae	E	
<i>Elaphoglossum wawrae</i>	laukahi, hoe a Maui, 'ekaha 'ula	Lomariaopsidaceae	E	
<i>Gonocormus prolifer</i>		Hymenophyllaceae	I	
<i>Grammitis hookeri</i>	māku'e lau li'i	Grammitidaceae	I	
<i>Grammitis tenella</i>	kolokolo, mahinalua	Grammitidaceae	E	
<i>Huperzia filiformis</i>		Lycopodiaceae	I	
<i>Huperzia phyllantha</i>	wawae'iole	Lycopodiaceae	I	
<i>Huperzia serrata</i>	wawae'iole	Lycopodiaceae	I	
<i>Hypolepis hawaiiensis</i>	olua	Dennstaedtiaceae	E	
<i>Lellingeria safordii</i>	kihe	Grammitidaceae	E	
<i>Lepisorus thunbergianus</i>	pākahakaha, 'ekaha ākōlea	Polypodiaceae	I	
<i>Lycopodium cernua</i>	wawae'iole	Lycopodiaceae	I	
<i>Lycopodium venustum</i>	wawae'iole	Lycopodiaceae	I	
<i>Macrothelypteris torresiana</i>		Thelypteridaceae	N	
<i>Marattia douglasii</i>	pala	Marattiaceae	E	
<i>Mecodium recurvum</i>	`ōhi`a kū	Hymenophyllaceae	E	
<i>Microlepia strigosa</i>	palapalai	Dennstaedtiaceae	I	
<i>Nephrolepis cordifolia</i>	narrow swordfern	Nephrolepidaceae	I	
<i>Nephrolepis exaltata</i> subsp. <i>hawaiiensis</i>	ni`ani`au, `ōkupu-kupu, pāmoho, kupukupu	Nephrolepidaceae	E	
<i>Nephrolepis multifora</i>	scaly swordfern	Nephrolepidaceae	N	
<i>Nothoperanema rubiginosa</i>	pauoa	Dryopteridaceae	E	
<i>Ophioderma pendulum</i>	puapua moa	Ophioglossaceae	I	
<i>Pityrogramma austroamericana</i>	gold fern, goldback fern	Pteridaceae	N	
<i>Pityrogramma calomelanos</i>	silver fern, silverback fern	Pteridaceae	N	
<i>Pneumatopteris sandwicensis</i>	hō'i'o-kula	Thelypteridaceae	E	
<i>Polypodium pellucidum</i>	'ae, 'ae lau nui	Polypodiaceae	E	
<i>Polystichum hillebrandii</i>	ka'upu, papa'oi	Dryopteridaceae	E	
<i>Pseudophegopteris keraudreniana</i>	waimaka-nui, 'ala'alai	Thelypteridaceae	E	
<i>Psilotum complanatum</i>	moa	Psilotaceae	I	
<i>Psilotum nudum</i>	pipi	Psilotaceae	I	
<i>Pteridium aquilinum</i>	kīlau, bracken fern	Dennstaedtiaceae	E	
<i>Pteris cretica</i>	'oāl'i, Cretan brake	Pteridaceae	I	
<i>Pteris excelsa</i>	waimakanui, 'iwa	Pteridaceae	I	
<i>Pteris irregularis</i>	māna	Pteridaceae	E	
<i>Sadleria cyatheoides</i>	'ama'u, ma'u	Blechnaceae	E	
<i>Sadleria pallida</i>	'ama'u, ma'u	Blechnaceae	E	
<i>Sadleria souleyetiana</i>	'ama'u, ma'u	Blechnaceae	E	
<i>Selaginella arbuscula</i>	lepelepe a moa	Sellaginellaceae	E	
<i>Selaginella kraussiana</i>	spreading selaginella	Sellaginellaceae	N	
<i>Sphaerocionium lanceolatum</i>	palai hinahina	Hymenophyllaceae	E	
<i>Sphaeropteris cooperi</i>	Australian tree fern	Cyatheaceae	N	
<i>Sphenomeris chinensis</i>	pala'ā	Lindsaeaceae	I	
<i>Sticherus owbyensis</i>		Gleicheniaceae	E	
<i>Vandenboschia davallioides</i>	kilau	Hymenophyllaceae	E	

Appendix B - Pu‘u Maka‘ala Birds (birds historically/currently found in or near the NAR).

Taxon	Common Name	Status
<i>Acridotheres tristis</i>	common myna	non-native
<i>Alauda arvensis</i>	Eurasian skylark	non-native
<i>Asio flammeus sandwichensis</i>	pueo, Hawaiian owl	endemic
<i>Branta sandvicensis</i>	nēnē, Hawaiian goose	endemic - endangered
<i>Buteo solitarius</i>	‘io, Hawaiian hawk	endemic - endangered
<i>Callipepla californica</i>	California quail	non-native
<i>Cardinalis cardinalis</i>	northern cardinal	non-native
<i>Carpodacus mexicanus</i>	house finch	non-native
<i>Cettia diphone</i>	Japanese bush warbler	non-native
<i>Chasiempis sandwichensis</i>	‘elepaio	endemic
<i>Francolinus erckelii</i>	Erckel’s francolin	non-native
<i>Garrulax canows</i>	hwamei, melodious laughing thrush	non-native
<i>Geopelia striata</i>	zebra dove	non-native
<i>Hemignathus munroi</i>	‘akiapōlā‘au	endemic - endangered
<i>Hemignathus virens</i>	‘amakihi	endemic
<i>Himatione sanguinea</i>	‘apapane	endemic
<i>Leiothrix lutea</i>	red-billed leiothrix	non-native
<i>Lonchura punctulata</i>	nutmeg mannikin	non-native
<i>Lophura leucomelanos</i>	kalij pheasant	non-native
<i>Loxops coccineus</i>	Hawai‘i ‘ākepa	endemic - endangered
<i>Oceanodroma castro</i>	‘akē‘akē, band-rumped storm petrel	indigenous - candidate
<i>Oreomystis mana</i>	Hawai‘i creeper	endemic - endangered
<i>Phaeornis obscurus</i>	‘ōma‘o	endemic
<i>Phasianus colchicus</i>	ring-necked pheasant	non-native
<i>Pluvialis fulva</i>	kōlea, Pacific golden plover	indigenous
<i>Psittirostra psittacea</i>	‘ō‘ū	endemic – endangered
<i>Pterodroma sandwichensis</i>	‘ua‘u or Hawaiian petrel	endemic - endangered
<i>Vestiaria coccinea</i>	‘i‘iwi	endemic
<i>Zosterops japonicus</i>	Japanese white-eye	non-native

Appendix C - Insects and related arthropods, including land snails, collected and/or recorded from Pu'u Maka'ala NAR (Preston 1995).

TAXA	STATUS¹
ACARI	
Oribatulidae	?
undetermined mites	?
AMPHIPODA	
Talitridae	?
ARANEAE	
COLLEMBOLA	
Entomobryidae	
<i>Entomobrya</i> spp.	end?
Isotomidae	
<i>Folsomia</i> sp.	end?
Sminthuridae	
nr. <i>Sminthurides</i> sp.	?
COLEOPTERA	
² Aglycyderidae	end
Anobiidae	
<i>Mirosternus lugubris</i> Perkins, 1910	end
<i>Xyletobius collingei</i> Perkins, 1910	end
Carabidae	
<i>Mecyclothorax</i> sp. nr. <i>paradoxus</i> (Blackburn, 1879)	end
<i>Mecyclothorax</i> sp. nr. <i>proximus</i> Britton, 1948	end
Ciidae	
<i>Cis</i> sp. nr. <i>setarius</i> Sharp, 1885	end?
Nitidulidae	
<i>Euptinus hawaiiensis</i> Sharp, 1878	end
Staphylinidae	
<i>Atheta</i> sp.	adv?
<i>Myllaena cognata</i> Sharp, 1908	end
DIPTERA	
Calliphoridae	
<i>Calliphora vomitoria</i> (Linnaeus, 1758)	adv
<i>Dyscritomyia</i> spp.	end
<i>Eucalliphora latifrons</i> (Hough, 1899)	adv
<i>Lucilia cuprina</i> (Wiedemann, 1830)	adv
Cecidomyiidae	?
Ceratopogonidae	
<i>Forcipomyia</i> prob. <i>hardyi</i> Wirth & Howarth, 1982	end
Chironomidae	
<i>Orthocladius</i> sp. A	end
<i>Orthocladius</i> sp. B	end
Chloropidae	
<i>Rhodesiella</i> sp.	end?
Dixiidae	adv
Dolichopodidae	
<i>Campsicnemus flaviventer</i> Hardy & Kohn, 1964	end
<i>Campsicnemus fumipennis</i> Parent, 1937	end
<i>Campsicnemus impariseta</i> Hardy & Kohn, 1964	end
<i>Campsicnemus longiquus</i> Tenorio, 1969	end
<i>Campsicnemus penicillatus</i> Parent, 1934	end
<i>Campsicnemus psychochaeta</i> Hardy & Kohn, 1964	end
<i>Campsicnemus scolimerus</i> Hardy & Kohn, 1964	end

<i>Campsicnemus</i> new sp. A (white specimens)	end
<i>Eurynogaster</i> sp. A	end
Drosophilidae	
<i>Drosophila suzukii</i> group	adv
² <i>Drosophila</i> spp. (picture wing group)	end
<i>Scaptomyza</i> spp.	end
Ephydriidae	
<i>Scatella</i> sp.	end
Muscidae	
² <i>Lispocephala confluens</i> (Malloch, 1928)	end
<i>Lispocephala dexioides</i> (Grimshaw, 1901)	end
<i>Lispocephala ingens</i> (Grimshaw, 1901)	end
Phoridae	
<i>Chonocephalus</i> sp.	end
<i>Megaselia</i> spp.	end
Psychodidae	
<i>Clogmia albipunctata</i> (Williston, 1893)	adv
<i>Psychoda</i> spp.	end?
Sarcophagidae	
<i>Ravinia lherminieri</i> (Robineau-Desvoidy, 1830)	adv
Sciaridae	
<i>Bradysia</i> sp.	end?
Sphaeroceridae	
<i>Leptocera abdominiseta</i> (Duda, 1925)	adv
<i>Leptocera</i> sp.	end?
Stratiomyidae	
<i>Wallacea albisetata</i> Meijere, 1907	adv
Syrphidae	
<i>Allograpta exotica</i> (Weidemann, 1830)	pur
Tipulidae	
<i>Limonia grimshawi</i> (Alexander, 1919)	end
<i>Limonia perkinsi</i> (Grimshaw, 1901)	adv
<i>Limonia stygipennis</i> (Alexander, 1919)	end
<i>Limonia</i> n. sp.	End
<i>Limnotes</i> sp.	adv
HETEROPTERA	
Lygaeidae	
<i>Neseis</i> sp.	end
² Miridae	
<i>Hyalopeplus pellucidus</i> (Stål, 1859)	end?
<i>Orthhotylus</i> spp.	end
<i>Sarona</i> sp.	end
Nabidae	
<i>Nabis oscillans</i> Blackburn, 1888	end
HOMOPTERA	
Aphididae	
<i>Aphis</i> sp.	adv
Cicadellidae	
<i>Nesophrosyne</i> spp.	end
Cixiidae	
<i>Iolania perkinsi</i> Kirkaldy, 1902	end
<i>Oliarus</i> sp. A	end
<i>Oliarus</i> sp. B	end
² Delphacidae	
<i>Leialoha</i> sp.	end

<i>Nesosydne</i> sp. A	end
<i>Nesosydne</i> sp. B	end
<i>Nesothoe</i> sp.	end
Flatidae	
<i>Siphanta acuta</i> (Walker, 1851)	adv
Psyllidae	
<i>Megatrioza</i> sp. A	end
<i>Megatrioza</i> sp. B	end
<i>Triozia</i> sp. A	end
<i>Triozia</i> sp. B	end
<i>Triozia</i> n. sp. [Nishida, et al, 1980]	end
HYMENOPTERA	
Agaonidae	
<i>Parapristina verticillata</i> (Waterston, 1921)	pur
<i>Pleistodontes froggatti</i> Mayr, 1906	pur
Aphelinidae	
<i>Aphelinus</i> sp. A	pur?
<i>Aphelinus</i> sp. B	pur?
Aphelinidae	
<i>Aphytis</i> nr. <i>chrysomphali</i> (Mercet, 1912)	pur?
<i>Encarsia</i> sp. A	pur?
<i>Encarsia</i> sp. B	pur?
<i>Encarsia</i> sp. C	pur?
Bethylidae	
<i>Sclerodermus</i> sp.	end
<i>Sierola</i> sp. A	end
<i>Sierola</i> sp. B	end
<i>Sierola</i> sp. C	end
Braconidae	
<i>Bracon terryi</i> (Bridwell, 1919)	adv
<i>Opius dissitus</i> Muesebeck, 1963	pur
<i>Opius</i> sp. A	pur?
<i>Opius</i> sp. B	pur?
Chalcididae	
<i>Brachymeria</i> sp.	pur?
Colletidae	
<i>Hylaeus</i> sp.	end
Diapriidae	
<i>Coptera silvestrii</i> (Kieffer, 1913)	pur
Dryinidae	
nr. <i>Tetrodontochelys</i> sp.	adv?
Encyrtidae	
<i>Anagyrus</i> sp. A	pur?
<i>Anagyrus</i> sp. B	pur?
<i>Anagyrus</i> sp. C	pur?
<i>Anagyrus</i> sp. D	pur?
nr. <i>Metaphycus</i> sp.	pur?
nr. <i>Ooencyrtus</i> sp.	pur?
Eucoilidae	
<i>Pseudeucoila</i> sp. A	end
<i>Pseudeucoila</i> sp. B	end
Eulophidae	
<i>Aprostocetus</i> sp.	pur?
<i>Chrysocharis</i> sp.	pur?
<i>Diglyphus begini</i> (Ashmead, 1904)	adv

Eupelmidae		
	² <i>Eupelmus</i> sp. A	end
	<i>Eupelmus</i> sp. B	end
	<i>Eupelmus</i> sp. C	end
	<i>Eupelmus</i> sp. D	end
	<i>Eupelmus</i> sp. E	end
Eurytomidae		
	<i>Eurytoma</i> sp.	adv
Ichneumonidae		
	<i>Diadegma blackburni</i> (Cameron, 1883)	adv
	<i>Diadegma</i> sp.	adv
	² <i>Enicospilus nigrolineatus</i> Ashmead, 1901	end
	<i>Enicospilus</i> sp. A	end
	<i>Enicospilus</i> sp. B	end
	<i>Ichneumon purpuripennis</i> Cresson, 1877	pur
	<i>Spolas</i> nr. <i>hawaiiensis</i> (Ashmead, 1901)	end
	<i>Spolas</i> sp. A	end
	<i>Spolas</i> sp. B	end
Mymaridae		
	<i>Anagrus</i> sp. A	pur?
Mymaridae		
	<i>Anagrus</i> sp. B	pur?
	<i>Polynema</i> sp.	end
Platygasteridae		
	<i>Amitus spiniferus</i> (Brethes, 1914)	pur
	<i>Fidiobia</i> sp.	pur?
	<i>Platygaster acciculus</i> Drake, 1969	adv
Proctotrupidae		
	<i>Brachyserphus hawaiiensis</i> (Ashmead, 1901)	adv?
	<i>Exallonyx trifoveatus</i> Kieffer, 1908	adv
Pteromalidae		
	<i>Spalangia</i> sp. A	?
	<i>Spalangia</i> sp. B	?
Scelionidae		
	<i>Baeus</i> sp.	pur
Sphecidae		
	<i>Ectemnius</i> sp. A	end
	<i>Ectemnius</i> sp. B	end
Trichogrammatidae		
	<i>Trichogramma</i> spp.	pur
Vespidae		
	<i>Odynerus</i> sp.	end
	<i>Vespula pensylvanica</i> (Saussure, 1857)	adv
ISOPODA		
Philosciidae		
	<i>Littorophiloscia</i> sp.	end?
Porcellionidae		
	<i>Porcellio</i> sp.	adv
LEPIDOPTERA		
Carposinidae		
	<i>Carposina</i> sp. A	end
	<i>Carposina</i> sp. B	end
Cosmopterigidae		
	<i>Hyposmocoma</i> sp. A	end
	<i>Hyposmocoma</i> sp. B	end

<i>Hyposmocoma</i> sp. C	end
<i>Hyposmocoma</i> sp. D	end
<i>Hyposmocoma</i> sp. E	end
<i>Hyposmocoma</i> sp. F	end
<i>Hyposmocoma</i> sp. G	end
<i>Hyposmocoma</i> sp. H	end
² Crambidae	
<i>Eudonia</i> sp. A	end
<i>Eudonia</i> sp. B	end
<i>Eudonia</i> sp. C	end
Crambidae	
<i>Eudonia</i> sp. D	end
<i>Eudonia</i> sp. E	end
<i>Mestolobes minuscula</i> (Butler, 1881)	end
<i>Mestolobes</i> sp.	end
<i>Omiodes accepta</i> (Butler, 1877)	end
<i>Omiodes asaphombra</i> Meyrick, 1899	end
<i>Udea argoscelis</i> (Meyrick, 1899)	end
Gelechiidae	
<i>Crasimorpha infuscata</i> Hodges, 1964	pur
² Geometridae	
<i>Eupithecia monticolens</i> Butler, 1881	end
<i>Scotorythra artemidora</i> Meyrick, 1899	end
<i>Scotorythra brunnea</i> (Warren, 1896)	end
<i>Scotorythra euryphaea</i> Meyrick, 1899	end
<i>Scotorythra pachyspila</i> Meyrick, 1899	end
Noctuidae	
<i>Haliophyle euclidias</i> (Meyrick, 1899)	end
<i>Hypena laceratalis</i> Walker, 1858	pur
<i>Pseudoschrankia</i> n. sp.	end
<i>Schrankia</i> sp.	end
Oecophoridae	
<i>Stoerberhinus testaceus</i> Butler, 1881	adv
<i>Thyrocopa</i> sp.	end
Sphingidae	
<i>Hyles wilsoni</i> (Rothschild, 1894)	end
Tineidae	
<i>Decadarchis</i> sp. A	adv
<i>Decadarchis</i> sp. B	adv
<i>Opogona omoscopia</i> (Meyrick, 1893)	adv
Tortricidae	
<i>Amorbia emigratella</i> Busck, 1910	adv
<i>Bactra straminea</i> (Butler, 1881)	adv
<i>Bradleyella</i> sp.	end
² <i>Cydia</i> sp. A	end
<i>Cydia</i> sp. B	end
<i>Cydia</i> sp. C	end
<i>Spheterista</i> sp.	end
NEUROPTERA	
Chrysopidae	
<i>Anomalochrysa</i> nr. <i>debilis</i> Perkins, 1899	end
<i>Chrysoperla comanche</i> (Banks, 1938)	adv
Hemerobiidae	
<i>Micromus brunnescens</i> (Perkins, 1899)	end

<i>Micromus vagus</i> (Perkins, 1899)	end
ODONATA	
² Coenagrionidae	
<i>Enallagma civile</i> (Hagen, 1862)	adv
<i>Megalagrion amaurodytum peles</i> (Perkins, 1899)	end
<i>Megalagrion calliphya microdemas</i> (Perkins, 1899)	end
<i>Megalagrion hawaiiense</i> (McLachlan, 1883)	end
ORTHOPTERA	
Gryllidae	
<i>Laupala</i> spp.	end
<i>Paratrigonidium</i> sp.	end
PSOCOPTERA	
Ectopsocidae	
<i>Ectopsocus</i> sp. A	adv
<i>Ectopsocus</i> sp. B	adv
Elipsocidae	
<i>Kilauella</i> nr. <i>erythrosticka</i> (Perkins, 1899)	end
<i>Palistreptus</i> spp.	end
Lepidopsocidae	
<i>Lepidopsocus</i> nr. <i>maculatus</i> Thornton, Lee & Chui, 1972	adv
Psocidae	
<i>Ptycta</i> sp. A	end
<i>Ptycta</i> sp. B	end
<i>Ptycta</i> sp. C	end
LAND SNAILS	
<i>Amastra armata</i>	nat
<i>Auriculella westerlundiana</i>	nat
<i>Cookeconcha</i> sp.	nat
<i>Cookeconcha thaanumi</i>	nat
<i>Euconulus gaetanoi</i>	nat
<i>Euconulus thaanumi</i>	nat
<i>Hawaiiia minuscula</i>	adv
<i>Hiona rufobrunnea</i>	nat
<i>Leptachatina</i> sp.	nat
<i>Leptachatina arborea</i>	nat
<i>Nesopupa anceyana</i>	nat
<i>Oxychilus alliaris</i>	adv
<i>Philonesia</i> sp.	nat
<i>Philonesia sericans</i>	nat

¹ Status codes: adv = adventive, end = endemic, nat = native, pur = purposely introduced

² Notable records.

Appendix B.

**He Mo‘olelo ‘Āina: A Cultural Study of the
Pu‘u Maka‘ala Natural Area Reserve, District
of Hilo and Puna, Island of Hawai‘i (2004)**

HE MO‘OLELO ‘ĀINA: A CULTURAL STUDY OF THE PU‘U MAKA‘ALA NATURAL AREA RESERVE DISTRICTS OF HILO AND PUNA, ISLAND OF HAWAI‘I



*View to Pu‘u Maka‘ala and Mauna Loa
(Photo Courtesy of DLNR-NARS)*



*“Birds eye” View of the Hāpu‘u and Scattered
Ōhi‘a Forest of Pu‘u Maka‘ala
(Photo Courtesy of DLNR-NARS)*



*‘Ōhāhā (Cyanea longipedunculata)
of Pu‘u Maka‘ala
(William Mull 1975;
Photo Courtesy of DLNR-NARS)*



*Julie Leialoha Describing Pu‘u Maka‘ala NAR
to NARS Commission Members and
Educators (Photo Courtesy of DLNR-NARS)*



Kumu Pono Associates LLC

*Historical & Archival Documentary Research · Oral History Interview Studies ·
Researching and Preparing Studies from Hawaiian Language Documents ·
Māhele ‘Āina, Boundary Commission, & Land History Records ·
Integrated Cultural Resources Management Planning ·
Preservation & Interpretive Program Development*

HE MO'OLELO 'ĀINA: A CULTURAL STUDY OF THE PU'U MAKA'ALA NATURAL AREA RESERVE DISTRICTS OF HILO AND PUNA, ISLAND OF HAWAI'I

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MAY 31, 2004

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Preservation & Interpretive Program Development*

EXECUTIVE SUMMARY

At the request of Ms. Lisa Hadway, Natural Area Specialist for the State of Hawai'i Department of Land and Natural Resources—Division of Forestry and Wildlife (DLNR-DOFAW), *Kumu Pono Associates LLC*, conducted a detailed study of historical and archival literature documenting the natural and cultural landscape and history of land use in the vicinity of the Pu'u Maka'ala Natural Area Reserve, and adjoining lands of Waiākea, in the District of Hilo, and 'Ōla'a, in the District of Puna. The documentation also includes detailed oral testimonies—describing the lands, traditional and customary practices, and historical land use—from native residents of lands in the 'Ōla'a, Waiākea-Humu'ula, and Keauhou vicinity, collected in the 1870s to 1890s. The documentation cited herein is the product of years of research, and includes specific research conducted for the study between October 2003 to April 2004. The research was conducted in private and public collections, and that documentation, cited herein, includes written narratives that cover the period from antiquity to the 1980s.

The archival-historical resources were located in the collections of the Hawai'i State Archives, Land Management Division, Survey Division, Bureau of Conveyances and the Natural Areas Reserve System offices; the Hawaiian Historical Society; the University of Hawai'i-Hilo Mo'okini Library; private family collections; and in the collection of *Kumu Pono Associates LLC*. The documentation includes rich narratives translated from native Hawaiian accounts; descriptions of lands that make up the Puna, Hilo and Eastern Ka'ū mountain lands, recorded in historic surveys; a history of land tenure from 1848 to the present; records documenting the establishment of the 'Ōla'a and Waiākea Forest Reserves, and the subsequent designation of the Pu'u Maka'ala Natural Area Reserve.

The Natural Area Reserve takes its name from Pu'u Maka'ala, literally, Stay-alert Hill—named by State Forester, Ralph Daelher in the early 1960s¹—the summit of which is situated a little more than 3,600 feet above sea level. While the name of the *pu'u* is of recent origin, no older name identifiable with the hill was located while conducting this research. Many *pu'u* on the upland slopes of the Hilo and Puna Districts are named, and it is likely that in traditional times this hill too had a name or names, depending on the area it was viewed from.

The native traditions and historical accounts associated with the neighboring lands of the upper Hilo-Puna forests span many centuries, from Hawaiian antiquity to the later period following western contact. The narratives describe customs and practices of the native people who resided on these lands, walked the trails, and who were sustained by the wealth of the forest lands.

Among the most detailed descriptions of the Hilo-Puna forest lands, including documentation of traditional and customary rights, are those found in the Kingdom collections, documenting the history of land tenure, and defining the boundaries of *ahupua'a* of Waiākea and 'Ōla'a. Detailed oral testimonies from elder native tenants were taken in court proceedings of the mid to late 1800s document the occurrence of traditional and customary practices, and nature of the resources within a given *ahupua'a*. In those records, we learn of the traditional knowledge and occurrence of native practices in the lands which today are a part of, and adjoin the Pu'u Maka'ala Natural Area Reserve.

We find in native traditions and beliefs, that Hawaiians shared spiritual and familial relationships with the natural resources around them. Each aspect of nature from the stars in the heavens, to the winds, clouds, rains, growth of the forests and life therein, and everything on the land and in the ocean, was believed to be alive. Indeed, every form of nature was a body-form of some god or lesser deity. As an example, in this context, and in association with lands which are now included in a part of the landscape of the Pu'u Maka'ala Natural Area Reserve, we find that Kū-ka-'ōhi'a-Laka, is a defied guardian of the 'ōhi'a growth of 'Ōla'a; *Ua-kuahine*, is the body form of a goddess of the rains in 'Ōla'a; and *Kū-lili-ka-ua* is the god of the thick mists that envelop the forests of the upper Puna,

¹ pers comm., Ralph Daelher, former State Forester (June 9, 2004).

Waiākea, and Keauhou lands. Indeed, tradition also tells us that the gods and goddesses of these forest lands were very protective of them. In olden times, travel through them was accompanied by prayer, and care. Traditions tell us that many a careless traveler, or collector of resources, found themselves lost in a maze of overgrowth and dense mists as a result of disrespectful and careless actions.

In the Hawaiian mind, care for each aspect of nature, the *kino lau* (myriad body-forms) of the elder life forms, was a way of life. This concept is still expressed by Hawaiian *kūpuna* (elders) through the present day, and passed on in many native families. Also, in this cultural context, anything which damages the native nature of the land, forests, ocean, and *kino lau* therein, damages the integrity of the whole. Thus caring for, and protecting the land and ocean resources, is a way of life.

In the traditional context above referenced, we find that the forests and mountain landscape—the native species, and the intangible components therein—are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property. Its protection, and the continued exercise of traditional and customary practices, in a traditional and customary manner, are mandated by native custom, and State and Federal Laws (as those establishing the Waiākea and ‘Ōla‘a Forest Reserves and Pu‘u Maka‘ala Natural Area Reserve; and the Endangered Species Act).

In this discussion, protection does not mean the exclusion, or extinguishing of traditional and customary practices, it simply means that such practices are done in a manner consistent with cultural subsistence, where each form of native life is treasured and protected. *Kūpuna* express this thought in the words, “*Ho‘ohana aku, a ho‘ōla aku!*” (Use it, and let it live!).

In the early 1900s, the Hilo and ‘Ōla‘a forest lands were determined to be of significance, and worthy of protection. In between 1905 to 1928, the lands of the ‘Ōla‘a and Waiākea Forest Reserves, and the neighboring Kīlauea Forest Reserve were dedicated to the public interest as unique natural resources. As a part of on-going ranching operations, and the mission of the newly formed forestry programs, hunting for pigs, and in earlier times, for wild cattle, has been practiced on lands of the Pu‘u Maka‘ala NAR. Such hunting interests remain of importance to community members and long-term management goals of the Natural Area Reserve System program.

In 1981, the Pu‘u Maka‘ala Natural Area Reserve, containing approximately 12,106 acres was dedicated as one of the extraordinary ecological systems of the Natural Area Reserve program of the State of Hawai‘i.

māua nō me ka ha‘aha‘a — Kepā a me Onaona Maly

“A‘ohe hana nui, ke alu ‘ia!

(It is no great task when done together by all!)

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INTRODUCTION

Background

As part of a state-wide program designed to protect, restore, and further the public benefit of significant Hawaiian natural resources making up three existing Natural Area Reserves, and one proposed reserve, all on the island of Hawai'i, Ms. Lisa Hadway, Natural Area Specialist for the State of Hawai'i Department of Land and Natural Resources—Division of Forestry and Wildlife (DLNR-DOFAW), requested that *Kumu Pono Associates LLC*², conduct detailed historical-archival research that would describe the traditional-cultural and historical setting of lands within existing, or proposed Natural Area Reserves on the Island of Hawai'i. This component of the study discusses several *ahupua'a*³ that contribute to the land area of the Pu'u Maka'ala Natural Area Reserve situated in the forest lands of the Hilo and Puna Districts on the Island of Hawai'i (*Figure 1*).

The Pu'u Maka'ala Natural Area Reserve (NAR) is situated on lands within the upper Waiākea *ahupua'a* of the Hilo District, and the *kalana* (sub-district) of 'Ōla'a within the District of Puna. The Pu'u Maka'ala NAR adjoins the Kīlauea Forest Reserve (in the District of Ka'ū), the Waiākea Forest Reserve (in the District of Hilo), and the 'Ōla'a Forest Reserve (in the District of Puna), which were established by Governor's Proclamations in 1928, 1923, and 1918, respectively. The Pu'u Maka'ala NAR was proposed in the 1970s, and authorized by Governor's Executive Order No. 3102, on November 16th, 1981. The NAR contains 12,106 acres, and takes its name from a *pu'u* (hill) which in the early 1960s was given the name "*Maka'ala*" (literally: Stay alert, be Vigilant; interpretively Lookout Hill⁴). Unfortunately, it does not appear that a traditional name for this *pu'u* was recorded in historical survey records. While several traditional and historical accounts name localities in the Waiākea-'Ōla'a uplands, they do not give the precise location of those localities, so it is not possible to know if any of those names refer to this particular feature.

In the narratives written to support the proposed establishment of the Pu'u Maka'ala NAR in the 1970s, the lands and resources of the area were described with the following narratives:

The area received its name from Puu Makaala, a cinder cone rising over 200 feet in the center of the proposed 2,612 acre tract on the slopes of Mauna Loa, Hawaii. It presently forms portions of the state-owned Waiakea and Olaa Forest Reserves and can be located on U.S.G.S Map No. N1390, Puu Makaala Quadrangle... It extends across an elevational gradient from 3,200-3,700 feet. It contains no streams. The heavy forest covering is believed to have never been disturbed by logging, grazing or other uses. The soil is very organic, with black muck that extends to a depth of several feet or more until lava rock is reached. There has been some disturbance by feral pigs...

Most of the area is an *'ōhi'a* rainforest ecosystem. There is a rich assortment of native plants (some 48 species) and associated native insects, from flies and butterflies to crawling forms. It is also a habitat for at least nine native birds, of which three are endangered species. Another ecosystem present, but located only in the far southwest section, is the *koa-'ōhi'a* rain forest. The Kulani Project addition contains a significant amount of this type of ecosystem.

² *Kumu Pono Associates LLC*: Kepā Maly, Cultural Historian-Resource Specialist and Onaona Maly, Researcher.

³ *Ahupua'a* is a traditional term used to describe an ancient Hawaiian land unit (extending from sea to mountain lands), and remains the primary land unit of the modern land classification system.

⁴ See notes regarding naming of Pu'u Maka'ala in ca. 1962, from telephone interview with retired Forester, Ralph Daehler, at end of study.

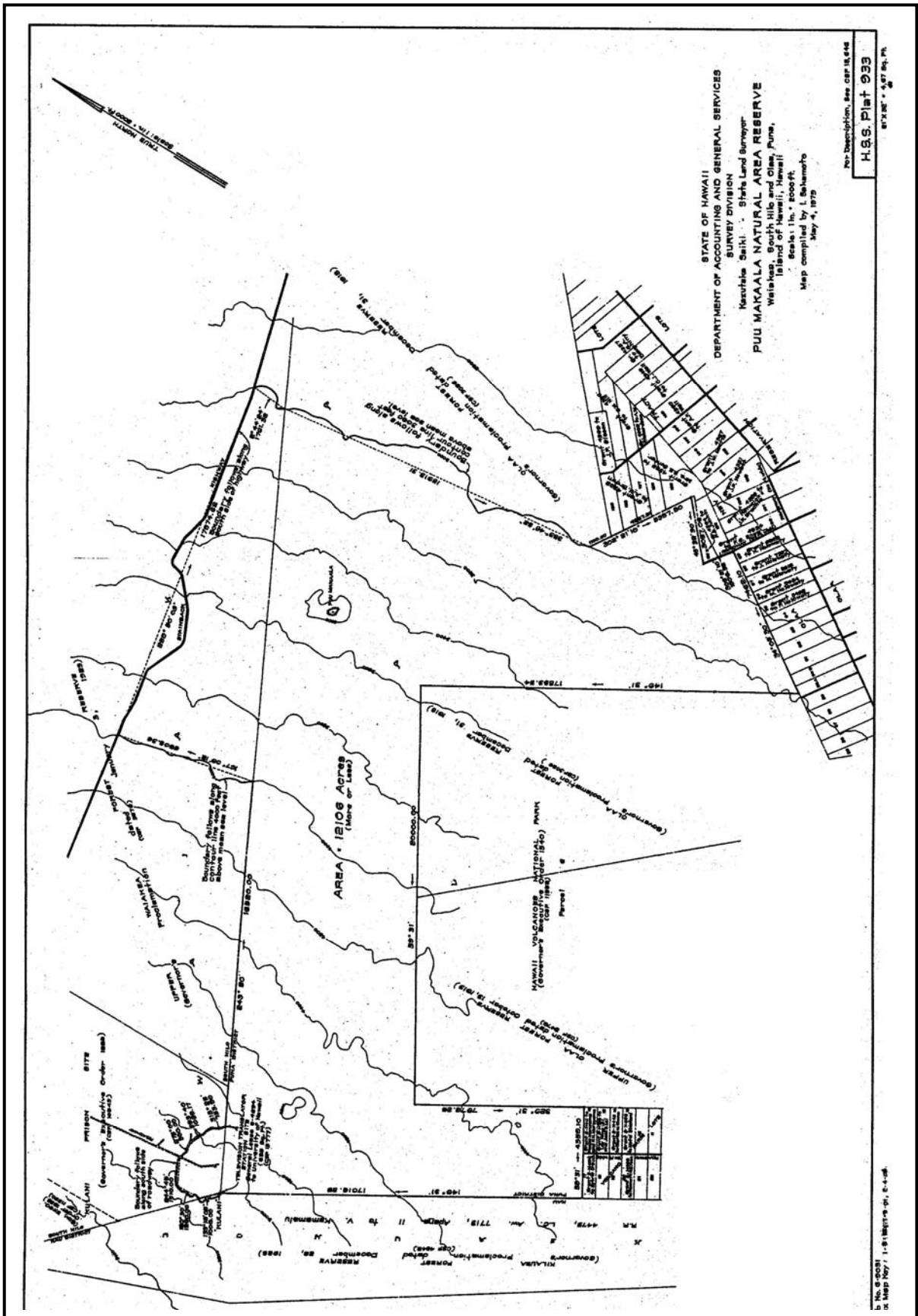


Figure 1. Pu'u Maka'ala Natural Area Reserve, and Neighboring Lands of Waiākea, 'Ōla'a, and Keauhou, Island of Hawai'i (1979)

Indicative of the dense and mature forest cover, the substrate consists of deep soils of “brown forest” and “humic” latosols. There is an average annual rainfall of 100-150 inches. The mature forest growth is a contrasting ecosystem to the developing forest condition preserved by the 640 acre Waiakea 1942 Lava Flow Natural Area Reserve about two miles away... [Pu’u Maka’ala NAR Folder, Natural Area Reserves Office]

This study seeks to provide readers with access to primary documentation on native traditions, customs, and practices associated with the Waiākea-‘Ōla’a forest lands; and to provide readers with a historical overview of the land and activities of people in the region from the early 1900s through the present-day. Such information will be helpful in planning phases and discussions of the Hilo-Puna community and agencies, as efforts to protect the unique natural and cultural landscape of the forest lands are undertaken. While a great deal of information has been compiled, and is presented in the following sections of this study, we acknowledge that additional information will likely be found through further research. The goal here, is to bring a significant collection of documentation into one study that will help all interested parties plan actions to ensure the well-being of the land for present and future generations.

Historical and Archival Research

The historical and archival research conducted for this study were performed in a manner consistent with Federal and State laws and guidelines for such studies. Among the pertinent laws and guidelines are the National Historic Preservation Act (NHPA) of 1966, as amended in 1992 (36 CFR Part 800); the Advisory Council on Historic Preservation’s “*Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review*” (ACHP 1985); National Register Bulletin 38, “*Guidelines for Evaluating and Documenting Traditional Cultural Properties*” (Parker and King 1990); the Hawai’i State Historic Preservation Statue (Chapter 6E), which affords protection to historic sites, including traditional cultural properties of on-going cultural significance; the criteria, standards, and guidelines of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) for the evaluation and documentation of cultural sites and practices, Title 13 Sub-Title 13:275-284 (October 21, 2002); and the November 1997 guidelines for cultural impact assessment studies, adopted by the Office of Environmental Quality Control (which also facilitate the standardized approach to compliance with Act 50 amending HRS Chapter 343; April 26, 2000).

While conducting the research, primary references included, but were not limited to—land use records, including an extensive review of Hawaiian Land Commission Award (L.C.A.) records from the *Māhele ‘Āina* (Land Division) of 1848; Boundary Commission Testimonies and Survey records of the Kingdom and Territory of Hawai’i; and historical texts authored or compiled by—D. Malo (1951); J.P. I’i (1959); S. M. Kamakau (1961, 1964, 1976, and 1991); Wm. Ellis (1963); J. Goodrich (1826); Chas. Wilkes (1845); and A. Fornander (1916-1919 and 1996). The study also includes several native accounts from Hawaiian language newspapers (compiled and translated from Hawaiian to English, by the author), and historical records authored by nineteenth century visitors to the region.

Archival-historical resources were located in the collections of the Hawai’i State Archives, Land Management Division, Survey Division, Natural Area Reserves office, and Bureau of Conveyances; the Bishop Museum Archives; Hawaiian Historical Society; University of Hawai’i-Hilo Mo’okini Library; private family collections; and in the collection of *Kumu Pono Associates LLC*. This information is generally cited in categories by chronological order of the period depicted in the narratives.

The historical record—including oral testimonies of elder native residents of lands in the Waiākea-‘Ōla’a vicinity—provide readers with detailed descriptions of traditional and customary practices, the nature of land use, and the types of features to be expected on the landscape. The descriptions of land use and subsistence practices range from antiquity to the middle 1900s, and represent the knowledge of *kama’āina* (natives) of the land.

A CULTURAL-HISTORICAL CONTEXT OF THE LANDS AND FORESTS OF THE HILO AND PUNA DISTRICTS

Hawaiian Settlement

Archaeologists and historians describe the inhabiting of these islands in the context of settlement which resulted from voyages taken across the vast open ocean, with people coming from small island groups. For many years archaeologists have proposed that early Polynesian settlement voyages between Kahiki (the ancestral homelands of the Hawaiian gods and people) and Hawai'i were underway by A.D. 300, with long distance voyages occurring fairly regularly through at least the thirteenth century. It has been generally reported that the sources of the early Hawaiian population—the Hawaiian “Kahiki”—were the Marquesas and Society Islands (Emory in Tatar 1982:16-18).

For generations following initial settlement, it appears that communities were clustered along the watered, windward (*ko'olau*) shores of the main Hawaiian Islands. Along the *ko'olau* shores, in areas such as Waiākea, Punahoa-Pi'ihonua, and Laupāhoehoe, streams flowed, rainfall was reliable, and agricultural production could become established. To a lesser extent, locations in Puna, such as in the Kea'au and Hā'ena vicinity, and in the Kapoho vicinity, early populations could also find the necessary resources for establishing community centers. Along these *ko'olau* shores, sheltered bays offered access to both deep sea and near shore fisheries. The latter, being enriched by nutrients carried in the fresh water flowing from the mountain streams, and in underground lava tube systems, and by which fishponds and estuarine systems could be developed. In these early times, the residents generally engaged in subsistence practices in the form of fishing, and in agriculture on lands extending towards the uplands from the bays (Handy, Handy and Pukui 1972:287).

Over a period of several centuries, areas with the richest natural resources became populated and perhaps crowded, and by ca. 900 to 1100 AD, the population began expanding to the more remote sections of Puna and the larger Kona (leeward) side of the island (Cordy 2000:130).

As a general summary of lowland residency and cultivation of food resources in the Waiākea section of Hilo, Handy, Handy and Pukui (1972) reported that:

Hilo as a major land division of Hawaii included the southeastern part of the windward coast...the northern portion, had many scattered settlements above streams running between high, forested *kula* lands, now planted with sugar cane. From Hilo Bay southeastward to Puna the shore and inland are rather barren and there were few settlements. The population of Hilo was anciently as now concentrated mostly around and out from Hilo Bay... The Hilo Bay region is one of lush tropical verdure and beauty, owing to the prevalence of nightly showers and moist warmth which prevail under the northeasterly trade winds into which it faces...

In lava-strewn South Hilo there were no streams whose valleys or banks were capable of being developed in terraces, but cuttings were stuck into the ground and on the shores and islets for many miles along the course of the Wailuku River far up into the forest zone. In the marshes surrounding Waiakea Bay, east of Hilo, taro was planted in a unique way, known as *kanu kipi*. Long mounds were built on the marshy bottom with their surface two or three feet above water level. Upon the top and along the sides of these mounds taro was planted. Flood waters which occasionally submerged the entire mound are said to have done no harm, as the flow was imperceptible. This swampy land is now abandoned to rank grass. *Kipi* (mounds) were also formerly made along Alenaio Stream above Hilo... [Handy, Handy and Pukui 1972:538-539]

Natural Resources and Land Management in the Hawaiian Cultural System

In Hawaiian culture, natural and cultural resources are one and the same. Native traditions describe the formation (literally the birth) of the Hawaiian Islands and the presence of life on, and around them, in the context of genealogical accounts. All forms of the natural environment, from the skies and mountain peaks, to the watered valleys and lava plains, and to the shore line and ocean depths are believed to be embodiments of Hawaiian gods and deities. One Hawaiian genealogical account, records that Wākea (the expanse of the sky–father) and Papa-hānau-moku (Papa, who gave birth to the islands)—also called Haumea-nui-hānau-wāwā (Great Haumea, born time and time again)—and various gods and creative forces of nature, gave birth to the islands. Hawai'i, the largest of the islands, was the first-born of these island children. As the Hawaiian genealogical account continues, we find that these same god-beings, or creative forces of nature who gave birth to the islands, were also the parents of the first man (Hāloa), and from this ancestor all Hawaiian people are descended (David Malo, 1951; Beckwith, 1970; Pukui and Korn, 1973). It was in this context of kinship, that the ancient Hawaiians addressed their environment, and it is the basis of the Hawaiian system of land use.

Through their generations of residency, the ancient Hawaiians developed a sophisticated system of land- and resource-management. By the time 'Umi-a-Liloa rose to rule the island of Hawai'i in ca. 1525, the island (*moku-puni*) was divided into six districts or *moku-o-loko* (cf. Fornander 1973–Vol. II:100-102). The district of Hilo is one of six major *moku-o-loko* on the island of Hawai'i. The district of Hilo itself, extends from the shore up to the 9,000 foot level on Mauna Kea, and up to the summit of Mauna Loa, where it joins the districts of Ka'ū, Kona and Hāmākua. Towards the east, Hilo joins Puna at Māwae, and continues *ma uka* (towards the mountains), adjoining the land of 'Ōla'a; and on it's north eastern boundary, Hilo joins Hāmākua at Ka'ula. Within this district, today simply described as North and South Hilo, there were at least three traditional regions. The area from Waiākea to the Puna boundary was known as *Hilo Hanakāhi*—Hilo, land of Hanakāhi, one of the noted chiefs of Hilo, whose reign was one of peace. The middle section of Hilo, fronted by the sandy beach of Waiākea Bay, extending from Kanukuokamanu (at the mouth of Wailoa Stream) to Wailuku River was simply known as *Hilo One*—Hilo of the sandy shore. The remainder of Hilo, extending from the cliffs on Wailuku River to Ka'ula was called *Hilo Palikū*—Hilo of the upright cliffs.

The entire district of Hilo has been most famed for its rains, and is commemorated in many traditional *mele* (chants) and *'ōlelo no'ēau* (poetical sayings) by reference to the rains. This may seem to some to be an undesirable epitaph, but in the Hawaiian mind, the rains were god given—manifestations of the gods Kāne and Lono, and also forms of lesser gods and goddess of the forests and expanse of the land. Rains gave life to, and healed the land, thus a land of water was a rich one.

Native tradition records that lands with “*wa*” (water) names were themselves associated with the god Lono (G.W. Kahiolo in *Ka Hae Hawaii*, July 10, 1861), thus another level of cultural significance might be associated with the land of Waiākea (Expansive-waters, or the Water of Ākea, progenitor of the Hawaiian race). We also find that one of the famous sayings of Hilo describes the beauty of the rains—source of the waters given by Lono—that seem to resonate from the leaves of the *'ōhi'a lehua* (*Metrosideros polymorpha*) trees which at one time grew luxuriantly from shore to mountains—

No ka pehi mau o ka ua iluna o ka lihilihi o ka lehua i ka wā a nā manu e kani hone ana a mūkīkī i ka wai e kilihune iho la i ka liko o ka lehua... o ka ua kani lehua o Hilo ia! —
Because the frequent pattering of rains upon the *lehua* blossoms is accompanied by the sweet singing of the birds as they sip the nectar which drips upon the young budding *lehua* leaves... the rain of Hilo is called the rain which resounds upon the *lehua* blossoms of Hilo! [Wise and Kihe in *Ka Hoku o Hawaii*; February 24, 1916 (Maly, translator)]

The land of 'Ōla'a stood alone, almost independent of other lands adjoining it in Puna, though it had no ocean frontage—being cut off by Kea'au and Waiākea. The name connotes sacredness and sanctity; the root of the name being "la'a." 'Ōla'a is famed in native tradition for its sacred lands, forest, native birds, and *olonā* resources. One ancient *mele* (chant), commemorating the forests, birds, and weather of 'Ōla'a, noting too that man traveled across the land tells us:

<p><i>Ka uka holo kia ahi manu 'Ōla'a</i></p> <p><i>I pō e noe ka uahi noe i ka nahele,</i></p> <p><i>Nōhenohea ka makani 'ūhau pua,</i></p> <p><i>He pua 'oni ke kanaka, he mea laha 'ole...</i></p>	<p>The birds fly like flaming darts to the uplands of 'Ōla'a, Where the mist and smoke darken the forest, Spread out by the breeze which lays out the blossoms, Man is like flower, roving about, something that is irreplaceable... [collection of Ho'ohila Kawelo; Maly, curator]</p>
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In the traditional system of land management, the large districts (*moku-o-loko*) like Hilo and Puna, and sub-regions (*'okana* and *kalana*) such as 'Ōla'a, were further divided into political regions and manageable units of land. These smaller divisions or units of land were tended to by the *maka'āinana* (people of the land) (see Malo 1951:63-67). Of all the land divisions, perhaps the most significant management unit throughout the islands was the *ahupua'a*.

Ahupua'a are subdivisions of land that were usually marked by altars with images or representations of a pig placed upon them, thus the name *ahu-pua'a* or pig altar. In their configuration, the *ahupua'a* may be compared to wedge-shaped pieces of land that generally radiate out from the center of the island, extending to the ocean fisheries fronting the land units. Their boundaries are generally defined by topography and geological features such as *pu'u* (hills), ridges, gullies, valleys, craters, or areas of a particular vegetation growth (see Boundary Commission testimonies in this study; and Lyons, 1875).

The *ahupua'a* were also divided into smaller manageable parcels of land—such as the *'ili*, *kō'ele*, *mahina 'ai*, *māla*, and *kīhāpai*—that generally run in a *mauka-makai* orientation, and are often marked by stone wall (boundary) alignments. In these smaller land parcels the *maka'āinana* cultivated crops necessary to sustain their families, and supplied the needs of the chiefly communities they were associated with. As long as sufficient tribute was offered and *kapu* (restrictions) were observed, the common people who lived in a given *ahupua'a* had access to most of the resources from mountain slopes to the ocean. These access rights were almost uniformly tied to residency on a particular land, and earned as a result of taking responsibility for stewardship of the natural environment and supplying the needs of ones' *ali'i* (see Malo 1951:63-67 and Kamakau 1961:372-377).

Entire *ahupua'a*, or portions of the land were generally under the jurisdiction of appointed *konoiki* or subordinate chief-landlords, who answered to an *ali'i-'ai-ahupua'a* (chief who controlled the *ahupua'a* resources). The *ali'i-'ai-ahupua'a* in turn answered to an *ali'i 'ai moku* (chief who claimed the abundance of the entire district). Thus, *ahupua'a* resources supported not only the *maka'āinana* and *'ohana* (families) who lived on the land, but also contributed to the support of the royal community of regional and/or island kingdoms. This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resource management planning. In this system, the land provided fruits, vegetables and some meat in the diet, and the ocean provided a wealth of protein resources.

We find that the system described above, is documented in native testimonies recorded as a part of court proceedings in the 1870s, by elder Hawaiian residents of Waiākea, 'Ōla'a and neighboring

lands. The witnesses to the Commissioner of Boundaries reported that traditional access and use of resources in the mountain lands was controlled and monitored by landlords and chiefs. Knowledge of the boundaries of *ahupua'a*, and the extent of rights on the mountain lands was important. If someone from another land (*ahupua'a* or district) was caught taking resources from a land other than their own, the items were taken from them. Indeed, the large collection of testimonies for the island of Hawai'i record that infractions of *ahupua'a* rights led to fights and death of the intruders. Interestingly, collection of native birds such as the *mamo* and *'ō'ō*, and the collection of *olonā* in the Waiākea and 'Ōla'a forest lands (presumably those which also fall within the present-day Natural Area Reserve) was recorded by elder *kama'āina*, though no reference to other forms of hunting, or pigs was made in the testimonies by natives in the 1800s (see Boundary Commission Testimonies in this study).

MO'OLELO 'ĀINA: NATIVE TRADITIONS AND HISTORICAL ACCOUNTS OF THE WAIĀKEA-'ŌLA'A FOREST LANDS

This section of the study provides readers with access to a collection of native traditions of the Hilo-Puna forest lands, some of the accounts translated from the original Hawaiian language narratives by Maly. The narratives span many centuries, from Hawaiian antiquity to the later period following western contact. Some of the narratives make specific references to places on the mountain lands associated with the Pu'u Maka'ala NAR, while other accounts are part of larger traditions that are associated with regional and island-wide events. The traditions describe customs and practices of the native people who resided on these lands, walked the trails, and who were sustained by the wealth of the mountain lands, the *kula* (plains and plateau lands), and the adjacent marine fisheries. It is also appropriate to note here, that the occurrence of these traditions—many in association with place names of land divisions, cultural sites, features of the landscape, and events in the history of the lands which make up the Pu'u Maka'ala NAR—are an indicator of the rich native history of those lands.

“He Kaa no Pikoikaalala, ke Keiki Akamai i ka Pana” (The Tradition of Pikoika'alalā—Describing Canoe Making and Bird Hunting in the Uplands of Waiākea and 'Ōla'a)

The tradition of Pikoika'alalā (Pikoi-son-of-the-crow), printed in the Hawaiian language newspaper, *Ku Okoa*, in 1865-1866, is one of the earliest written accounts, that provides detailed narratives of the traditional and customary practices associated with the upland forests of Waiākea and 'Ōla'a. The tradition was submitted to the paper by S.M. Kauai, and ran from December 16th, 1865 to March 10th, 1866.

Pikoika'alalā was born to 'Alalā and Koukou on the island of Kaua'i, and his family were *kūpua* (beings with supernatural powers and multiple body-forms). Pikoika'alalā possessed exceptional sight and excelled in the Hawaiian art of *pana pua* (shooting with bow and arrow). Through the tradition of Pikoika'alalā, readers learn that many localities throughout the islands are named for places where he competed in matches with archers, shooting *'iole* (rats) and birds from great distances. The tradition is set in the late 1500s when Keawe-nui-a-'Umi, the king of Hawai'i Island, was in need of an expert to shoot some supernatural *'elepaio* birds that continually interrupted the work of his canoe makers in the uplands of 'Ōla'a and Hilo.

Keawe-nui-a-'Umi learned of Mainele, a champion in the sport of *pana pua*, who resided on O'ahu, and promised him that if he could rid the forest of the enemy *'elepaio*, he could wed his daughter, the beautiful Keakalaulani. As the story unfolds below, we learn that Mainele boasted of his great skills, but he was unable to kill the two birds. In the meantime, Waiākea (for whom the land of Waiākea was named), one of the stewards of Keawe-nui-a-'Umi, befriended Pikoika'alalā, and learned that he was an expert in the art of *pana pua*.

Prior to his arrival in Hilo, Pikoika'alalā made Waiākea promise that he would not tell anyone who he was, for he had heard of the boastful nature of Mainele, and he wished to teach him a lesson. The narratives below (translated by Maly), focus on events in the uplands of Waiākea and 'Ōla'a. By the description of the events in this part of the tradition, we learn about the make up of the upland forests, named localities, and some of the practices of ancient Hawaiians in the region coinciding with the Pu'u Maka'ala NAR.

Arriving in the Hilo District Pikoika'alalā asked Waiākea:

HELU 5.

“...Aia i hea kahi o ua mau manu hanaino waa nei?” “Aia no ma waho aku o Panaewa,” “e pii hoi ha kaula i ike au,” wahi a Pikoikaalala.

Part 5.

“...Where are those birds who make trouble for the canoes found?” “They are there, outside of Pana'ewa.” Pikoika'alalā then said, “Let us go up there so that I may see.”

O ka hele aku la no ia o laua a hiki, a ike aku la o Pikoiakaalala i kahi i kau ai na manu hanaino waa, a me ke kahua kahi hoi e kalai ai na kahuna a Keawenuiaumi, o ka inoa o ia wahi, o Kalehuapueo, aia no kela wahi ma kai ae o Kaluaopele, mauka ae o Olaa, iwaena konu o ka ululaau, he ahua nae, ina e hiki ilaila, e hiki ia oe ke nana mai ia kai o Hilo, me kou ike maopopo no nae ia kai, he loihi no nae, ua ane hiki paha i ka 27 mile ka loa; a hoi aku la no laua i kai o Hilo, e like no me ka mea mau i ke kaumaha i ka manu i na la a pau a laua e hele ai; a he mea mau no hoi ia laua ka lawe pinepine aku i manu na ke alii Keawenuiaumi, a o ka ke alii mea hoohuoi mau no hoi ia, no ka nui launa ole o ka manu, a he mea mau no hoi ia Keawenuiaumi ka ninaninau mau ia Waiakea kona kahu, i ka mea nana i hoomake ina manu he nui, ike kela ano manu i keia ano manu.

Eia na inoa pakahi o na manu a Pikoiakaalala i pana ai i mea ai no ka wa maka pehu o Hilo. O ka Oo, ka liwi, ka Ou, ka Akakane, ka Amakihi, a me ka Mamo, o na manu ai-lehua no a pau o ka uka i Olaa a me ka nahele laau loloo o Panaewa; oia mau manu ka ke keiki Pikoiakaalala i panai, a o ka Waiakea hoi ia e haawi aku ai i ke alii nui me na lii malalo iho, na kaukualii, na puali, me na koa a me na kanaka hoi o ke alii.

A no ka ninau mau o Keawenuiaumi i ka mea nana i pana kela mau manu—i hoike iae la maluna—alaila, hai aku la o Waiakea penei: “He wahi aikane no nau.” “No hea?” wahi a ke alii, “no Oahu mai no,” alaila ninau mai la o Keawenuiaumi, “O wai ka inoa oia aikane au?” “O wai la, aole i hai mai i kona inoa iau,” wahi a Waiakea, he oiaio no hoi paha ia, no ka mea hoi, aole no i ike na mea a pau o Pikoiakaalala keia, aole no hoi i hai i kona inoa ia Waiakea; aka nae, o na hana akamai a pau a Pikoiakaalala kana i ike ai, mai ko laua holo ana mai o Oahu aku a hiki i keia wahi i olelo iae nei, a ua hoopaa loa o Waiakea i kana mea i ike ai, no ke akamai lua ole o ua aikane nei ana, (Pikoiakaalala) oia hoi na pana ana i na iole mai Oahu mai a hiki ma Kohala i Hawaii.

The two traveled till they reached the place, and Pikoi-a-ka-‘alalā saw where the birds who made trouble for the canoes were perched. He also saw the grounds where the canoe making priest of Keawe-nui-a-‘Umi worked. The name of this place was Kalehuapueo, it is there below Kaluaopele (the Volcano), in the uplands of ‘Ōla‘a, in the middle of the forest. There is a small hill there, and if you go there, you will be able to look to the sea of Hilo. By the sight of the sea, you will know that it is a great distance off, perhaps 27 miles away. The two then returned to Hilo, and as was the custom, they were weighted down by birds on all the days they went to the mountains. They frequently went and took birds for the chief Keawe-nui-a-‘Umi, who grew suspicious because so many birds were brought down. Keawe-nui-a-‘Umi regularly asked Waiākea, who was killing these birds, for many different kinds were brought down.

Here are the names of the birds which Pikoi-a-ka-‘alalā shot during his time in Hilo; the ‘Ō‘ō, ‘I‘iwi, ‘Ō‘ū, ‘Akakane, ‘Amakihi, and the Mamo, the birds which eat of the *lehua* blossoms in the uplands of ‘Ōla‘a, and the long-treed forest of Panaewa. Those were the birds shot by Pikoi-a-ka-‘alalā, and given by Waiākea to the king, the chiefs below him, the attendant chiefs, the warriors and the men of the chief.

Because Keawe-nui-a-‘Umi continually asked questions about the one who shot the birds—as described above—Waiākea answered thus: It is a friend of mine.” “Where from?” Asked the chief. “From O‘ahu.” Keawe-nui-a-‘Umi then asked, “What is the name of your friend?” “What indeed? He has not told me his name,” responded Waiākea. Now this is perhaps true, because very few people knew of Pikoi-a-ka-‘alalā, and he had not actually told his name to Waiākea. But because of all the amazing things that Pikoi-a-ka-‘alalā had done—that is the shooting of rats from O‘ahu to Kohala, Hawai‘i, Waiākea knew that his friend (Pikoi-a-ka-‘alalā) was second to none in the skill.

(E waiho iki iho kakou i ka hoonioniolo ana no Pikoiaakaalala ke keiki o Kauai o Manokalanipo, a me Waiakea hoi kahi kanaka o Kauakanilehua o Hilo Hanakahi, a e kuehu ae kakou i ka lehu o kapuahi no Mainele a me na hoe waa.)

la Mainele ma i noho ai iuka o Kohala i ke kalai hoe, a hala hookahi malama, a loa ka hoe, alaila, makaukau na waa e holo aku i Hilo, kahi hoi o ke alii nana i hoouna aku e kii ia Mainele. A hiki o Mainele ma i Hilo, ua makaukau mua hoi ka ai, ka puua, me na mea no hoi a pau e lawa ai ka malihini; a o ke o no hoi ia i pii ai e pana i ko Keawenuiaumi enemi mau.

O ka hoomaka iho la no ia o ka pii o Mainele me ke alii, a me na kanaka a pau he nui, a o ka poe makaikai no hoi o kela wahi keia wahi o Hilo a me Puna. A hiki no hoi o Mainele i ke kahua kahi kalai-waa, a ike iho la nae i ke kumu koa kahi e kau mau ai ua mau manu nei, aole nae he ikeiaku o na enemi o ke alii, no ka mea hoi, aia no a koele ke koi i ka waa, alaila, o ka manawa iho la no ia e lele mai ai o ua mau manu nei a kau i ke kumu o kekahi koa nui. Hookoele no hoi na kahuna a ke alii i kekahi kaele waa kahiko no a lakou mamua i haalele ai, i mea hoi e lohe ai ua mau manu la, alaila lele mai, oiai o ka laua hana mau ia ke lohe i kekahi koi e koele ana.

O ka manawa no ia e hiki ai, me ko laua manao paha he kalai-waa, no ka mea, o ko laua enemi nui hoi ia o ke kalaiwaa. A he oi no hoi o na manu pololei nui wale i ke koho e mai no mamua i na olelo hooiloilo, e olelo mai ai penei: "E Keawenuiaumi e! haalele ia he waa ino, he waa puha, ua loli kaele." Aole no hoi ma ko Keawenuiaumi waa wale no ka laua hana e hooiloilo ai, o ka waa o kela kanaka keia kanaka ka laua e hanai.

O ka lele mai la no ia o ua mau manu la a kau mai la iluna, ma ko laua wahi mau e kau ai. I ua mau manu la no a kau mai, ike aku la no hoi o Mainele, ke akamai kaulana; o kona manawa iho la no ia i haalele koke ae ai i kana mea make, me ka olelo kaena e anae mamua o kona hookuu ana i kana pua, penei no hoi: "Heaha la ke kumu o ke ku ole ana o keia mau manu i ka poe i hele mai ai e pana i keia mau manu, ma ke kua paha

(Let us now leave the upright nature of Pikoia-ka-'alalā, the youth of Kauai of Manokalanipō, and Waiākea, the man of the land of Hilo Hanakāhi, where the rains resonate on the leaves of the lehua; and let us stir up the ashes of the fireplace of Mainele and the canoe paddlers.)

While Mainele and folks were residing in the uplands of Kohala, cutting wood for paddles, there passed one cycle of the moon, and they then had the paddles made. Therefore the canoes were made ready to travel to Hilo, the place from which the king had sent for Mainele and his companions. The food was made ready, the pig and all the things to be brought for the visitor; and those things necessary for the journey to the uplands to shoot the enemies of Keawe-nui-a-'Umi.

Mainele and the King, and many of the people, those who had traveled from one place or another in Hilo and Puna, began their journey to the uplands. When Mainele arrived at the canoe making grounds, he saw the koa trees where birds had perched, though the (bird) enemies of the king were not to be seen. But when the striking of the adzes was heard on the hulls of the canoes, the birds flew and perched atop a large koa tree. When the priest of the king, began to dig out one of the old canoe hulls, left by from an earlier time when they had fled; it was then, when the birds heard the chipping, that they began to fly about.

That was what they did, when they heard the digging, because their great enemy were the canoe makers. Now normally, these types of birds were foremost in stating whether worms were in the wood, but here, they called out always: "Say Keawe-nui-a-'Umi! Leave it behind, it is a bad canoe, a canoe that will shatter, a rotted hull." It was not only the canoes of Keawe-nui-a-'Umi, but the canoes of other men as well, that the two birds did this to.

These birds flew and perched at their usual place above. When the birds perched there, Mainele saw them, he then began boasting about his fame and skill with the bow, and that he could kill them for which he released his arrow: "There is no tree that these birds can land on that the people cannot shoot them. They will be shot in the back perhaps, for their bodies are large, and they land nearby..."

ka pana ana i ku ole ai? No ka mea, he nui na kino, a he kokoke loa no hoi laua e kau mai nei...”

A lohe ae la ke alii, a me ka aha kanaka e ku pu ana me ia, (Mainele) oliloli nui ae la lakou. O ke kuu aku la no ia o Mainele i kana pua, me kona manao hoi e ku aku na manu ia ia, he ole ka hoi ua mea he ku aku, mai ku no nae, o ka pololi ana o ka pua a ku no i ka mino kahiko o na manu, oia no ka mea i halai, o ka hoomau aku la no ia o Mainele i kana hana i kaulana ai o ka pana, oi pana wale a la aohe wahi mea ku aku o na manu, a po ia la, moe iho la no o Keawenuiaumi me Mainele, a me na kanaka a pau ilaila.

A i ke ao anae no, oia ka lua o ka la, i lawa no i ka maamaa anae, o ko Mainele manawa iho la no ia e panai, me ke ake nui e ku na enemi mau o ke alii, aole no hoi he komo wahi ai iki i kona opu, a no ke ku ole o na manu, olelo ae la ia i ke alii e hana i laau alanui nona e pii aku ai iluna o ke kumu koa, i kokoke i kahi o ua mau manu nei e kau ana, me kona manao a kokoke iki ae, alaila, ku ke panae. A paa ke alanui, pii ae la o Mainele alaila, pana ae la no ia i na manu, oi pana wale no ia la a ahiahi, aohe no he mea a ku iki, a moe hou no ilaila.

A ao ae la, o ke kolu ia o ka la, alua no hoi alapii, i mea hoi e kokoke ae ai o ka pana no hoi ka Mainele, o ka nana no hoi ka ke alii, a me na kanaka iluna, me ke ake nui e ku aku ana no ia Mainele na manu, hele no hoi a uakaha ka a-i o ke alii, a nalulu ka lae, me na kanaka a pau i ka ua mea o ke kali ana no ke ku o na manu i ke akamai kaulana o Mainele a po wale no ke kolu o ka la, aohe no he ku o na manu.

Moe no a ao ae, o ka ha ia o ka la, a akolu hoi alapii o ka hana ana, e like no me ka Mainele e olelo ai, pela no ke alii e olelo ai i kona poe kanaka e hana, a ane kokoke loa o Mainele ma kahi a na manu e kau ai, o kana no ka pana, oi pana wale no a aohe no he ku o ua mau manu la, he akamai no hoi o Mainele i ka pana, he akamai no hoi na manu i ka alo ana i ka Mainele mea make e lele aku ana he pua.

A po iho la ka ha o ka la, moe no ke alii, me na kanaka a pau, a ao ae la, o ka lima ia o ka la, aha no hoi alapii o ka hana ana, a ia hana ana o

Hearing this, the king and the people gathered there with him (Mainele), and were exceedingly happy. Then Mainele released his arrow, thinking that he would strike the birds, but he did not hit them. He tried again and again, his arrows hungered for the birds, but all the shots of this famous person, missed. When darkness fell, Keawe-nui-a-'Umi, Mainele, and all the people with them went to sleep.

With the light of day—this was the second day—Mainele practiced and when it was enough, he began again to shoot, with great desire for these enemies of the king. Because the birds did not land nearby, he told the king to have a wooden ladder made so that he could climb atop one of the *koa* trees, close to where the birds regularly perched. He thought that if he could get closer, he would be able to shoot them. The ladder was made secure, and Mainele climbed upon it. But again, his arrows missed, and with the coming of night, the people again slept there.

At day light, the third day, a second ladder was made so as to enable Mainele to shoot from a closer location. The king and all of the people looked on and saw the great desire of Mainele to get the birds. Looking up, the neck of the king was stiff, and his brow ached, it was so with all of the people who were awaiting the striking of the birds through the ingenuity of Mainele. But as the third night approached, the birds had not been struck.

They slept again, and arose at daylight, and had a third ladder made. Thus Mainele drew near to the place where the birds perched. He shot his best arrow, and it did not strike the birds. While Mainele was smart with the bow, the birds too were smart at dodging the deadly arrows of Mainele.

The fourth night settled in, and the king and all his people slept. At daylight on the fifth day, a fourth ladder was built, and Mainele was even

ke alapii, ua kokoke loa i kahi a na enemi e kau mau ai, a e lalau ae no o Mainele i na manu me kona mau lima, e loa no, aole no hoi i ike na manu i ke kokoke loa o ke alapii, kahi hoi a Mainele e noho ana, a haalele la hoi i ko laua wahi e kau mua ai, i loa no i ka po a ao ae no, o ka na kahuna hana mau no hoi ka hookele me ke koi i na kaele-waa e waiho ana... Oiai ua hiki ae o Mainele iluna o kahi i hana ia nona, i na manu no a kau mai, o ko Mainele lalau ae la no ia me kona mau lima, alo ae la no na manu, oi lalau wale o Mainele me kona mau lima huluhulu a aole he loa ike o na manu. Hele no hoi a uluhua o Mainele i na manu, me he hoa hakaka kanaka la. A o ke alii hoi o Keawenuiaumi, ua hele a uiha, a luhi, a uakaha ka a-i, a me kona poe kanaka pu kekahi, oi noke wale o Mainele i ka lalau lima a aohe he loa ike o na manu, a po wale ka lima o ka la, moe no ilaila a ao ae o ke ono ia o ka la, ike ae la o Mainele ua ao, hoomaka ae la ia e pii iluna o kahi ana e hopu ai i na manu, alaila pane mai la o Keawenuiaumi, "Aole au i upu i kau kaikamahine maikai a na ke kanaka akamai i ka hopu lima i kuu mau enemi, i upu au i kau mea maikai a na ke kanaka akamai i ka pana, e like hoi me oe e Mainele, wahi a ka poe i ike ia oe; a no kou lohe ana hoi ia oe he akamai lua ole i ka pana, hoouna aku ai au i kou mau hoe waa pono, me kou mau waa kapu, nou wale iho no, aole no hai; a ka inoa he akamai io oe, aole ka, hoi iho ilalo."

O ka hoi iho la no ia o Mainele me ka hilahila nui. [Ianuari 13, 1866]

HELU 6.

E ka poe e heluhelu ana, ua ike ae la hoi kakou i ko Mainele akamai ole, a me kana mau olelo kaena e ana mamua, a me kona ku ana i ka leo a ke alii (Keawenuiaumi). A e olelo ae hoi kakou no ke keiki Pikoikaalala, a me Waiakea hoi kona kuleana o ka ua Kanilehua a me ke one o Ohele i Kanukuokamanu.

la Keawenuiaumi ma i pii ai iuka me Mainele, e like me ka mea i kii iai nona, a o Waiakea pu no hoi kekahi i na la a Mainele e pana ana, ma ke ao wale no nae, a ahiahi no hoi no o Waiakea i kai, oiai o kana aikane (Pikoikaalala) wale no ko ka hale, no ka mea, aohe he lana nui o kona manao i ka pii iuka e ike i ko Mainele pana ana, no ka mea hoi, ua maopopo no iaia, aohe e ku ana na manu ia Mainele, nolaila no ke kumu o ko

closer to the place where his enemy perched. Mainele then grasped for the birds with his hands, trying to catch them, but he could not, as the birds wouldn't come near the ladder, where Mainele was sitting. They left where they had originally perched through the days and nights that they had bothered the priest and the canoe carvers... Mainele was situated atop the place made for him, and the birds landed. Mainele then reached out to try and grab the birds, but he could in no way grab them. Mainele went after the birds, fighting as if they were a human enemy. The king, Keawenui-a-'Umi became wearied, and the necks of all gathered there became stiff and sore. Again, Mainele was unable to secure the birds, and the fifth night fell. They all slept and at daylight the sixth day, Mainele again climbed the ladder and tried to grab the birds. Keawenui-a-'Umi called out to him, "I did not think that I was going to give my pleasing daughter to a man who was smart at grabbing my enemies with his hands. I thought that my daughter was going to go to a man who was skilled with the bow, like I thought you were, Mainele. Everyone who told me of you said that you were second to none in your skill with the bow, thus I sent my paddlers and sacred canoes, reserved only for me, after you. But now I see that it is not so. Return down here."

Thus, Mainele returned down with great shame. [January 13, 1866]

Part 6.

So my readers, we have seen that Mainele was not so smart, as was declared by his boastful words spoken earlier, and in his rising up to the voice of the king (Keawenui-a-'Umi). Now let us speak again of our youth, Pikoikaalala and of Waiakea, and his place in the Kanilehua rains, and the sands of 'Ohele at Kanukuokamanu.

When Keawenui-a-'Umi and his companions traveled to the uplands with Mainele, Waiakea, who had gone to fetch him was there as well. He stayed during certain days when Mainele was shooting at the birds, but in the evening, Waiakea returned to the shore where his friend (Pikoikaalala) remained at the house. This was because he had no great desire to travel to the uplands to see Mainele's efforts at

Pikoiakaalala noho ana i kai, a no ka hoonanea ia hoi kekahi e ke aheahe makani he Malanai, a me ka hooholu maikai ia e ka lau o ka niu o Mokuola, a o kana mea loa ia e lealea loa ana; mai kona wa i hiki mai ai a hiki i ka manawa a kakou e lohe nei. A he mea mau no hoi i ke Kama Aliiwahine a ke Alii Kalani Keawenuiaumi i ka hele mau ana ma ko Waiakea hale, no ka mea hoi, ua kaomi mau ia kona kania-i e na lawalu manu ai-lehua i ka uka i Olaa, a me ka nahele o Panaewa. A na ia mea i kau-o holookoa mai i kona nui kino e hele mai i kahi o Waiakea, a no ka halawai ana o ke kiionohi o ke kaikamahine alii me ke akawailiula o Mana (Pikoiakaalala) a no laila, ua loaa i ke kaikamahine alii ka haawina kaumaha o kona puuwai palupalu no Pikoiakaalala...

A eono la o Keawenuiaumi iuka, a elima hoi po, a i ke ono hoi o ka la i olelo iae la, oia hoi ka la a Keawenuiaumi i pane aku ai ia Mainele a kakou i kuehu aku nei i kela Helu.

Pii hou aku la no o Waiakea e ike no i ka Mainele hana, a o kana hana mau iho la no ia o ka pii, a o ka Pikoiakaalala mea mau no hoi ka ninau, "Pehea mai la na manu?" O ka hoole no hoi ka Waiakea hana, "Aohe he ku o na manu." A ia Waiakea i hiki aku ai iuka, ike aku la oia e kulou mai anao Mainele, aohe he ekemu iki, aohe hoi he kau mai ma kona wahi mau, oiai ua hala iho la na enemī o ke alii ia Mainele.

Nolaila, ninau ae la o Waiakea i ke alii, "No keaha hoi ka mea e kulou nei o Mainele, aohe hoi he ekumu iki, aohe hoi he pana mai i na manu?" "No ke akamai ole," wahi a Keawenuiaumi.

Alaila, pane aku la o Waiakea penei, oiai he wahi kahu iwikuamoo ponoia no ke alii; "E kuu Haku e; e aho paha e hoao hoi i kau wahi pana." "Aia i hea kau pana?" wahi a Keawenuiaumi. "Aia no hoi i kai o Hilo, i kou hale no ia e noho la." Ninau mai la o Keawenuiaumi, "Nohea ia kanaka?" "No Oahu mai no hoi," wahi a Waiakea. "Oia no hoi ka mea nana e pana na haawe manu au i amo aku ai i na la maka pehu ai o kakou la, au no hoi i ninau mai ai iau la," wahi a Waiakea.

shooting. He knew that Mainele would have no luck in striking the birds, thus Pikoi-a-ka-'alalā remained at the shore, relaxing in the soothing *Malanai* breeze which causes the fronds of the coconut trees of Mokuola to sway. This was his great pleasure, from the time of his arrival through that of which we have heard. The royal daughter of King Keawe-nui-a-'Umi (named Keakalaulani), also regularly went to the house of Waiākea, where she frequently ate the broiled birds that eat the *lehua* blossoms in the uplands of 'Ōla'a and the forests of Pana'ewa. Thus this fair chiefess met with the youth of the red glistening waters of Mānā (Pikoi-a-ka-'alalā). The chiefess had grown heavy, with a softness in her heart for Pikoi-a-ka-'alalā...

Now, for six days and five nights, Keawe-nui-a-'Umi was in the uplands. It was on the sixth day the Keawe-nui-a-'Umi told Mainele, that which we read above.

Waiākea went again to the uplands to see what Mainele was doing, and when he returned, Pikoi-a-ka-'alalā would ask him, "How are the birds?" Waiākea would tell him, "The birds have not been struck." When Waiākea had gone to the uplands last, he saw Mainele standing with his head bent down, he had no answer, and no place to go at all, thus the enemies of the king had passed on to Mainele.

Waiākea then asked the King, "Why is Mainele standing there with his head bent down, with the least bit to say, did he not shoot the birds?" "No, because he did not have the skill," said Keawe-nui-a-'Umi.

Waiākea then spoke as a true retainer of the king, "My lord; perhaps you will try my friend with the bow." "Where is your bow-man?" Asked Keawe-nui-a-'Umi. "There at the shore of Hilo, at my house where I live." Keawe-nui-a-'Umi then asked, "Where is this man from?" "From O'ahu," said Waiākea. "He is the one who has shot the abundance of birds, which we ate until our eyes bulged. I will ask him," said Waiākea.

...Penei hoi o Waiakea i olelo ai, "He oi wale no kela keiki akamai nui wale, ia lakou nei i holo e mai ai (Mainele ma) ma na waa kaulua mai Oahu mai, hoi mai hoi au mai ka makaikai ana mai, a hiki mai au i kahi i kau ai na waa o makou, o kou wahi waa wale no ke kau ana, a e ku ana ua keiki la malaila, a iau e hoomakaukau ana i kuu wahi waa, ninau mai la ua keiki la, E holo ana kou waa a i hea? hai aku la au, "E hoi ana au i Hawaii, o makou hoi me ka waa kaulua, i kii mai nei ia Mainele, a eia ka hoi ua hala e aku nei." Alaila, olelo mai la kela iau, "O kaha hoi ha ke holo i ike au i kou aina o Hawaii." ae aku la au, ae, o ko ia la ee mai la no ia, a o ka holo mai la no ia o maua.

...Alaila, kena koke mai la o Keawenuiaumi, "O kii hoi ha," o ke kii mai la no ia o Waiakea a hiki ana, ia hiki anaku o Waiakea...olelo aku la o Waiakea, "I kii mai nei au ia oe e pii kaua iuka e panai oe i na enemi o kuu alii Keawenuiaumi, no kou ike ana ia oe no kou akamai lua ole i ka pana, nolaila, ua hai aku nei au i ke alii i na mea a pau au i ike ai nou, a oia ka mea i hoouna mai nei o Keawenuiaumi iau e kii mai ia oe, no ka mea, ua huhu loa ia o Mainele, a ua uluhua loa no hoi ke alii no ke ku ole o kona mau enemi."

Alaila, olelo mai la o Pikoiakaalala, "He punahele no nae paha oe ia Keawenuiaumi?" "Ae," wahi a Waiakea. Alaila, i aku la o Pikoiakaalala, "A i na he punahele io oe ea, E pii oe a olelo aku i poi nui, e hoopuha a piha pono i ka wai, a e lawe ae a malalo pono o ke kumu o ke koa, kahi a na manu e kau ai," he ae wale no ka Waiakea. "A eia hou, ina e ike oe ua hiki aku au, alaila, e paae oe me ka pauku laau i ko lima, a iau e ku ana ma kahi o ke poi wai a nanae iluna i kahi a na manu e kau mai ana."

HELU 7.

"A pau auanei kuu nana ana iluna i na manu la ea, alaila, e hahau iho oe i kekahi kanaka o Mainele ma, oiai elima ko lakou nui mai Oahu mai. A iau auanei e kilo ana ilalo i ke poi wai la ea, alaila, hahau no oe i kekahi kanaka; pela no oe e hahau ai a pau i ka make eha kanaka, a o Mainele hoi, e waiho oe ia ia, aia a ike mai oe iau e lena ana au i kuu kikoo, a heluhelu au i ke mele, a pau ia, hookuu au i kuu pua, a make na

Waiakea then said, "The knowledge and skill of this youth is above everyone else's. When we went on our journey to O'ahu (for Mainele and companions), and the double-hulled canoes, landed on O'ahu, when we came back from our journey on land, I saw this youth standing next to my canoe. And as I prepared my canoe, the youth asked me, "Where is your canoe off to?" And I answered, "I am returning to Hawai'i, all of us and the double-hulled canoes. We have fetched Mainele, and he has gone." He then said to me, "Let the two of us travel, so that I may see your land, Hawai'i." I agreed and he boarded the canoe, and we two traveled together.

Keawe-nui-a-'Umi then ordered, "Bring him here." So Waiakea went and fetched him. When Waiakea came to stand before his friend (Pikoi-a-ka-'alalā)... Waiakea said, "I have come to bring you to the uplands, that you may shoot the enemies of my king, Keawe-nui-a-'Umi, for I have seen your unsurpassed skill with the bow. Thus I told the king all that I had seen you do, and so he is the one who sent me to get you. He is very angry with Mainele, the king is very troubled that he did not strike down his enemies."

Pikoi-a-ka-'alalā then spoke, "Perhaps you are a favorite of Keawe-nui-a-'Umi?" "Yes," answered Waiakea. Pikoi-a-ka-'alalā then said, "If you are a true favorite, you must go up there and take a large container and fill it with water. Take it below the koa tree where the birds perch." Waiakea agreed to do so. "Here also, when you see that I have arrived, strike your hand with a piece of wood until I am standing at the place where the water container is set, and I am looking up to where the birds perch." [January 20, 1866]

Part 7.

"When I am finished looking above at the birds, you must strike down one of the men with Mainele folks, for there are five of them who have come from O'ahu. And then when I gaze into the water container, you must again strike down one of the men; and so it must be that you strike and kill four men, you must only leave Mainele. You will then see me string my bow, and I shall recite a chant. When I release

manu, alaila, hahau iho no oe ia Mainele, i hookahi kona make ana me na enemi mau o ke Alii; pela auanei oe e hanai, e like me kau olelo ia oe, ke punahele io hoi oe na ke alii.”

O keia mau olelo a pau a Pikoiakaalala i aoao ai ia Waiakea, he ae wale no ka Waiakea. A pau ko laua kamailio ana no keia mau mea i olelo ia; hoomaka koke iho la o Waiakea e kukini mama, e hai aku i kona Haku Alii i na mea a pau a kana pana akamai, ana i kaena e ai imua o ke alii nona ka enemi mau o na manu.

la Waiakea i pii ai, oia aku no mamua o ka pii ana, mahope wali aku no o Pikoiakaalala, o kona kumu hoi i emi hope ai, no ka walea i ke kui lei lehua mamo ai a ka manu, a me kona hoonau pu ana aku kekahi me ka ua i Hilo one, (Keakalaulani) ia Waiakea e ahai ana i na huaolelo i haia iaia, aole no hoi oia i ike mai i ka Pikoiakaalala ma hoonau ana mai mahope. A hiki e o Waiakea i kahi a ke alii Keawenuiaumi e noho ana, ma Kalehuapueo, a o Pikoiakaalala ma aku no hoi a Makaulele, ike aku la o Pikoiakaalala i ka popohe maikai mai a ka lehua ula me ka lehua kea, olelo ae la ia i ke Kama Alii Wahine, “Ina paha e ike au i ke kui ana o ka lei lehua, ina la wau ua hele e kui i lei no kua,” pane mai la ke Kama Alii Wahine opio, “Owau no kai ike, nau no e kui aku i lei nou, a paa ko lei, pii hoi oe, a hoi no hoi au a Alenoho, kakali o ka huikau o na manu i ka pua o ka lehua.”

O ke kui iho la no ia o Keakalaulani a lawa na lei lehua eha. O ke kui ana a ua Kama Alii Wahine opio la i na lei lehua eha, i pauku ia ka lehua ula me ka lehua kea, a hoolei aku la no hoi o Keakalaulani ia Pikoiakaalala i na lei; a no ke kokolo waianuhe ana mai a ke aheahe makani mailoko mai o ka ululaau, a o ka laua mea hoi ia e nanea ana ma ia wahi, me ko laua manao e kali ia Waiakea a kii hou mai. la ia i kuehu pau mai ai ka lau o ka palai noho uka a me ka maile laulilii i ko lakou onaona, a he mea oluolu loa i ko ke Alii Wahine manao.

A ia Waiakea hoi i hoea aku ai oia wale no, aole hoi ka mea ana i kii hou ai (Pikoiakaalala.) Ninau mai la o Keawenuiaumi, “Auhea la hoi ke keiki

my arrow, the birds shall be killed. Then you will kill Mainele, thus his death shall come at the time of the death of the enemies of the King. These are the things that you must do, as I have instructed, then you will become the true favorite one of the king.”

All of the instructions given by Pikoi-a-ka-‘alalā to Waiākea, Waiākea agreed to. When they finished their conversation, Waiākea swiftly ran back to tell the King all about the skilled one with the bow, and what had been said about the one who had boasted before the king and the despised birds.

While Waiākea was going to the uplands, Pikoi-a-ka-‘alalā was slowly following behind. The reason being that he was enjoying himself, making garlands of the *lehua mamo* blossoms, food of the *mamo* birds, and traveling with Keakalaulani, who was like the rains of *Hilo One*. Waiākea followed the instructions given him, but he did not know that Pikoi-a-ka-‘alalā them, were following behind. When Waiākea arrived before the King, Keawe-nui-a-‘Umi, who was then dwelling at Kalehuapueo, Pikoi-a-ka-‘alalā them were at Makaulele, where they saw the perfect fullness of the *lehua* blossoms—red *lehua* and white *lehua*. He said to the Chiefess, “If only I knew how to string a *lei* of these *lehua* blossoms, I would make a *lei* for us two.” The Chiefess answered, “I am one who knows how, let me make a *lei* for you. And when you go to the uplands, I will return and wait at ‘Alenoho, waiting with tumult of the birds on the *lehua* blossoms.

Keakalaulani then made four perfect garlands of *lehua*. The four *lehua* garlands made by the young chiefess, were made in sections of red *lehua* blossoms and white *lehua* blossoms, with which she adorned Pikoi-a-ka-‘alalā; the cool moist breeze caressed the forest, they two relaxed and awaited the return of Waiākea. They then thought to go gather the *palai* of the uplands and the *maile lauli’i*, for their fragrance was something that gave comfort to the thoughts of the Chiefess.

Now when Waiākea returned, he was by himself, the one whom he had gone to fetch, (Pikoi-a-ka-‘alalā) was not with him. Keawe-

akamai i ka pana, au i olelo iho nei iau, a o ka makou ia e kali aku nei?" Olelo aku la no hoi o Waiakea, "Ei ae no mahope mai, i pii e mai nei au mamua nei e olelo aku ia oe, a ina oe e ae mai alaila, e olelo aku au?" "Pehea ia olelo au e ae aku ai au?" Alaila, hoopuka mai la o Keawenuiaumi i kona manao penei: "Ua ike no oukou a pau i kau mau mea i hooko ai no ka poe a pau i na mai e pio kou mau enemy manu; a ma ka lakou mau olelo wale no au e hooko aku ai; o kau mau olelo no hoi a pau au e olelo mai nei no kau akamai, pela no au e hooko aku ai." A pau ka olelo ana a ke alii, hoomakaukau ia iho la na mea a pau i oleloia. Hoopiha ia iho la kekahi poi nui a piha i ka wai, hapaiia aku la a ke kumu o ke koa. A ike iho la o Waiakea ua hooko ia kona mau olelo a pau e kona Haku.

Alaila, ua kii aku la o Waiakea ia Pikoiakaalala, a loa no iaia e pukukui ana no i ke anu a ka ua lililehua o Makaualele. "O oe mai la ia?" wahi a Pikoiakaalala. "Owau keia o Waiakea o kau aikane aloha, i kii hou mai nei au ia oe, ua ae mai nei kuu Haku i na mea a pau au i kena mai ai iau e pii e mamua, a o ia hoi au i holo hou mai nei ia oe." "Ina kua," wahi a Pikoiakaalala o ka pii aku la no ia o laua (Pikoiakaalala ma), a hoi no hoi o Keakalaulani ma me kona wahi kahu wahine i kai o Hilo.

la Pikoiakaalala ma i hiki aku ai ma kekahi oioina, o Mahinaakaaka ka inoa, aia no kela wahi ma ke alanui e pii ana i Olaa. Ilaila, ike aku la o Pikoiakaalala i kekahi iole nui, pane aku la ia ia Waiakea, "Ka iole nui hoi!" "Aia i hea?" wahi a Waiakea, "Ei aku mamua o kua, ua hele ka nuku a paa i ka pulu hapuu." O ka pana aku la no ia o Pikoiakaalala, ku no ua iole nei, o Akiakaiole, a ua pana ia no ia wahi o Akiakaiole, aia no ma Olaa. Mahope aku no hoi laua nei, a ike iho la o Waiakea i keia iole nui io e waiho ana. A pii aku la no laua nei a hiki i Kapueuhi, malaila no ko laua komo anaku, no ka mea, o ke alanui no ia e pii ai a hiki i kahua kalaiwaa o ke alii Keawenuiaumi, oia hoi o Kalehuapueo.

A hiki aku la laua nei i kahi i oleloia ae nei, pihoihoi nui mai la ka ahakanaka me na huaolelo ma ko lakou waha, "Eia ua pana akamai loa la! A pela mau ka ka aha olelo, a no ka hooho nui ana o na kanaka, oiai e noho ana no o Mainele ia Kepookulou, a i kee anae iluna, ike aku la ia ia

nui-a-'Umi asked, "Where is the youth that is skilled with the bow of whom you told me, and for whom we wait?" Waiakea answered, "He is following behind, I came to the uplands first to speak with you." "What are the words that you wish to speak?" "What do you think of these words that I have spoken to you?" Keawe-nui-a-'Umi the spoke his thoughts, "All of you know the things that I have done for the one who would extinguish my enemies. And it was only by their saying it, that I fulfilled the needs. Now, all that you have said, from your skilled one, so I shall fulfill his instructions." When the king finished speaking, all things that were instructed were prepared. A large container was filled with water and carried to the koa tree. Waiakea saw that all that he had spoken to his Lord had been accomplished.

Then Waiakea went to fetch Pikoi-a-ka-'alalā, and found him there in the cold misty rains of Makaualele. "So it is you?" said Pikoi-a-ka-'alalā. "It is I, your friend," said Waiakea, "Come to fetch you, for my Lord had agreed to all that you said, before I went up. And now I have come for you." Pikoi-a-ka-'alalā said "It is for us." So they two made preparations to go to the uplands. Keakalaulani and her female attendant returned to the shore of Hilo.

Pikoi-a-ka-'alalā and his companion arrived at a trailside resting place known by the name of Mahina'akaaka; that place is along the trail that ascends to 'Ōla'a. There, Pikoi-a-ka-'alalā saw a very large 'iole, he told Waiakea, "What a large 'iole!" "Where?" "There in front of us. The snout is held fast in the pulu of the hāpu'u." Pikoi-a-ka-'alalā then shot, and struck the iole named 'Aki'akia'iole. 'Aki'akia'iole is now one of the storied places in 'Ōla'a. Afterwards, Waiakea saw the great iole left there. They then continued upland till they reached Kapu'euhi; they entered there because the trail rises up to the clearing of the canoe makers of the king, Keawe-nui-a-'Umi, that is Kalehuapueo.

They then arrived at the place spoken of above, and the people were greatly excited, and the words from their mouths were "So here is the expert with the pana!" Such were the words and murmuring of the people. Meanwhile, Mainele was sitting with his head

Pikoiakaalala ma e pii mai ana, a i kona ike ana o ke keiki no a laua i pana ai i Kulaokahua, a i mua hoi o Kakuihewa, manao maopopo loa iho la ia, me ka olelo ae i kona mau hoa eha, "E make ana paha kakou," "I ke aha hoi?" wahi a kona mau hoa. O ke keiki no hoi keia a maua i pana ai iloko o ka hale o Kakuihewa i Oahu." Kai no paha he keiki e keia i olelo iae nei...

A ma ia wa i hoili ia iho ai ko Mainele naau e ka ukana kaumaha he hilahila, me ka manao no nae hoi, o ka hilahila wale no ke loa iaia, aole la hoi o ka make pu kekahi e hana ia nona. A ku o Pikoiakaalala ma ke kumu o ke koa, kahi hoi a ke poi wai e ku ana, ka laau hoi a na manu e kau mau ai, nanae la ia iluna, a ike ae la i na manu e kau ana i ka wekiu, oiai ua hookoele e iaku mamua, i mea e lohe ole ai ka mea kaulana i ka pana; a ike lea ae la o Pikoiakaalala i na manu, hoi iho la kona mau maka ilalo i ke poiwai hoomanao ae la o Waiakea i kona kauoha, hapai ae la i kana laau, a hahau iho la i kekahi kanaka o Mainele, a make loa, ka Pikoiakaalala no ke kilo i ke poi wai, o ka Waiakea hana no hoi ka pepehi i kanaka o Mainele, a pau eha kanaka i ka make, a o Mainele aku no hoi ka hope, aia a heluhelu ae o Pikoiakaalala i kana mele mau, alaila, o ko Mainele wa ia e make ai ia Waiakea. A ma ia wa no, hoomaka iho la o Pikoiakaalala e lena i kana kikoo, me ka nana no nae o na maka ilalo i ke poiwai.

Heluhelu ae la ia i kana wahi mele mau. Penei no ia:

*"Aia la, aia la o Pikoiakaalala,
O Alala no ka makuakane,
O Koukou no ka makuahine,
Hanau o Kikookalani,
O Kikookahonua,
O Kikookamauna,
O Kikookamoana,
O Kikookapo,
O Kikookeao,
O Kapunanui,
O Kapunaiki,
O Ke-i,
O Ke-hamau,
Hamau - Aia ka hoi ua manu iluna,
Eia hoi au ilalo nei,
E lele ae oe e kuu pua,
O ka a-i o kela manu,*

hung down, as Pikoi-a-ka-'alalā and his companion drew near. Then he knew that this was the youth with whom he had competed in the sport of *pana* at Kulaokahu'a (O'ahu), before the king, Kakuihewa. He then knew, and told his four companions, "We are going to die." Why?" they asked. "This is the youth that we competed with in the sport of *pana* at the house of Kakuihewa, at O'ahu." "Perhaps this is a different youth," they said.

Then Mainele's very core trembled with sadness and the burden of shame, knowing that only shame would be had by him; he did not know that death would be the result of his deeds. Pikoi-a-ka-'alalā stood at the *koa* tree, where the water container had been set, and below the branch where the birds regularly perched. He looked up and saw the birds perched at the very top of the tree. He then caused the tapping of the wood to begin, so that the sound of the bow of this famous one would not be heard. Pikoi-a-ka-'alalā rejoiced at seeing the birds, and then looked down into the water container. Waiākea then remembered what he had been instructed, and took up his club and struck and killed the first of the men who had accompanied Mainele; and so he killed all four of the men. Only Mainele remained. Then Pikoi-a-ka-'alalā began his chant, and that was the time that Mainele was to die. At the same time, Pikoi-a-ka-'alalā began to string his bow, while his eyes were looking down into the water container.

He recounted his mele, thus:

*"Behold, there is Pikoi-a-ka-'alalā,
'Alalā is the father,
Koukou is the mother,
Born was Kīko'okalani
(Expanse of the heavens),
Expanse of the earth,
Expanse of the mountain,
Expanse of the sea,
Expanse of the night,
Expanse of the light,
Of the large spring,
Of the little spring,
That which is spoken,
That which is silent,
Silence, there are the birds above,
And here I am below,
Let you fly my arrow,*

*O ka a-i o keia manu,
Huihui a kahi hookahi.”*

O ka hookuu aku la no ia o Pikoiakaalala i kana pua, oia kolili no a ku ana na a-i o a na manu a elua; i ka pua no ana a lele, o ka manawa koke iho la no ia o Pikoiakaalala i holo ai i kai, me kona ike ole aku i ke ku ana o na manu. Uwa nui ae la ka pihe kanaka, me ka hoocho ana; “a make ka manu e!” A pela mau aku no ka ikuwa hauwalaau ana o nalii me na kanaka.

A o Pikoiakaalala hoi, aia kela ke holo kiki la i kai, me kona manao no, aole e ku ana iaia na manu, no ka mea, he mau manu akamai loa i ka alo ana i ka pua. Eia ka auanei ua ku aku la no, a no ke ku ana ka ka mea e uwa nui ia mai nei mahope. A iaia i akakuu iki iho ai kona holo ana, ua komo aku la nae keia i ka nahele loloa o Panaewa; halulu ana hoi o Waiakea ma-hope ona, a alawa ae la ia, o Waiakea no; ninau ae la o Pikoiakaalala, “Pehea na manu, ua ku nae paha?” “Ae, ua ku,” wahi a Waiakea. “A heaha hoi kou mea i holo mai nei?” “No kou manao no aole i ku na manu...” “E hoi hou kaua,” wahi a Waiakea, o ka hoi hou aku la no o laua nei a hiki i kahi o ka luahi a kana pua, o na enemi mau hoi o Keawenuiaumi.”

Ku kohana iho la o Pikoiakaalala imua o ke alii, nona na enemi e waiho ana i ka make. Ia wa, hoike ae la oia i kona inoa, a me kona akamai nui, penei no ia:

“O kuu mea i upu ai, o ka mea e make ai o kou mau enemi, alaila, e lilo kau kaikamahine i wahine hoao nana, a e hooili aku no hoi au i kou Noho Alii maluna ona, oiai hoi, o oe ae nei ke akamai lua ole, nana i pale ae nei i ka mea uluhua a kou naau, e enemi mau ai i ke Kau me ka Hooilo, o ka noho ana o nei aina, me ka lana nui o kou manao, e lilo i keiki oe nau, a owau hoi kou makua, a o Hawaii nei ka Moku noho ia, o luna, o lalo, o uka, o kai, o ke kanaka nui, o ke kanaka iki, a hale nui, a hale iki, ua pau a me oe. A o kuu Kama Lei aloha he kaikamahine, o ka mea ia nana e hoopumehana kou poli o na po ua lanipili o ua wahi nei” (Hilohanakahi).

The target is that bird,
The target is that bird,
Joined together as one.”

Pikoi-a-ka-‘alalā then released his arrow, it twirled and struck the two birds; the moment the arrow flew, Pikoi-a-ka-‘alalā immediately departed for the lowlands, not knowing whether or not he had hit the birds. There was a great roar from the people there, calling out, “The birds are dead!” And such was the din of the voices of the chiefs and people.

Now Pikoi-a-ka-‘alalā had arrived at the shore, not knowing if he had killed the birds or not; for the two birds were extremely clever at dodging the arrows. But he had hit them, and that was the reason for the great cry rising behind him. So he slowed down his pace, and entered into the dense forest of Pana‘ewa. Waiākea was noisily following him, and saw him. Pikoi-a-ka-‘alalā asked Waiākea, “How are the birds, were they hit?” Waiākea said, “Yes.” “And why have you followed me?” Because at first I thought that perhaps the birds had not been hit...” Waiākea then said, “Let us two return to the place where the arrow struck the enemies of Keawe-nui-a-‘Umi.”

Pikoi-a-ka-‘alalā stood alone before the king, and the dead enemies were there on the side. At the time he revealed his name to the king, his great skill was known, the king spoke thus:

“My desire was that my enemies be killed, and to the one who succeeded, would be wed to my daughter, and also inherit my kingdom. Therefore, because you have unsurpassed knowledge, and have protected me from my enemies—those who caused me grief summer and winter, in the dwelling upon this land—it is with great hope that you will become a son to me, and I will be your father. Hawai‘i will be the Island upon which you dwell—above, below, from the uplands to the sea; the great men, the little men; the great houses, the little houses, all are for you. And my cherished daughter, a beloved lei, is the one who will warm your breast on the rainy nights of this place here” (Hilo Hanakāhi).

A pau na olelo a ke alii, o ka hoi iho la no ia o ke alii me na makaainana a pau, a halihali pu ia o Mainele me na manu i kai o Hilo, a kau ia i ka Heiau i Poo, aia no kela wahi ma Hilo one, a malaila pu o Kanukuokamanu, o ka nuku no ia o ua mau manu la... [Iaunari 27, 1866]

When the king finished speaking, he, all the chiefs and people, and those carrying Mainele and the birds, returned to the shore of Hilo. Mainele was placed on the Temple at Po'o; that place is there on *Hilo One*, at Kanukuokamanu; and it is named for the *nuku* (beaks) of those birds... [January 27, 1866]

Another indication of the traditional importance of resources in the lands of 'Ōla'a and Waiākea is found in the writings of native historian, John Papa I'i (1959). I'i reported that following the death of Kalani'ōpu'u in 1782, the island of Hawai'i was to have been ruled by Kīwala'ō, Kalani'ōpu'u's son, while the gods and *heiau* were to be cared for by Kamehameha I. Disagreements arose over the division and redistribution of lands following Kalani'ōpu'u's death. I'i reported that while the division of lands to be made by Kīwala'ō was being discussed, his half-brother, Keōua, was told by one of his advisers:

“...Perhaps you should go to the chief and ask that these lands be given to us. Let Waiākea and Keaau be the container from whence our food is to come and Olaa the lid⁵.” Keoua did so, but the other Kau chiefs objected to this and spoke disparagingly to him. When Keoua returned, his advisor asked, “How was your venture?” When Keoua told him all that had been said, the man remarked seriously, “A break in a gourd container can be mended by patching, but a break in the land cannot be mended that way...” (I'i 1959:14)

Kū-ka-'ōhi'a-Laka

The tradition of Kū-ka-'ōhi'a-Laka dates from the period of settlement of these islands, when the gods themselves took human forms and resided upon the land. It is recorded that the gods Kū-ka-'ōhi'a-Laka and his sister Ka-ua-kuahiwi came from Kāhiki (the ancestral home land) to Hawai'i, and settled at Kea'au and 'Ōla'a, Puna. Kū-ka-'ōhi'a-Laka (Kū) and his wife resided near the shore at Kea'au, and Ka-ua-kuahiwi, her husband and children lived upland in 'Ōla'a. Kū's wife was stingy, and at one time denied Ka-ua-kuahiwi and her family fish that Kū had caught. Out of desperation, Ka-ua-kuahiwi turned her husband and children into rats, and turned herself into a spring of water. When Kū learned of this occurrence, he went to the spring and turned himself into an 'ōhi'a tree (cf. Green and Pukui 1995:19-20; and Beckwith 1970). This 'ōhi'a tree was known as a supernatural tree and the spring and tree were one of the *wahi pana* (special storied places) along the ancient trail leading to and from the volcano area in 'Ōla'a. The location of Kū-ka-'ōhi'a-Laka was near the 13 mile marker of the old Volcano Road (pers comm. M.K. Pukui, 1976).

Ka U'i Keamalu (Keamalu the Beauty)

There once lived at Paliuli, an upland region of 'Ōla'a, a beautiful chiefess named Keamalu. Keamalu was raised in the seclusion of the forests by her supernatural elders, and until she matured, she was never seen by anyone. A spring in 'Ōla'a is named Pūnāwai o Keamalu, and it was there, that the chiefess went to bathe. One day while at Pūnāwai o Keamalu, a young man came upon her, and he was so taken by her beauty that he asked her to become his wife. She refused, but he would not leave her, and her bird guardians took her away on their wings. Word of Keamalu's beauty went throughout Puna, and the young man's sweetheart, the beautiful Kalehua'ula and her parents spoke disparagingly about Keamalu. Keamalu's guardians were angered by the comments, and a contest was arranged so that all the people of Puna could see and compare the two beauties. Keamalu, adorned with *maile* and *lehua kea* (white blossomed *lehua*), with 'i'iwi flying over her, won the contest.

⁵ The reference to 'Ōla'a as the “lid,” may be taken to imply that the fine resources of bird feathers, *olonā* fiber for cordage, and the famous *kapa* (bark cloth) called 'ō'ū-holo-wai-o-La'a were the wealth which covered the needs of the chiefs.

She and the young man were married, and they lived at Paliuli. “As for the spring of Keamalu, it was hidden and is shown to very few people” (Green and Pukui, 1995:32-33).

**“Kaa Hooniua Puuwai no Ka-Miki”
(The Heart Stirring Story of Ma-Miki)**

Perhaps one of the most detailed native traditions which includes rich accounts of place names and traditional practices associated with the Puna-Hilo forest lands, and associated *ahupua‘a*, is the historical account titled “Kaa Hooniua Puuwai no Ka-Miki” (The Heart Stirring Tale of Ka-Miki). The story of Ka-Miki was published in the Hawaiian language newspaper *Ka Hoku o Hawaii* (1914-1917). It is a long and complex account that was recorded for the paper by Hawaiian historians John Wise and J.W.H.I. Kihe (translators of the work of A. Fornander), with contributions from others of their peers. While “Ka-Miki” is not an entirely ancient account, the authors used a mixture of traditions, local stories, tales, and family traditions in association with place names to tie together fragments of site specific history that had been handed down over the generations.

The complete narrative include historical accounts of more than 800 place names (many personified, commemorating particular individuals) around the island of Hawai‘i. While the personification of individuals and their associated place names may not be entirely “ancient,” such place name-person accounts are common throughout Hawaiian and Polynesian traditions. The selected narratives below, are excerpted from various sections of the tradition, and provide readers with descriptions of the land, resources, areas of residence, and practices of the native residents, as handed down by *kama‘āina* (those familiar with the land). Of particular interest, specific documentation is given pertaining to the practice of bird catchers, the nature of weather patterns, and the naming of many places on the mountain landscape.

The English translations below (translated by Maly), are a synopsis of the Hawaiian texts, with emphasis on the main events of the original narratives. Also, when the meaning was clear, diacritical marks have been added to help with pronunciation of the Hawaiian place names and words.

This *mo‘olelo* is set in the 1300s (by association with the chief Pili-a-Ka‘aiea), and is an account of two supernatural brothers, Ka-Miki (The quick, or adept, one) and Maka-‘iole (Rat [squinting] eyes). The narratives describe the birth of the brothers, their upbringing, and their journey around the island of Hawai‘i along the ancient *ala loa* and *ala hele* (trails and paths) that encircled the island. During their journey, the brothers competed alongside the trails they traveled, and in famed *kahua* (contest fields) and royal courts, against *‘ōlohe* (experts skilled in fighting or in other competitions, such as running, fishing, debating, or solving riddles, that were practiced by the ancient Hawaiians). They also challenged priests whose dishonorable conduct offended the gods of ancient Hawai‘i.

Ka-Miki and Maka-‘iole were empowered by their ancestress *Ka-uluhe-nui-hihi-kolo-i-uka* (The great entangled growth of *uluhe* fern which spreads across the uplands), who was one of the myriad of body forms of the goddess *Haumea*, one of the creative forces of nature—also called *Papa* or *Hina*—who was also a goddess of priests and competitors.

Pōhaku-loa (Long stone)

The boundary point between Keauhou, Waiākea and ‘Ōla‘a.

Pōhakuloa was a deity of the forest lands which extended across Mauna Loa towards Mauna Kea, and he was called upon by canoe makers. In his human form, Pōhakuloa was an *‘ōlohe* expert and wood worker.

When Ka-Miki and Maka-‘iole left ‘Uwēkahuna *mā* (and companions) at Kīlauea, they traveled into the upland section of the district of Puna. Hearing the striking sounds of

ko'i pōhaku pāhoa (large adze against wood), the brothers thought that perhaps canoe makers were working nearby. As they approached the source of the sounds, Ka-Miki and Maka-ʻiole saw a large round house, of the type with a high pitched roof (*pū'o'a*). And at the center of the house a man was working on a *koa* log which was seven fathoms long and three feet in diameter. [September 16, 1915]

Working intently, this man was startled at hearing a voice call to him, thus he stopped his carving. Ka-Miki then asked, "Is this the path by which one would travel to Kea'au?" Angered at being interrupted, Pōhakuloa responded, "Don't you know the direction of the path upon which you two travel? If you just go straight on you will reach Kea'au." He then went on to say, "My job is not to stand here directing travelers along the trails."

Ka-Miki told Pōhakuloa, "We only asked because we thought that you were a man like us, had we known you were one of the — *Pahulu ke akua 'āhuluhulu o ka mauna* (Ghoulish broad adze gods of the mountain), we would not have bothered you."

Ka-Miki and Pōhakuloa exchanged taunts, and Pōhakuloa threatened to throw Ka-Miki and Maka-ʻiole into a deep pit. Ka-Miki then told Pōhakuloa, "It is unlikely that you could beat *Nana-i-ke-kahi* and *Kahuelo-ku*. It was more likely that the great grandchildren of *Ka-uluhe* and *Lani-nui-ku'i-a-mamao-loa* will bind you like a pig, and leave you along the *ala loa* for travelers to see."

Angered, Pōhakuloa leapt to attack Ka-Miki, and was immediately bound, unable to move. Though he tried with all his might and skill, Pōhakuloa was unable to free himself. Ka-Miki called out to Pōhakuloa —

Pa'a loa e Pōhakuloa. Pa'a i ka 'alihi o Kanikawī ke kōkō aīwaiwa a ku'u mau kūpuna wahine... Pa'a 'oe i ke kāwelewele o Halekumuka'aha ka 'upena ku'u a ka nananana, o Kai-halulu ia, o ku'i a holo, pi'i a noho, pupu'u a moe mālie, kau i ke Kōkī o Wailau...

Pōhakuloa is secured. Bound in the lines of *Kanikawī*, the mysterious net of my female ancestors... You are bound in the ropes of Halekumuka'aha, in the net set down by the spider, and though thrashing about like the sea of Kaihalulu, which strikes and runs, which rises and recedes, which mounds up and lies calm, you cannot escape, for you are placed like the shrimp at Kōkī, Wailau (Moloka'i)...

...Pōhakuloa realized that these young travelers were no ordinary people, but that they traveled with the gods, deities and guardians of the *'ōlohe*, and he surrendered, acknowledging the skill and nature of Ka-Miki and Maka-ʻiole. Pōhakuloa also promised that from then on, he would use his knowledge wisely.

Pōhakuloa then went to his brother-in-law, Kapu'euhi, to ask his assistance in preparing food and *'awa* for Ka-Miki and Maka-ʻiole. Kapu'euhi laughed upon hearing Pōhakuloa's story and planned to show up Pōhakuloa, by tricking and defeating Ka-Miki and Maka-ʻiole [September 23, 1915].

Kapu'euhi lost and vowed revenge, but Pōhakuloa remained true to his word of friendship, refusing to assist Kapu'euhi. Kapu'euhi then went to Kaniahiku to enlist her assistance [October 14, 1915].

Ka-pu'e-uhi (The yam planting mound).

The lands of Kapu'euhi, in the upper forests of Kali'u, at 'Ōla'a, were named for the *'ōlohe* chief, Kapu'euhi.

Kapu'euhi went to get Ka-Miki and Maka-'iole from Pōhakuloa's compound and invited them to his house for 'awa and food. Kapu'euhi challenged Ka-Miki and Maka-'iole to drink five cups of 'awa, stating that if they were unable to drink that amount, he would throw them out of his house. Now this type of 'awa, the 'awa kau lā'au ('awa planted by the birds on tree branches) was very powerful, and few people could drink large quantities. Thus, many people were thrown from Kapu'euhi's compound and left to wonder drunk and lost in the forest. This practice of Kapu'euhi's was the source of the saying — "*Lilo i Puna i ke au a ka hewahewa!*" (Lost in Puna in a time of demented thoughts—drunkenness; descriptive of aimless wandering, or senseless work!).

Ka-Miki accepted the challenge, but stated that if they won, they would throw Kapu'euhi out of his compound. Ka-Miki then offered an 'awa prayer chant to *Ka-uluhe*, *Haumea*, and their associated god forms:

<i>lā Kumakua-moe-awakea</i>	To (the deity) Kumakua [tall <i>Iehua</i> which reclines in the afternoon sun]
<i>lā 'Ōhi'a-nui-moe-awakea</i>	To 'Ōhi'a-nui [great 'ōhi'a which reclines in <i>the afternoon sun</i>]
<i>I nā Wahine-moe-awakea</i>	The women who sleep in the midday sun
<i>lā Ka-'ohu-kolo-mai-iluna-o-ka-lā'au</i>	To the mist which creeps atop the forest
<i>lā Ka-uluhe-nui-hihi-kolo-i-uka...</i>	To Ka-uluhe the great entangled <i>uluhe</i> fern growth of the uplands...
<i>lā Hai-uli wahine o Mākea</i>	To Hai-uli wife of Mākea
<i>O Kamehanalani, O Kāmeha'ikana</i>	Who is also called Kamehanalani, or Kāmeha'ikana,
<i>O Haumea, O Haumea-nui-a-ke-aīwaiwa.</i>	It is Haumea, great mysterious Haumea.

Hearing Ka-Miki's prayer, his deified ancestresses responded, and *Ka-'ohu-kolo-mai-iluna-o-ka-lā'au* caused a mist to envelope Kapu'euhi's compound, and its' foundation was rocked by the strong winds, the 'ōhi'a, *kōlea*, *kāwa'u*, *kōpiko*, 'ama'u, and *koa* were all broken in the winds that blew. [September 30, 1915]

Ka-Miki and Maka-'iole drank all the 'awa and Kapu'euhi was startled at the strength of the two young strangers. Kapu'euhi tried to back out of his earlier challenge, but Ka-Miki would not release him from the arrangement, thus Kapu'euhi had to fetch more 'awa for Ka-Miki and Maka-'iole.

Now Kapu'euhi lived near the spring of Wai-uli. His compound consisted of several houses, and in one guest house he killed many travelers while they slept. He placed his compound near the *ala loa* which ran from Pana'ewa through 'Ōla'a, into coastal Puna and on to Ka'ū. Kapu'euhi's regular practice was get travelers drunk on 'awa. Once the travelers were asleep, Kapu'euhi would play a *hōkiokio* (gourd nose flute) to call his assistants who were hiding in another one of his houses. They would kill the guests and take their valuables; *kapa*, finely woven mats, feathers, and *olonā*... [October 7, 1915]

Unable to get Ka-Miki and Maka-'iole drunk, and angered that Ka-Miki discerned his true nature, Kapu'euhi leapt to attack Ka-Miki and was quickly beaten and thrown out of his compound onto the *ala loa*. Kapu'euhi was startled at his quick defeat, and he feigned friendship with Ka-Miki and Maka-'iole. Ka-Miki told Kapu'euhi that to live, he and his companions would need to give up their waylaying of travelers. Kapu'euhi asked for three days to consider, Ka-Miki agreed.

Kapu'euhi then began to plot for revenge, Pōhakuloa refused to help, so Kapu'euhi went to enlist the aid of the most feared 'ōlohe of Puna's forests; Kaniahiku and her

grandson, Keahialaka. Kaniahiku and her god Kūlilikaia were guardians of the forests of Kali'u and Malama, damaging the forest greatly angered them. Many people died while traveling in the forests, carelessly breaking plants or loudly calling out, disturbing the silence.

Kaniahiku told Kapu'euhi to tell Ka-Miki and Maka-'iole that the guardians of the 'awa grove had nearly killed him while he gathered the 'awa. She then told Kapu'euhi to take Ka-Miki and Maka-'iole to the 'awa grove of Mauānuikananuha, where she would cause them to get lost and die. This happened to many who traveled through the Puna forests. And once lost in the forest, there was no way out. Calling out in the forest caused an echo which sounded like a person calling, but following the echo led one deeper into the forest, and this is the reason that the famous saying of Puna came about. Travelers through the forest were warned —

E nihi e ka hele mai ho'opā, mai pūlale i ka 'ike a ka maka o ako hewa i ka nui o ka lehua, a ho'opuni 'ia e ka 'ino! (Travel cautiously, being careful not to touch the *lehua*, don't rush to see things lest you mistakenly break something and the many *lehua* become offended, causing you to become surrounded by a storm!) [October 21, 1915]

Following Kaniahiku's instructions, Kapu'euhi led Ka-Miki and Maka-'iole deep into the forest of Kali'u, under the pretext of taking them to the 'awa grove of Mauānuikananuha. Wandering to and fro, Kapu'euhi secretly broke *lehua*, 'ōhelo, and *kupali'i* plants as a sign to Kaniahiku of their whereabouts in the forest. Kaniahiku then caused the mist rains and forest envelope Ka-Miki and Maka-'iole. Kapu'euhi then abandoned them, and was led to safety by 'Akiāloa, Kaniahiku's dual-formed sister.

Kaniahiku then caused a heavy mist to settle upon them and the forest. The plants also grew in tangled mats, blocking the trail from sight. Ka-Miki and Maka-'iole called upon the deity forms of *Ka-uluhe* and her god companions to assist them —

*Lani-pipili, Lani-'oaka,
Lani-ki'ei, Lani-hālō,
Lani-kilo, Lani-papanu'u,
Lani-ka'ahela, Lani-hāko'i,
Lani-mamao,
Lani-Uli-wahine o Nu'umealani
Ia Haumea!
Ia Haumea-nui-a ke aīwaiwa...*

Clinging and flashing heavens*
Peering and peeking gods
Divining and highest gods
Traveling and agitated gods
God who clears (the heavens),
Uli-wahine of Nu'umealani
Oh Haumea!
Great mysterious Haumea...

Thus the darkening of the sun was ended, *Ka-'ōnohi-o-ka-lā* caused the mists to recede, and the forest growth withdrew before Ka-Miki and Maka-'iole, and was scattered as a pathway for their feet. As the forest receded, an 'auwai [the name of a wet forest trail] was formed by *Ka-uluhe* and she led Ka-Miki mā to the sacred 'awa plantation of Mauānuikananuha and Kūlilikaia.

Seeing that Ka-Miki and Maka-'iole had escaped from her efforts at killing them in the forest, Kaniahiku sent her sister, who possessed the form of an 'Akiāloa (*Hemingnathus munroi*) bird to have Mauānuikananuha and Kūlilikaia carry the 'awa to her compound and hide in her house, where an altar was prepared. Ka-Miki and Maka-'iole reached Mauānuikananuha before the instructions could be carried out, and Ka-Miki and Maka-'iole climbed upon the tree-form of the god. Kaniahiku then called to

* These are all names of gods and goddesses of the forests and weather phenomena.

Mauānuikananuha to extend its' body high into the sky, and then fall to the forest, thinking this would kill Ka-Miki and Maka-'iole. *Ka-uluhe* caused forest growth to cover Mauānuikananuha, and thus this plan was thwarted as well.

Ka-Miki then captured Kapu'euhi and imprisoned him underneath the tangled branching growth of Mauānuikananuha, telling Kapu'euhi that he would remain there until Maka-'iole and he had their fill of the 'awa. *Kaniahiku* then sent her 'Akiāloa formed sister to fetch her grandson Keahialaka, in preparation for hand to hand combat [October 28, 1915].

Finding Kapu'euhi with Kaniahiku, Ka-Miki confronted him with his treachery, and then securely bound him in the net of his ancestresses... Maka-'iole then entangled Kapu'euhi in the fallen branches of Mauānuikananuha, where Kapu'euhi was left bound... [November 4, 1915]

Ka-Miki went on to defeat Kaniahiku, her grandson, and other famed 'ōlohe of Puna as well... [November 11, 1915] ...Among the contestants from Puna, was the 'ōlohe master, Kahauale'a. It was agreed that Kahauale'a and Ka-Miki would compete in three contests; *uma* (hand wrestling), *kūpahu* (pushing one's opponent from the arena), and *kūkini* (running) contests. In the *kūkini* contest, Ka-Miki and Kahauale'a were required to gather certain famous items to prove that they had actually reached the designated places. These things were:

The sacred water of the goddess *Waka-keaka-i-ka-wai* and accurately describe the nature of the spring Keakaikali'ulā and forest of Pali-uli;

A valuable bark-cloth sheet—*kuina kapa 'Ō'ūholowai-o-La'a* for which 'Ōla'a was famed;

Ten *olonā* (*Touchardia latifolia*) leaves of 'Ōla'a;

One of Puna's famed *moena makali'i pua hīnano* (fine mesh mats woven from the pandanus flower sheaths); and

To bring back living 'o'opu 'ai *lehua* (*Gobidae* fish) of Hi'ilawe and 'anae *momona* (fat plump rich mullet) which swam in the waters of Pāka'alana. [January 6, 1916]

Now the lands of Puna are famed for the forest and mist rains called *Uakuahine*. The nature of this place is described by *kama'āina* as —

Ka noe pōhina i ka uhiwai kokolo iluna o ka lā'au holo kia-ahi manu pō i ka nahele i ka uka 'Ōla'a, a me nā lehua wena o Pana'ewa-nui-moku-lehua 'ōhi'a kupu-hāo'eo'e i ka ua [kani] lehua i ka wī a ka manu a pō e!

The dark dripping mists crawl above the trees, the birds dart to and fro in the upland forest of 'Ōla'a, and the glowing *lehua* blossoms of Pana'ewa-nui-moku-lehua, the sculpted (staggered) 'ōhi'a growth in the *lehua*, rain that resounds with the song of the birds.

The mist laden forests of upper 'Ōla'a and Hilo are also described in the mele—

*Pō Puna, pō Hilo
Pō wale Hilo e
Pō Hilo i ka uahi o ku'u 'āina
Ola ia kini ke 'ā mai la no i ke ahi...*

Darkened is Puna, darkened is Hilo
Indeed Hilo is completely darkened
Hilo is made dark by the mists of my land
The multitudes live by the lighting of
the fire...

At the outset of the competition, Keahialaka provided the *kapa*, *olonā* leaves, and *moena*, thus eliminating Ka-Miki's need to gather those items. The two competitors then participated in the *uma* and *kūpahu* contests and the roar of the crowd was heard from the shore to the depths of the *waokele*, the upper forests of Kali'u and Malama. Kahauale'a was defeated in both of those contests. Then the *kūkini* contest between Kahauale'a and Ka-Miki began. Ka-Miki was carried to Pali-uli [in the uplands of 'Ōla'a and Kea'au] on '*Ōhi'a-nui-moe-awakea* [one of the body forms of Ka-uluhe]. Thus, he arrived at the spring Keaka-i-ka-li'u-lā which was the dwelling place of Lā'ie-wai (who came to be called Ka-wahine-i-ka-li'ulā) and Lā'ie-lohelohe, the sacred chiefesses and wards of Waka-ke-aka-i-ka-wai and Ka-puka-i-haoa-ka-lā-o-lalo. This was an exceedingly sacred area. Guarded by Waka, it was encircled by rainbows, filled with the songs of '*iwi*, and '*ō'ō* birds, and surrounded by all manner of plants. On the lands around the spring were grown the prostrate sugar cane called *Mikioi-o-lehua*, the bananas called *Mānai-'ula-i-ka-wao*, the taro called *Pāpākole-koa'e-o-lele-kea*, and the '*awa* called *Waimaka-a-ka-manu o Puna*.

Ka-Miki took a leaf of the *pāpākolekoa'e* taro, and folded it into a cup ('*āpu lā'alo*) to hold the water...and returned to Pū'ula *mā*. Ka-Miki presented the water to Pū'ula and described the beauty of Paliuli to those assembled. Kahauale'a had been unable to reach Paliuli and the spring of Keakaikali'ulā, so instead, he brought the water of Waiuli at 'Ōla'a. His deception was detected, because of the dark nature of the water, thus Ka-Miki won this part of the *kūkini* contest... [January 13, 1916]

Ua-kuahine (Elder sister rain – a famous mist rain of the 'Ōla'a forest).

Ua-kuahine was an exceedingly beautiful woman who lived in 'Ōla'a. One day while traveling on the *ala loa* through the upland forest, to visit the family of her husband in Ka'ū, a strong storm arose. Uakuahine grasped onto a tree, and her husband held on to a different tree. While waiting out the storm, a traveler held onto the same tree as Uakuahine. He inquired where she was bound on her journey, and she told him Ka'ū, to visit the family of her husband.

Once the storm passed, Uakuahine's husband killed her in a fit of jealousy and buried her under a *kukui* tree there. Where she was killed, a grove of *kukui* and '*ōhi'a* trees grew, and to this day, the forest grove is called *Ka ulu kukui o Ua-kuahine*. As her skin darkened in her grave, the water in the neighboring spring also darkened, and so came to be called Wai-uli (Dark water). Uakuahine herself, was transformed into the mist which clings to the trees in the forest of 'Ōla'a, and the thick mist for which the region is famed, is mentioned in *mele* and sayings like —

'Āina holo kia ahi manu ala i ka pō i ka nahele...

Land where the birds dart to and fro in the darkened forest...

Now during the contest between Ka-Miki and Kahauale'a, Kahauale'a was unable to get water from the spring Keakaikali'ulā at Paliuli, so instead, he brought the water of Waiuli. His ruse was detected, because of the dark nature of the water... [February 3, 1916]

...Following those contests, Ka-Miki and Maka-'iole befriended Keahialaka, and agreed that he could become their traveling companion. Ka-Miki returned to Kaniahiku and released Kapu'euhi who was near death. Kapu'euhi then returned to his compound and with Pōhakuloa, he prepared food for Ka-Miki, Maka-'iole and Keahialaka. When Ka-Miki, Maka-'iole and Keahialaka departed from the compound of Kapu'euhi, they descended the *ala loa* towards Hilo to continue their journey.

The travelers arrived at a large compound and community, where they saw a man coming towards them with a club. This man was Kūkulu-a-hāne'e-a-hina-pū [Kūkulu]. Kūkulu was a guardian of the chiefess and lands called Pana'ewa-nui-moku-lehua [Great Pana'ewa of the *lehua* forest]. Pana'ewa was a sacred chiefess of Hilo, the sister of the chiefs Waiākea and Pi'ihonua.

The chiefess' compound and surrounding community were forbidden to strangers, and Kūkulu regularly killed unaware travelers [thus the name "Pana'ewa" (Unjust place)]. Kūkulu challenged Ka-Miki *mā* but he was quickly defeated, and Ka-Miki left him there as an example to other 'ōlohe and to receive his due justice. Ka-Miki *mā* then continued their journey into Hilo, seeking out 'Ūpēloa, Ku'u-aho-hilo-loa, and Haili-kula-manu, unjust competitors of Waiākea and vicinity... [February 17, 1916].

Bird Catching Techniques of the Ancient Hawaiians

In addition to the references cited earlier, there are a number of traditional accounts describing the arts of the class of people who caught native birds in order to collect their feathers. Several methods of bird catching were widely practiced by native Hawaiians. Except for the account of Pikoi-a-ka-'alalā, cited above, most of the early historical accounts recorded in the 1800s tell us that traditionally, the rarer birds, whose feathers were sought for ornamental purposes were not killed by the bird catchers. One account from the later period in the life of Kamehameha I, reported that as a result of growing commercial activities in the islands, traditional methods of harvesting resources and catching birds, were changing. Regarding these changes, and the response of Kamehameha I to careless collection of bird feathers, Kamakau (1961) wrote:

Troubles that arose were not of his making, and those that had to do with disputes about religion came after his time. He ordered the sandalwood cutters to spare the young trees and, not to let the felled trees fall on the saplings. "Who are to have the young trees now that you are getting old?" he was asked and he answered, "When I die my chief and my children will inherit them." He gave similar orders to bird catchers, canoe makers, weavers of feather capes, wood carvers, and fishermen. These are the acts of a wise and Christian king who has regard for the future of his children, but the old rulers of Hawaii did the same. [Kamakau, 1961:209-210]

While researching various ethnographic records of the Bernice Pauahi Bishop Museum (BPBM), the author reviewed Hawaiian language papers (handwritten and typed) collected by island historian, Theodore Kelsey. Kelsey was born in Hilo in the late 1800s, and spent his entire life speaking with elderly Hawaiian people, collecting their stories, and translating their writings. Among his papers curated at the Bishop Museum (BPBM Archives—SC Kelsey; Box 1.5), are notes on various aspects of Hawaiian culture including bird catching. Kelsey's informant, was the elder Reverend Nālimu, who shared his account of bird catching, both as a means of providing feathers used for making Hawaiian emblems of royalty, and with other birds, as a food source. The account specifically references localities in the uplands of the Hilo District and 'Ōla'a, and is a first-hand description of traditional and customary practices which had broad application in the mountain regions.

The following Hawaiian texts are presented verbatim as recorded by Kelsey in c. 1921 (including his use of diacritical marks). The English translation of the Hawaiian narratives was prepared by the author of this study, and reflects the basic tenor of the Hawaiian narratives. It should be noted here, that in the Hawaiian language, occurrences of certain words naturally imply a specific action or statement, which is reflected in the translation:

"AHELE MANU"

by H.B. Nalimu

Po'e kia manu o Laa, oia ka po'e ahele manu, kekahi me ka laau a kekahi me ka lehua. O ka mea ahele manu ma ka lehua malaila ka puka e hanai kokoke i ka lehua, he puka paa ke-ia. Kekahi piko o ke kaula ma ka la-la o ka 'ohi'a e paa ai. Elima, eono paha

anana ka lo-ihi o ke aho mai ka puka mai a hiki i ka lima o ke kanaka e paa nei i ka piko o ke aho. A o ka puka aia ma kahi kokoke i ka lehua e kiko aku ai ka manu i ka lehua. I ka wa e lele mai ai ka manu lele no a ku maluna o ke-ia puka e kiko aku i ka lehua. A ia manawa e huki ai ke kanaka i ka piko o ke kaula a paa ka wawae o ka manu. Pii ke kanaka iluna a lawe i ka manu a hana hou aku i kela puka malaila. O ka akakane a me ka 'iwi, a me ka 'o-o' iluna o ka pua lehua. Ahele me ke aho olona' makalii. Maluna o ka mai'a pala e ahele i' ai ka manu o-u'.

“KĀWILI KĒPAU.”

O ke kepau oia ke kohu o ka 'ulu. E 'oki-oki ai i ka 'ulu a kahe mai ke kohu ke'oke'o, a i ka wa e maloo ai ua kohu 'la i ke ahiahi alaila ua paa a'e ua kohu la.

Hele oe e ho-ulu-ulu ke-ia kohu a pau. Ho-ulu-ulu a nui, alaila lilo a'e'la ua' kohu nei i kepau. Alaila hele oe e 'ohi i hookahi kukui maka a hemo kona iwi 'a 'o kona 'i'o malama 'oe kela'. Hele hou oe i ka' pa-ihi ku-kepau (kind of clover) he pa-ihi 'ele-ele ia, a hoohui me ke kukui maka, alaila nau a wali ke kukui maka me ka pa-ihi. Hookomo iloko o ke kapa wauke (he mea uaua ia), alaila 'uwi' i ka wai o ke kukui a me ka pa-ihi iloko o ka 'opihi, oia ka "ipuhao" e kupa 'ai iluna o ke kapuahi. I ka wa e hoomaka ai e paila alaila 'oki-oki i ke kepau a liliu a hookomo iloko o ke-ia wai kukui me ka pa-ihi i paila ia. Kii elua ni-au ai 'ole ia, mau laau liliu paha e koali ai iloko o ke-ia wai paila.

Pela e hanai a pau kela' wai a mo'a kela' kepau. Hookomo iloko o ke poho 'opihi a i 'ole he la-i' a wahi i ka la-i'. Kāwili 'iuka a'e nei o Mokau-lele. Neenee ke pulu 'ohi'a o ia wahi ilalo o ka pahoehoe.

Ilalo no oe e ku ai o ka pahoehoe a hana oe i ke kepau iluna o ka pua lehua. Ina ekolu, eha' pua lehua au i kāwili ai i ke kēpau alaila i ka wa e pili ai kekahi pua lehua i ka manu alaila alualu a loaa. Pee hou oe iloko o ka pulu 'ohi'a (kāhi o ka lau 'ohi'a e luhe ana ilalo, oia ka pulu 'ohi'a) a pili hou kekahi manu. Opa' ke poo o ka manu a make. Hookomo iloko o kekahi eke. Hala ekolu paha alaila ho'i, nui ka manu, i hookahi kaau, iwakalua, kanakolu paha. A kela manu makalii; ua momona—kuhikuhi kona i'o, momona. Oia ke kāwili kēpau.

“LAAU KIA MANU.”

Ekolu, eha' paha anana ka lo-ihi o ka laau. Kau ia ka pua lehua iluna o ia laau nei mai kekahi 'ao-ao o ka laau a hiki i kekahi poo o ka laau. Hana elua kanaka, kekahi ma kekahi laau a kekahi ma kekahi. Kepau maluna o ka laau a he mau pua lehua mawaena o ke-ia mau kēpau—he laau kia manu ia [_____]. Olaa ka aina kia manu a me Piihonua. Nui ka manu o-o' ma Puu O-o'. Malaila ka po'e kia manu e hele ai a loaa na lei hulu no na lii. O Pana-'ewa kekahi wahi kia manu.

Huki ka laau kia manu iluna mawaena o na 'ohi'a elua. Hana me ka 'upena kekahi. Huki ia iluna ka 'upena, hookahi laau maluna, hookahi laau malalo. He 'upena 'olona' maka hakahaka, a he kaula 'olona' ma na poo. 'Elima, eha', ekolu paha anana kela' 'upena palupalu. Lele no ka manu, paa ka wawae, paa ka pekekeu. Ina' hookahi, elua manu, waiho no pela', oia na manu e kahea ana i na manu e a'e. Nui ka manu, hookuu ilalo ka 'upena a huki hou iluna. He ulu 'ohi'a ma kekahi 'ao-ao a me kekahi 'ao-ao. Oia ka hana ana o ka po'e lawai'a manu. Ho'i i ka hale e wehe ai ka hulu o ka manu 'o-o'. Piha ke po'i i ka hulu a haku lei. Malalo o ka po-ae-ae o ka o-o' oia ka hulu a-a', a maluna o ka piapia oia me pue.

Bird Snaring (or Trapping)

Bird catchers (kia manu) of 'Ōla'a were people who snared ('āhele) birds. Some with branches and others with lehua blossoms. The individual who snared birds among the lehua made a snare (lasso) close to the lehua flower, the snare was secured there.

One end of the line was securely fastened on the branch of the 'ōhi'a. The cord of perhaps five or six fathoms long, extended from the lasso (on the branch) to the man's hand where the end of the line was held tightly. The snare was placed close to a *lehua* blossom, where the bird would step (*kīko'o*) to the *lehua*. At that time, the man would then pull the end of the cordage and secure the feet of the bird. The man then climbed the tree, took the bird, and he would make the snare there again. The 'akakane ('apapane), the 'i'iwi, and the 'ō'ō were caught up in the *lehua*, snared with fine *olonā* cordage. The 'ō'ū bird was snared while it was on the ripe banana fruit.

Preparing Bird Lime to Kāwili, or Ensnare Birds.

The bird lime (*kēpau*) is made from the sap of the breadfruit. Cut the breadfruit bark and the white sap flows, and when the sap is dry, say in the evening, the sap is hardened. You go and gather the sap. When enough has been gathered, the sap can be made into bird lime. Then you go and gather some raw *kukui*, removing the shell, you keep its meat. You then go and get the "clover" for making bird lime ('ihi-ku-kapu, the *Nasturtium sarmentosum*), it is a black *pā'ihī*, and you mix it with the raw *kukui*. Then you chew it, and the *kukui* and *pā'ihī* become slimy. This is put into a *wauke* bark cloth (it is a tough piece), then the juice of the *kukui* and *pā'ihī* are squeezed into the 'ōpihi (shell), it is the "pot" for cooking the broth over the fire. When it starts to boil, the ('ulu) gum is cut into small pieces and put in the juice of the *kukui* and *pā'ihī* so it can boil. Then get two coconut mid-ribs or perhaps little sticks to stir this boiling juice. This is how it is done until the juice is cooked and becomes the birdlime. It is then placed into the empty 'ōpihi or a *ti* leaf, wrapped up in *ti* leaves. Kāwili is in the uplands adjoining Mokaulele. Then go to where there is low branching 'ōhi'a (*pulu 'ōhi'a*), where the *pāhoehoe* is below.

You are below on the *pāhoehoe*, and you apply the bird lime above around the *lehua* flowers. Now you *kāwili* (twist, i.e. apply) this bird lime in among three or four *lehua* flowers, then when a bird is stuck by one of the *lehua* that blossoms, you free it and it is caught. You then hide again among the low 'ōhi'a branches (a place where the 'ōhi'a tops droop down, that is the *pulu 'ōhi'a*), and catch another bird. You squeeze the birds head and it is killed. It is placed into a bag. Returning (home) perhaps around three 'o clock, there are many birds, perhaps forty, twenty, or thirty. Those small birds; when fat—the meat is tasty and sweet. That's how one prepares *kawili kēpau*, or bird lime to ensnare birds.

Snaring Birds on Branches.

The (decoy) branch is perhaps three or four fathoms long. *Lehua* blossoms are placed on this branch, from one side of the branch up to the tip of the branch. Two men do this job, one at one (end of the) branch and one at the other. Bird lime is placed on top of the branch along with many *lehua* blossoms in between this bird lime—this is a bird catchers (*kia manu*) branch [drawn] |_____|. 'Ōla'a and Pi'ihonua are lands of bird catchers. There are many 'ō'ō birds at Pu'u 'Ō'ō. It is there that the bird catchers go to get the feathers for adornments (*lei*) of the chiefs. Pana'ewa is also a place of the bird catchers.

The bird catchers (decoy) branch is pulled in between the 'ōhi'a *lehua* trees. One (person) uses the net. The net is pulled up, one branch is above, one branch is below. It is an open (wide) meshed *olonā* net ('upena *olonā* maka *hakahaka*), and *olonā* cordage at the tip. It is a soft (pliable) net perhaps five, four, or three fathoms long. As the birds fly their feet are caught, or their wings caught. Now if there are one or two birds, they are left, these are the birds that call out to the other birds. When there are many birds the net is let down (the birds taken), then the net is pulled up again. 'Ōhi'a growth is all around. So this is the work of the "bird-fishers," or *lawai'a manu*. They return to the house and then remove the feathers of the *manu* 'ō'ō. When the container

is filled with feathers, a *lei* is made. Below the wing-pit is where the male 'ō'ō bird feathers are, and above on the back by the tail, are the pale yellow feathers. [Nalimu in Kelsey; Bishop Museum , Archives–SC Kelsey; Box 1.5; Maly, translator]

One additional tradition collected by Kelsey in 1921, references named locations in the uplands of Waiākea. Kelsey's aged informant, Reverend Henry B. Nalimu, who was born in Hilo in 1835, shared with him his recollections of 'Ī-hālau (the long house of the chief 'Ī):

I, a relative of Rev. Nalimu's, constructed the ditch of I-auwai...

I-halau, the great long house of I, was *mauka* of Waiakea, near Pooholua and *mauka* of that place. Rev. Nalimu has only heard of the place. He thinks that it is in the forest. When the occupants of I-halau finished a meal they slammed the covers down onto their calabashes in unison so that the report could be heard at I-ko'a, the fishing-grounds of I where he fished for *ahi*. The location of this *ko'a* was obtained by bringing into line the coconuts of Papa'i and the Cape of Anapuka (ka lae o Anapuka) on the Puna side, and on the Hilo side, the coconuts of Kau Maui (near Keaukaha), and the cape of Kiha... [Kelsey notes, 1921; in collection of June Gutmanis]

THE MAUNA LOA MOUNTAIN LANDS OF THE 'ŌLA'A, WAIĀKEA AND KEAUHOU VICINITY DESCRIBED BY VISITORS OF THE HISTORICAL PERIOD (1794-1875)

Because the lands of the upper 'Ōla'a and Waiākea region were remote, it appears that access was most frequently made by specialists in the collection of bird feathers, the makers of canoes, and collectors of other unique items for which the region may have been known. Except for the detailed narratives of the tradition of Pikoi-a-ka-'alalā, most other traditions, and early historical accounts by native Hawaiians, seem to place the routes of travel beyond the limits of the lands within the Pu'u Maka'ala NAR. The main routes being out of Hilo through 'Ōla'a, *mauka*, near its boundary with Kea'au, or *mauka* between Kīlauea, across Keauhou (of Kapāpala in Ka'ū), within view of the boundary between 'Ōla'a (Pu'u Kūlani), and out across the Waiākea and Humu'ula lands of the Hilo District. Thus, there appears to be little specific reference in the historical record to the immediate study area lands.

From the journals, letters, and articles of historic visitors traveling the routes mentioned above, we are given a glimpse into the nature of the landscape, and a record of changes thereon, with the passing of time. As outlying lands were changed—resulting from the impacts of introduced grazing animals, and in some instances from lava flows of Mauna Loa—we develop a sense of why the Pu'u Maka'ala NAR is important to the future well-being of the Hawaiian natural environment. The NAR is a remnant of the unique cultural and natural landscape as described in the traditional accounts.

The narratives below, date from 1794 to 1875, and are the first-hand records of observations and travel across the mountain lands and in the forest adjoining the Pu'u Maka'ala NAR.

First Foreigner Ascends Mauna Loa in 1794

In 1793-1794, botanist, Archibald Menzies visited Hawai'i with Captain Vancouver, during which time Menzies and crew members walked inland with native guides to botanize and take readings of the topography. While ascending Mauna Loa, Menzies observed that the Hawaiians kept "*Mora*" (*heiau* – ceremonial sites) along the trails in the forests and up the mountain, at which they regularly stopped in prayer and to make offerings (Menzies 1920:85). The following excerpts from Menzies notes describe this practice:

Forest Shrines

"So bigoted are these people to their religion that here and there, on the sides of the path, they have little Morais, or spots consecrated to their Deity, which none of them ever pass without leaving something—let it be ever so trifling—to obtain his good will, and they were highly delighted, indeed, when we followed their example in throwing a nail or a few beads, or a piece of tapa, before their Deity, which the women were not allowed to pass without uncovering their breasts and shoulders." [Menzies 1920:85]

From Kapāpala, Menzies and party traveled *mauka* of Kīlauea, and from there, they cut across the mountain lands, to begin their ascent of Mauna Loa. Menzies narratives provide readers with the first written account of the forest lands and nature of Mauna Loa:

Kapapala.

Though we had much reason to be satisfied every step we went, with the kind attentions and unbounded hospitality of the natives, yet we could not help being now a little out of temper with them at the great distance they were taking us as it were round the foot of the mountain, till in the afternoon we reached a fine plantation called Kapapala, belonging to the king, from which they told us we were to ascend the mountain. As the chief had here to provide his last supplies of provisions for our journey up, we were obliged to stop for the night to allow him some time for that purpose...

...We were now within a few miles of the volcano, of which there seemed to be this day a considerable eruption, and as the wind blew from that direction, the smoke, dust and ashes arising from it proved very troublesome to our eyes in travelling with our faces towards it.

February 13th. Before we set out on the morning of the 13th, I observed the barometer at eight, when the mercury stood at 28 in. 20 pts., which made our height at this place 1800 feet above the level of the sea. The thermometer was at the same time 67 degs.

After breakfast, everything being got ready, and the party arranged, we continued our march through the plantation for two or three miles further, and then began our ascent up the south-east side of Mauna Loa in an easy slanting direction, passing through groves of trees and clear spots alternately by a narrow rugged path without meeting any more cultivated ground after we quitted the plantation of Kapapala, or any houses till towards sunset, when we came to two or three old huts where our guides told us we must encamp for the night. The chief no longer depended on his own knowledge of the path, but brought men with him from the last plantation to conduct the whole party up the mountain, which now lay between us and Kealakekua. We had the volcano to our right most part of this day and in the forenoon the smoke and ashes arising from it made [page 188] the air very thick, which at times proved very tormenting to our eyes.

At sunset the thermometer was at 54 degs., and the barometer stood at 26 in. 50 pts., which made our height from the sea 3,510 feet.

February 14th. At sunrise next morning the thermometer was so low as 41 degs... ..the air was at this time so chilly that the natives complained so much of the cold that we did not stir from the place of our encampment till after breakfast, when we again set forward up the mountain in a reversed oblique direction to what we came the day before, but in so winding and circuitous a manner and through such pathless and rugged tracts, avoiding the clumps of forest here and there, that, had we not good guides with us, we should have met with insurmountable difficulties.

We had sight now and then of the lower edge of the snow which did not appear to be far above us... Towards evening, we reached the upper verge of the forest nearly over Kapapala, where we encamped for the conveniency of having wood at hand to burn and erect our huts with... Near our encampment [page 190] I found a large beautiful species of *Vicia*¹²⁸ clambering up amongst the thickets in full bloom.

Reaches the Upper Edge of Forest.

Being now at the upper edge of the forest I observed the barometer at six in the evening, when it stood at 23 in. 73 pts., which is equal to 6,500 ft. in altitude. This may be considered the height at which the wood ceases to grow upon the sides of this immense mountain. The thermometer observed at the same time was at 41 degs., and as we had heated ourselves a good deal in this day's march up the mountain, we felt the air after sunset remarkably chilly and cold, which induced us to keep large fires burning near our huts the whole night. Notwithstanding this precaution, many of the natives were so restless with the cold and continued coughing that they enjoyed very little repose, and not indeed without cause, for when we got up next morning, the thermometer was at 28 degs, and the grass which grew about our huts was so stiff and whitened with hoar frost, and the earth that was in anywise moist or swampy was encrusted with icy concretions about our encampment. The frost must therefore have

¹²⁸ *Vicia Menziesii*, Sprengel, or *V. grandiflora* Smith. This species of legume has not been found by modern collectors.

been keen during the night time, and from this circumstance I think we may consider the upper edge of the wood as the lower line of congelation upon this mountain. Meeting with it so low down as we here did and that, too, on a tropical mountain so closely surrounded by the mild temperature of sea air, will no doubt stagger the belief of those who have been led to consider the lower line of congelation within the tropics; and having a much greater altitude even in continental regions which are always allowed to be colder than islands of moderate size. [page 191]

Natives Unwilling to Proceed.

February 15th. The natives, who were all barefooted, could not stir out of their huts in the morning until after breakfast, when the cheering influence of the sun dispersed the frost, but they greatly dreaded its consequences further up the mountain where they said that the cold was so intense that it would certainly kill us and them, too, and they described its effects by contracting and shivering themselves and cautioning us very strongly against going higher up or exposing ourselves or them to such danger. Even the old chief Luhea was so strongly prepossessed of this opinion that he now entreated us in the most earnest manner to relinquish the idea of going higher, for that he and several others were already nearly overcome with the fatigue of the journey and that the cold of the mountain would kill them... [Menzies, 1920:192]

On February 16th, 1794, Menzies and party arrived at the summit of Mauna Loa, the first foreigners to do so. It was not until January 1834, that another foreigner would again reach the summit of Mauna Loa.

Waiākea Described in 1823

Following the death of Kamehameha I in 1819, the Hawaiian religious and political systems began undergoing radical changes. Just moments after his death, Ka'ahumanu proclaimed herself "*Kuhina nui*" (Prime Minister), and approximately six months later the ancient *kapu* system was overthrown in chiefly centers. Less than a year after Kamehameha's death, Protestant missionaries arrived from America. In 1823, British missionary William Ellis and members of the American Board of Commissioners for Foreign Missions (ABCFM) toured the island of Hawai'i seeking out communities in which to further the work of the growing Calvinist mission.

During the visit, Ellis and his companions traveled around the island and upon portions of the mountain lands. While Ellis and his party did not travel the *mauka* route between Mauna Kea and Mauna Loa to Kīlauea, Ellis did write about the mountain lands as described by others he'd spoken with:

Few Inland Settlements

There are a few inland settlements on the east and north-west parts of the island, but, in general, the interior is an uninhabited wilderness.

The heart of Hawaii, forming a vast central valley between Mouna Roa, Mouna Kea, and Mouna Huararai, is almost unknown, no road leads across it from the east to the western shore, but it is reported, by the natives who have entered it, to be "bristled with forests of *ohia*," or to exhibit vast tracts of sterile and indurated lava.

The circumstance of large flocks of wild geese being frequently seen in the mountains, would lead to the supposition that there must be large ponds or lakes to which they resort; but if any exist, they have hitherto remained undiscovered... [Ellis, 1963:4]

Travel Across the 'Ōla'a-Humu'ula Uplands in 1830

In 1830, Reverend Hiram Bingham and family visited Waimea, and in September they were joined by members of the royal household for a visit to Mauna Kea. During the same visit, a trip was made to

Kīlauea, and Bingham's journal includes as description of the journey over land to the plateau lands between Mauna Loa and Mauna Kea, on their way back to Waimea.

...After spending about thirty hours at Pele's chief seat, we set off, towards evening, on the 21st, to cross the wilderness to Waimea, which required the time of a little more than two days and two nights. Walking till late, we laid ourselves down where we could find a place. The next day we continued our journey northwardly, towards Mauna Kea, lodging out in the wilderness, in the same manner, at night, the majestic mountain being half a day's walk to the north of us.

Rose at four o'clock from our mountain couch, — a day's journey from any human habitation; saw lightning at a great distance at sea — our elevation being 4000 or 5000 feet; packed our sleeping *kapa*; offered our morning sacrifice in these solitudes of the centre of Hawaii, and as the day dawned, set forward on our journey. We passed over several large tracts of lava, of different kinds, some smooth, vitreous, and shining, some twisted and coiled like huge ropes, and some consisting of sharp, irregular, loose, rugged volcanic masses, of every form and size, from an [page 393] ounce in weight, to several tons, thrown, I could not conceive how, into a chaos or field of the roughest surface, presenting a forbidding area, from one to forty square miles in extent, and though not precipitous, yet so horrid as to forbid a path, and defy the approach of horses and cattle. In the crevices of the more solid lava we found the *ohelo*, somewhat resembling the whortleberry, nourished by frequent showers and dew. At ten o'clock, we halted for breakfast; raised a smoke, as a signal for the horse keeper, at the watering-place, at the south base of Mauna Kea, to approach, and moved on, till twelve o'clock, when I was very glad to see and mount the horse sent over from Waimea to meet me... [Bingham, 1969:394]

The Mauna Loa Mountain Lands Described by David Douglas (1834)

Scottish Naturalist, David Douglas toured the interior lands on Hawai'i in 1834, and also traveled to the summits of Mauna Kea and Mauna Loa. After a visit and observations at Kīlauea, Douglas traveled to Kapāpala, and made preparations for the ascent of Mauna Loa. The route traveled took Douglas *mauka* of the lands that now make up the Pu'u Maka'ala NAR, and on to the summit of Mauna Loa. Excerpts from Douglas' narratives, published in the Hawaiian Spectator in 1839, provide readers with a description of the lands traveled through, the nature and make up of the forest; and the presence of native dwellings for bird catchers:

...Tuesday, January the 28th. I hired two guides the elder of whom, a short stout man, was particularly recommended to me by the chief for his knowledge of the mountain. By profession he is a bird-catcher, going in quest of that particular kind of bird which furnishes the feathers of which the ancient cloaks, used by the natives of these islands, are made. The other guide was a young man. Three volunteers offered to accompany me; one a very stout fat dame, apparently about thirty, another not much more than half that age, a really well looking girl, tall and athletic: but to the first, the bird-catcher gave such an awful account of the perils to be under-gone, that both the females finally declined the attempt, and only the third person, a young man went with me. My original party often, besides Honori and the two guides, set out at light, with as usual, a terrible array of taro, calabashes full of *poi*, sweet potatoes, dry *poi* tied up in Ti-leaves, and goats flesh, each bearing a pole on his shoulder with a bundle at either end... [page 418] ...Among my attendants was one singular looking personage, a stripling, who carried a small packet of instruments, and trotted away, arrayed in a Cutty-Sark of most "scanty longitude," the upper portion of which had once been of white, and the lower of red flannel. Honori brought up the rear with a small telescope slung over his shoulder, and an umbrella, which owing perhaps to his asthmatic complaint, he never fails to carry with him, both in fair and foul weather.

We returned for about a mile and a half along the road that led to the Great Volcano, and then struck off to the left in a small path that wound in a northerly direction up the green, grassy flank of Mauna Roa. I soon found that Honori's cough would not allow him to keep up with the rest of the party, so leaving one guide with him, and making the bird-catcher take the lead, I proceeded at a quick rate. This part of the island is very beautiful; the ground, though hilly, is covered with a tolerably thick soil, which supports a fine sward of Grass, Ferns, climbing plants, and, in some places, timber of considerable size. Koa, Tutui, and Mamane trees. Though fallen trees and brush-wood occasionally intercepted the path, still it was by no means so difficult as that by which I had ascended Mauna Kea. To avoid a woody point of steep ascent, we turned a little eastward, after having traveled about five miles and a half, and passed several deserted dwellings, apparently only intended as the temporary abodes of bird-catchers and sandal wood-cutters. Calabashes and Pumpkins, with Tobacco, were the only plants that I observed growing near them. At eleven, A.M., we came to a small pool of [page 419] fresh water, collected in the lava, the temperature of which was 55°; here my people halted for a few minutes to smoke. The barometer stood at 26 inch., the air 62°, and the dew point 58°. The wind was from the south, with a gentle fanning breeze and a clear sky. Hence the path turns north-west, for a mile and a half, becoming a little steeper, till it leads to a beautiful circular well, three feet deep, flowing in the lava, its banks fringed with strawberry vines, and shaded by an *Acacia*-tree grove. Here we again rested for half an hour. We might be said here to have ascended above the woody country; the ground became more steep and broken, with a thinner soil and trees of humbler growth, leading towards the south-east ridge of Mauna Roa, which, judging from a distance, appeared the part to which there is the easiest access. I would recommend to any Naturalists who may in future visit this mountain, to have their canteens filled at the well just mentioned, for my guide trusting to one which existed in a cave further up, and which he was unable to find, declined to provide himself with this indispensable article at the lower well, and we were consequently put to the greatest inconvenience.

Among the brushwood was a strong kind of Raspberry bush, destitute of leaves; the fruit, I am told, is white. At four P.M. we arrived at a place where the lava suddenly became very rugged, and the brush wood low, where we rested and chewed sugar-cane of which we carried a large supply, and where the guides were anxious to remain all night. As this was not very desirable, since we had no water, I proceeded for an hour longer, to what might be called the Line of Shrubs, and at two miles and a half further on encamped for the night. We collected some small stems of a heath-like plant, which with the dried stalks of the same species of *Compositae* which I observed on Mauna Kea, afforded a tolerably good fire. The man who carried the provisions did not make his appearance—indeed it is very difficult except by literally driving them before you, to make the natives keep up with an active traveler... [Douglas, 1839:420]

The United States Exploring Expedition, 1840-1841

In 1841, members of the United States Exploring Expedition, under the command of Charles Wilkes, accompanied by a party of native Hawaiians and foreign residents (numbering nearly three hundred individuals) traveled to the summit of Mauna Loa. The party departed from Waiākea, traveled *mauka* through 'Ōla'a, and on to Kīlauea. Observations and exploration were undertaken at Kīlauea, and then the party traveled through Keauhou, *mauka*, along the forest above the 'Ōla'a Forest Reserves and Pu'u Maka'ala NAR, and on to Mauna Loa. The following narratives are excerpted from Wilkes' account of departure from Kīlauea, and journey to the Mauna Loa summit:

At dawn on the morning of the 18th, the signal called us to make preparations for our journey, and as all things had now been more systematically arranged, we anticipated less difficulty in our onward journey. The natives seemed to be all in good spirits, and

moved with alacrity... The water that I have mentioned as being found in the small pools, the product of condensation, was exhausted before we left the crater. This was in consequence of the natives having filled their calabashes; and we had particularly instructed our servants and the sailors to do the same. The former provided themselves; but the latter, sailor-like, preferred to take their chance of meeting with it on the road, rather than carry a load for their future supply. I discovered, after we started, that they were unprovided, but was informed that there was, within about two miles, an old canoe which would be found full of [page 130] water. On our arrival at it, we found that the natives, who had preceded us, after supplying themselves had emptied out the rest.

Our route was taken at first and for a few miles in a due west line, for the top of Mauna Loa, over the extensive plain surrounding the volcano; it then deviated to the southward, over an ancient lava-bed, very much broken, that appeared never to have been traversed before. We now became for the first time acquainted with clinkers. To describe these, it is merely necessary to say, they are like the scoria from a foundry, only instead of being the size of the fist, they are from one to ten feet square, and armed on all sides with sharp points; they are for the most part loose, and what makes them still more dangerous, is that a great deal of the vitreous lava is among them. Of the origin of these immense masses and their extent, I shall have occasion to speak hereafter; suffice it for the present to say, there never was more difficult or unpleasant ground to travel over.

Our guide Puhano of Puna, who we understood had accompanied Douglass and Lowenstern on their ascents, now took the lead, but it soon appeared that he knew little of the route. I therefore, in company with Mr. Brinsmade, took the lead, compass in hand; and after walking over the broken and torn-up ground, we turned again towards the hill-side, and began a rapid ascent through a belt of long grass, where the rock was covered with white clay, and seldom to be seen. This part appeared to have suffered much from drought; for in passing along we came to several narrow and dry water-courses, but met with no water.

At two o'clock we had nearly reached the upper limit of the woods, and as the clouds began to pass over, and obscure the path, we determined to halt and encamp. We made several fires along the route, in order to guide those behind, and as a mark for the stragglers; bushes were also broken off, and their tops laid in the direction we were going, by the natives; and I likewise had the trees blazed, as a further indication, well known to our men. Chronometer sights were taken here, and the altitude by barometer was five thousand and eighty-six feet.

During the day, the reason that had induced the natives to empty the water out from the canoe, became evident in their anxiety to sell us water. My friend the consul had hired an especial bearer for his calabash of water, determining that he would have a sufficient supply. By our watching and cautioning the old man who had it in charge, he became somewhat alarmed and unsteady, as I thought also from fatigue. When he had arrived within a short distance of the camp, he stumbled on a smooth place, fell, and broke the calabash into numerous pieces. Those who were coming up, seeing the accident, rushed to partake of its contents, but the fluid quickly disappeared in [page 131] the loose and absorbent lava. This was a dreadful blow to my friend's feelings, and produced much laughter among us, in which the consul himself at length joined; although I must confess I was somewhat of his opinion, that it had been done designedly, either to secure the sale of that belonging to others, or to get rid of the load, which had been a great annoyance and trouble to the bearer all day, and for which he had already been paid...

We were now for a long time enveloped in mist, for we had reached the region of clouds. The thermometer at 6 P. M., stood at 54°; the dew-point at 44°. Instead of trade-winds from the northeast, we had a mountain breeze from the west, which caused the temperature to fall to 43°, and produced a feeling of great cold, being a fall of forty degrees since we left the coast... [page 132]

At sunrise on the 19th, we had the temperature at 48°.

As the ascent was now becoming laborious, we selected and left the things we had no immediate use for, to follow us by easy stages. We then took a diagonal direction through the remaining portion of the woods. By one o'clock we had lost all signs of trees, and were surrounded by low scraggy bushes: the change of vegetation became evident, not only in species, but in size; we also passed through extensive patches that had been destroyed by fire. Sandalwood was seen, not as a tree, but a low shrub.

During the day we had passed extensive caves, in all of which I had search made for water. These often lead a long distance under ground, and some of the men passed in at one end and out at another.

Intending to stop on Sunday not far above these caves, calabash-tops were left in one or two where water was found to be dropping, in hopes by this means to procure a small supply; but on returning the next day, it was found that very little had accumulated. These caves or tunnels had apparently been caused by a flow of lava down the side of the mountain, which on cooling had left the upper part arched or vaulted, the fluid running off at its lower extremity or opening and spreading itself over the surface. The opening into them was formed by the roof having fallen in, and partly blocked up the tunnel. At no great distance from the opening, the floor on each side was smooth and closely resembled the flow of the lava on the surface. These openings were usually known by the quantity of raspberry and other bushes around them; and they reminded me of the caverns in limestone districts... [Wilkes, 1970:133]

The landscape of the mountain lands was again described by Wilkes, when his party descended from Mauna Loa, returning to Kilauea:

.... After a rest of two hours, and obtaining new shoes, we went on and reached the Sunday Station at five o'clock, scarcely able to drag one foot after the other. Here we were soon enveloped in mist, and found the soft and delightful temperature of spring. I cannot venture to describe the effect this produced on us after our three weeks' sojourn on the cold, bleak, and barren summit. I felt for the first time in my life fairly broken down, and almost past the soothing effects of the *loomi-loomi*, which the natives at once offered as a relief to me: it may be called a lesser shampooing, and consists, as practiced in the Sandwich Islands, of a gentle kneading of the limbs, which has a great tendency to restore the circulation, and relax the muscles and joints. The natives use it for rheumatism, headache, and all kinds of pains. It requires some skill to do it well, and there is the greatest difference in the performance between persons who are practiced in it and those who are not. The chiefs generally have two persons employed at the same time. We soon had a good fire made before our Hawaiian hut; its warmth, together with an excellent supper, made us comfortable, and we were soon asleep on the dried grass.

The next morning, when I awoke, all nature seemed to be alive: the [page 166] songs of the birds, the cheerful voices of the natives, were delightful; the green foliage gave everything an air of spring. We were so stiff as scarcely to be able to move, which was all that now remained to remind us of the scenes we had left, and the fatigues we had undergone. When we again set off, it was amusing to see the whole party moving

along with their stiff and aching limbs, trying to appear but little fatigued. At twelve o'clock we reached the station where he had abandoned our chairs, and I never was more relieved than when I reached mine, for I was quite unable to walk any further. Here, also, we were met by the natives with fruit; indeed, every step we took seemed to be restoring us to the comforts of life. Late in the afternoon of the 14th we reached the crater of Kilauea, after an absence of twenty-eight days, eight of which had been consumed in travelling, six in going up and two in returning from the summit... [Wilkes, 1970:167]

Travel to Kilauea and the Mountain Lands (1875)

In 1875, Henry M. Whitney, editor of the Hawaiian Gazette, published a "Hawaiian Guide Book." The publication was produced as one of the early promotional guides to encourage visitation to the Hawaiian Islands, and included descriptions of the islands, harbors, agriculture, plantations, scenery, volcanoes, climate, population, commerce, and places to stay while visiting. His publication of 1875 provides readers with interesting commentary on travel via the old roadways from Hilo, via 'Ōla'a Village and the half-way house (presumably Hawelu's half-way house), to Kilauea.

To The Volcano Kilauea [1875]

Two routes may be taken to the crater Kilauea, on the slope of Mauna Loa, one by Puna, the other by Olaa. It will be advisable to combine both, by going one way and returning the other. Time being an object, the trip to and from the crater via Olaa can be accomplished in three days, which will give one day and two nights at the volcano house... [Whitney 1875:78]

...The short route to Kilauea Crater, leads out of Hilo [page 80] village by Volcano street, adorned with white cottages... The road soon becomes densely fenced with the *ohia* bushes, then crosses the end of the famous Waiakea fish ponds and only fairly starts in the wilderness after passing Gov. Lyman's cattle ranch in Waiakea. It is no macadamized thoroughfare and will try the patience of most travelers. Ten miles bring the traveler into the magnificent woods...

Fifteen miles from Hilo Olaa is reached, the half-way stopping place. The intermediate territory is covered with *ti* plants and ferns, while the road consists mostly of *pahoehoe* lava, covered with bunch grass and occasional bushes and trees.

"The Half-way House" at Olaa is merely a cluster of grass houses, a passable rest for visitors... Although this point is 1138 feet above the sea level, and ten miles from Keaau, (the nearest point on the sea shore) the roar of the sea may be distinctly heard during a heavy surf. Leaving Olaa, the route is over *pahoehoe* in all its varieties, thickly covered with wild grass, straggling ferns, creeping vines, and that vegetation which in tropical lands seeks only water to become impenetrable. Fires have swept over parts of the adjoining land and the blackened rocks with their scant supplies of soil, demonstrate how little alluvial earth nature requires to run wild, when it has plenty of light, warmth and moisture. [page 81]

Here the ascent hitherto very gradual becomes more rapid, reaches into a second rim of *Koa* woods, becomes more level and after a short gallop, the traveler finds himself, (eight hours from Hilo,) on the brink of the famous crater, and, four thousand feet above the level of the sea, dismounts from his tired animal and enters the Volcano House... [Whitney 1875:82]

Whitney's narratives continue, describing travel around and through Kilauea, and he then references the ascent of Mauna Loa. The route being across Keauhou, *mauka* of the lands that make up the 'Ōla'a Forest Reserve and Pu'u Maka'ala NAR. (Whitney 1875:93-95).

THE WAIĀKEA-‘ŌLA‘A FOREST LANDS DESCRIBED IN LAND TENURE DOCUMENTS, SURVEY RECORDS, AND GOVERNMENT COMMUNICATIONS

The most detailed historical descriptions of the Waiākea and ‘Ōla‘a forest lands, and of neighboring Keauhou, including documentation of traditional and customary rights, are those found in the Kingdom collections, documenting the history of land tenure, and defining the boundaries of *ahupua‘a* in the Hilo, Puna, and Ka‘ū Districts. This section of the study presents readers with the laws of the Hawaiian Kingdom, which established fee-simple land ownership and codified native tenant rights. Subsequent to the definition of land rights, the Kingdom set about the processes to determine the metes and bounds of the lands which had been granted in fee-simple interest to various parties. As a result, detailed oral testimonies from elder native tenants were taken in court proceedings, which further documented the occurrence of traditional and customary practices, and nature of the resources within given *ahupua‘a*. In those records, which follow below, we learn of the traditional knowledge and occurrence of native practices in the lands which today are a part of, and adjoin the Pu‘u Maka‘ala NAR.

The Māhele ‘Āina (Land Division) of 1848

In Hawai‘i prior to western contact, all land, ocean and natural resources were held in trust by the high chiefs (*ali‘i ‘ai ahupua‘a* or *ali‘i ‘ai moku*). The use of land, fisheries and other resources was given to the *hoa‘āina* (native tenants) at the prerogative of the *ali‘i* and their representatives or land agents (*konohiki*), who were generally lesser chiefs as well. By 1845, the Hawaiian system of land tenure was being radically altered, and the foundation for implementing the *Māhele ‘Āina* (a fee-simple right of ownership) was set in place by Kauikeaouli (Kamehameha III).

Following implementation of the *Māhele*, the King also initiated a land grant program, issuing fee-simple “Royal Patents” on granted land. In addition to the sale of fee-simple interests in land, the Crown and Government lands were also made available for leases and, in some cases, for sale. Together, these three land programs opened the door for the development of the large ranching interests in the lowlands below ‘Ōla‘a and Waiākea, and on the Keauhou-Kapāpala forest lands. Because of the remote nature of the lands and dense forests of the ‘Ōla‘a-Waiākea lands that make up the Pu‘u Maka‘ala NAR, no leases or conveyances were recorded for those lands. This said, it is likely that Hawaiian visitation collection of resources associated with traditional and customary practices continued in the Pu‘u Maka‘ala NAR lands for some time through the middle to late 1800s.

On December 10th, 1845, King Kamehameha III (Kauikeaouli), signed into law “Article IV. —of The Board Of Commissioners to Quiet Land Titles,” a joint resolution defining the responsibilities of the Board of Commissioners. Several actions were implemented by this law, among them:

SECTION I. His Majesty shall appoint through the minister of the interior, and upon consultation with the privy council, five commissioners, one of whom shall be the attorney general of this kingdom, to be a board for the investigation and final ascertainment or rejection of all claims of private individuals, whether natives or foreigners, to any landed property acquired anterior to the passage of this act; the awards of which board, unless appealed from as hereinafter allowed, shall be binding upon the minister of the interior and upon the applicant...

SECTION VII. The decisions of said board shall be in accordance with the principles established by the civil code of this kingdom in regard to prescription, occupancy, fixtures, native usages in regard to landed tenures, water privileges and rights of piscary, the rights of women, the rights of absentees, tenancy and subtenancy, — primogeniture and rights of adoption; which decisions being of a majority in number of said board, shall be only subject to appeal to the supreme court, and when such appeal shall not have been taken, they shall be final...

Section IX. The minister of the interior shall issue patents or leases to the claimants of lands pursuant to the terms in which the said board shall have confirmed their respective claims, upon being paid the fees of patenting or of leasing (as the case may be)... [In the Polynesian; January 3, 1846:140]

As the *Māhele* evolved, it defined the land interests of Kauikeaouli (King Kamehameha III), some 252 high-ranking *Ali'i* and *Konohiki*, and the Government. As a result of the *Māhele*, all land in the Kingdom of Hawai'i came to be placed in one of three categories: (1) Crown Lands (for the occupant of the throne); (2) Government Lands; and (3) *Konohiki* Lands. The "Enabling" or "*Kuleana* Act" of the *Māhele* (December 21, 1849) further defined the frame work by which *hoa'āina* (native tenants) could apply for, and be granted fee-simple interest in "*Kuleana*" lands (cf. Kamakau in *Ke Au Okoa* July 8 & 15, 1869; 1961:403-403). The *Kuleana* Act also reconfirmed the rights of *hoa'āina* to access on trails, subsistence and collection of resources necessary to their life upon the land in their given *ahupua'a*. The *Kuleana* Act, remains the foundation of law pertaining to native tenant rights. The Act was passed on August 6, 1850, and reads:

An Act confirming certain resolutions of the King and Privy Council passed on the 21st day of December 1849, granting to the common people allodial titles for their own lands and house lots, and certain other privileges... That the following sections which were passed by the King in Privy Council on the 21st day of December A.D. 1849 when the Legislature was not in session, be, and are hereby confirmed, and that certain other provisions be inserted, as follows:

Section 1. Resolved. That fee simple titles, free of commutation, be and are hereby granted to all native tenants, who occupy and improve any portion of any Government land, for the land they so occupy and improve, and whose claims to said lands shall be recognized as genuine by the Land Commission; Provided, however, that the Resolution shall not extend to Konohikis or other persons having the care of Government lands or to the house lots and other lands, in which the Government have an interest, in the Districts of Honolulu, Lahaina and Hilo.

Section 2. By and with the consent of the King and Chiefs in Privy Council assembled, it is hereby resolved, that fee simple titles free of commutation, be and are hereby granted to all native tenants who occupy and improve any lands other than those mentioned in the preceding Resolution, held by the King or any chief or Konohiki for the land they so occupy and improve. Provided however, this Resolution shall not extend to house lots or other lands situated in the Districts of Honolulu, Lahaina and Hilo.

Section 3. Resolved that the Board of Commissioners to quiet Land titles be, and is hereby empowered to award fee simple titles in accordance with the foregoing Resolutions; to define and separate the portions belonging to different individuals; and to provide for an equitable exchange of such different portions where it can be done, so that each man's land may be by itself.

Section 4. Resolved that a certain portion of the Government lands in each Island shall be set apart, and placed in the hands of special agents to be disposed of in lots of from one to fifty acres in fee simple to such natives as may not be otherwise furnished with sufficient lands at a minimum price of fifty cents per acre.

Section 5. In granting to the People, their House lots in fee simple, such as are separate and distinct from their cultivated lands, the amount of land in each of said House lots shall not exceed one quarter of an acre.

Section 6. In granting to the people their cultivated grounds, or *Kalo* lands, they shall only be entitled to what they have really cultivated, and which lie in the form of cultivated lands; and not such as the people may have cultivated in different spots, with the seeming intention of enlarging their lots; nor shall they be entitled to the waste lands.

Section 7. When the Landlords have taken allodial titles to their lands the people on each of their lands shall not be deprived of the right to take firewood, *aho* cord, thatch, or *ti* leaf from the land on which they live, for their own private use, should they need them, but they shall not have a right to take such articles to sell for profit. They shall also inform the Landlord or his agent, and proceed with his consent. The people shall also have a right to drinking water, and running water, and the right of way. The springs of water, and running water, and roads shall be free to all should they need them, on all lands granted in fee simple. Provided, that this shall not be applicable to wells and water courses which individuals have made for their own use.
Done and passed at the Council House, Honolulu this 6th day of August 1850. [copied from original hand written “Enabling Act”⁶ – HSA, DLNR 2-4]

The most important source of documentation that describes native Hawaiian residency and land use practices — identifying specific residents, types of land use, crops cultivated, and features on the landscape — is found in the records of the *Māhele ‘Āina*. While the “Land Division” gave the *hoa‘āina* an opportunity to acquire fee-simple property interest (*kuleana*) on land which they lived and actively cultivated, the process required them to provide personal testimonies regarding their residency and land use practices. As a result, records of the *Māhele ‘Āina* present readers with first-hand accounts from native tenants generally spanning the period from ca. 1819 to 1855. The lands awarded to the *hoa‘āina* became known as “*Kuleana* Lands” and all the claims and awards (the Land Commission Awards or L.C.A.) were given *Helu* (numbers). The L.C.A. numbers remain in use today, and identify the original owners of lands in Hawai‘i.

The work of the Land Commission was brought to a close on March 31, 1855. The program met with mixed results, and it has been calculated that the total amount of land awarded to *hoa‘āina* (native tenants – the common people of Hawai‘i) equaled approximately 28,658 acres, of a total four million available acres (see Governor’s report 1902:7).

Disposition of Primary Lands Making up and Adjoining The Pu‘u Maka‘ala Natural Area Reserve in the Māhele

The lands which make up the Pu‘u Maka‘ala NAR include *ahupua‘a* belonging to the Hilo and Puna Districts, and are also bounded by lands in the Ka‘ū District. In the *Māhele*, the following division of lands was agreed to by the King and participating *ali‘i* (all page references are to the “*Buke Mahele*” 1848):

<i>Keauhou, Ka‘ū</i>	<i>Keauhou, Ili i Kau, Kapapala</i> ; retained by V. Kamamalu (pp.5-6).
<i>‘Ōla‘a, Puna</i>	Olaa (Kalana); relinquished by Kaunuohua to King Kamehameha III (pp. 91-92). Retained as Crown Land by the King.
<i>Waiākea, Hilo</i>	Relinquished by Kaunuohua to King Kamehameha III (pp. 91-92). Retained as Crown Land by the King.

⁶ See also “*Kanawai Hoopai Karaima no ko Hawaii Pae Aina*” (Penal Code) 1850.

Within these lands, *hoa'āina* also made claims for small *kuleana*. Our review of all records of the *Māhele* revealed that the following number of claims were made in these lands⁷:

<i>Ahupuaa</i>	<i>Claims</i>	<i>Awarded</i>	<i>Not Awarded</i>
<i>Keauhou, Ka'ū</i>	0	0	0
<i>'Ōla'a, Puna</i>	1	0	1
<i>Waiākea, Hilo</i>	36	24	12

None of the claims by *hoa'āina* identified uses or parcels within the lands that are now a part of the Pu'u Maka'ala NAR, though it is understood (based on traditional and customary practices, and the laws cited above) that native tenants of the lands would have accessed the forest lands in order to collect resources or participate in other traditional practices.

An indicator of the cultural significance of the forest lands adjoining, if not also within the present day 'Ōla'a-Waiākea Forest Reserves and Pu'u Maka'ala Natural Area Reserve is found in the following letter of 1857, in which the important *koa* forests of the Kapāpala-Keauhou vicinity in Ka'ū are mentioned:

Waimea, Hawaii
26, March, 1857

Isaac Y. Davis; to Keoni Ana, Minister of the Interior
(Regarding status of the King's Lands at Apua, Kapapala and other locations):

...I have made a circuit of the Island of Hawaii, and I have returned.

I have seen all the places that I visited, and saw the lands of the King in Puna, Kau & Kona, some are good, and some are not good...

Kapapala, Ahupuaa in Kau, is a large land, but one side is stone, but, the side joining the mountain is good, plenty of earth, the land is rich and green as I observed. The canoe *koa* forest in Kau belongs to Kapapala, there is also a pond, but I did not visit it, and this land is similar to Waimea.

I called the people to come, and I told them my desire to lease said land hoping that I would be able to get between \$300.00 and \$500.00, and if five hundred, all the better, but the natives said only \$50.00 to \$60.00, and then up to a hundred, and not more, so I did not consent... [HSA Interior Department Lands]

The forest lands of 'Ōla'a are noted for their growth of *hāpu'u* (*Cibotium*) tree ferns. The collection of *pulu* was one of the activities undertaken in the 'Ōla'a section, as mentioned in the following letter from 1866. At the time, the applicant, T. Spencer, also applied for the right to run a few head of animals in the forest lands:

Honolulu, Oahu
23, April, 1866

Thomas Spencer. to J.O. Dominis:

...I would respectfully ask of you as a favor, to grant, or procure for me, a *Pulu* privilege on the land called ***Olaa***— I do not ask you for "The privilege," but a *Pulu* privilege, and to run what few animals I have connected with the business. I cannot afford to pay but a small sum, as the business will not warrant it—I am barely making both ends meet, I assure you, out of it. I called this morning on Mr. Rufus Lyman for information, in regard

⁷ The on-going research of Kumu Pono Associates LLC in the nearly 60,000 records of the *Māhele 'Āina*, may lead to modifications in these numbers at a later date.

to this business who referred me to you, and has kindly promised me to write you for instructions. Be so good as to grant me this favor... [HSA Interior Department Lands]

Later in 1866, we find that native applicants were seeking “*pulu* privileges” in ‘Ōla’a as well, and that they had knowledge of the native birds and other resources in the uplands:

Hilo, Sept. 18th, 1866

R.A. Lyman; to J.O. Dominis:

...Kaaikai & Kaaia are the ones who wish to lease **Olaa** for five years from the first of next January. Provided that they are allowed to have the *pulu*, and only the *pulu*. Birds, & *awa*, to be reserved. They would like to have two or three weeks more to consider about it, and wish to know whether you will allow them to pay on the 1st of July of each year, or whether they will have to pay the first of every year. Please let me know about this, and I will let you know as soon as I can if they will take it... [HSA Interior Department Lands]

***Proceedings of the Boundary Commission:
Documenting Traditional and Customary Practices,
and Land Boundaries (1873-1875)***

In 1862, a Commission of Boundaries (the Boundary Commission) was established in the Kingdom of Hawai‘i to legally set the boundaries of *ahupua‘a* that had been awarded to *Ali‘i*, *Konohiki*, and foreigners during the *Māhele*. In 1874, the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them (W.D. Alexander in Thrum 1891:117-118). The primary informants for the boundary descriptions were old native residents of the areas being discussed (generally born between the 1780s to 1820s). The native witnesses usually spoke in Hawaiian, and their testimony was translated into English and transcribed as the proceedings occurred.

Readers will note that there are significant inconsistencies in spelling of various words, including place names, people names, and features on the landscape. This is problematic, but with the help of maps produced as a part of the surveys to establish boundaries, and other period maps (e.g. Register Map No.’s 42 & 524; and Land Court Application Map No. 1053), many of the locations described can be identified. We have also observed that in some testimonies, when the original translator-transcriber used two of the same vowels, it indicated that he/she heard a lengthened pronunciation of a particular vowel. This emphasis of pronunciation is now indicated by a macron mark—for example, the word “*neenee*” (for *nēnē*), the native goose formerly hunted on the mountain lands above the Pu‘u Maka‘ala NAR. While in the modern context of the language, two of the same vowels are generally both pronounced, and broken by an ‘*okina* or glottal mark.

The narratives cited below, are verbatim transcripts from the testimonies given by native residents or land owners, and those given by surveyors who recorded the boundaries based on the testimony of native guides. The testimonies include descriptions of the lands of ‘Ōla’a and Kea‘au (Puna); Waiākea (Hilo) by association with the adjoining lands of ‘Ōla’a, Kukuau, Kaūmana and Humu‘ula; and Keauhou (Ka‘ū).

While the excerpts from the testimonies, extend beyond the specific limits of the Pu‘u Maka‘ala NAR, they are important as they demonstrate thorough knowledge of the landscape, and demonstrate continuity in the types of traditional and customary practices described at various elevational zones. Thus, while something may not have been recorded for ‘Ōla’a or Waiākea, the description of practices in a neighboring land, suggests that such knowledge existed within lands that make up the study area. The witnesses generally described the boundaries as they rose from the ocean or lowlands, running through the forest lands, to a point where they reached the slopes of Mauna Loa. ‘Ōla’a and Waiākea are both cut off by larger lands of the Hilo and Ka‘ū Districts. The primary upland boundary points given are Pōhakuloa, Kūlani, Kīpū, and Māwae.

Also, while situated in the *ahupua'a* of Waiākea and 'Ōla'a, access to the forest resources of what is now the Pu'u Maka'ala NAR and adjoining areas, would have sometimes been gained from neighboring lands such as Kea'au, Kukuau, Humu'ula, Keauhou and Kapāpala. The selected native testimonies describe a wide range of traditional practices in the uplands of Waiākea, 'Ōla'a, and in adjoining lands. The types of usage includes: travel on native trails, land use in a wide range of elevational zones; collection of resources; the collection of, or "hunting" of birds; canoe making; and the subsequent practices associated with hunting introduced ungulates—all under the control of *Konohiki*⁸. The testimonies also record that changes had occurred on the landscape during the life-time of the witnesses. It is of importance to note that the boundaries were known by the native tenants, and the rights to take or hunt resources in traditional times were fiercely protected—individuals without chiefly, genealogical claims, or residency ties to given lands were not allowed to trespass and take resources from the *ahupua'a*.

Underlining, square bracketing, bold and italic print are used by the compilers here, to highlight place names and particular points of historical interest recorded in the testimonies. The proceedings for the cited lands are given in alphabetical order, and date of recordation.

In the days leading up to the recordation of testimonies regarding the boundaries of Waiākea and Humu'ula, Hilo; and Keauhou, Ka'ū, we find that a difference of opinion had arisen among the witnesses. The commission proceedings standardized the boundaries of these lands, sometimes without following the former traditional boundaries:

Hilo May 1st 1873

R.A. Lyman; to J.O. Dominis, Agt. of Crown Lands

(Regarding hearings for Crown Lands before Boundary Commission):

I have set the 2d of next June for the hearing of testimony for the settlement of the boundaries of Punahoa, Makahanaloa & Pepekeo in Hilo, Keaau & Keahialaka in Puna, Honuapo & Pakaniiki in Kau. I will have the hearing at Hilo. The Crown Com. are interested in the lands of Piihonua & ***Humuula*** joining Makahanaloa & Pepekeo, Ponahawai joining Punahoa 1st; ***Waiakea & Olaa*** joining Keaau in Puna.

Please to authorize some one to appear at the hearing and look after your interests...
[HSA – ID Lands]

Hilo, June 9, 1873

R.A. Lyman, to J.O. Dominis, Agent of Crown Lands

(Regarding Boundaries of Humu'ula and Neighboring, and Disposition of Pi'ihonua):

...Enclosed, please find a list of lands as near as I can make it out at present. I have written to Mr. Wiltse and Hoapili asking them to send you correct lists of lands in their districts and to forward me copies as soon as possible. Please to send me surveys of as many of the lands as you can. If the surveys made by my brothers have been lost, I think that any brother could make out new copies of most of them. The survey of ***Humuula*** made by Wiltse cuts way into Waiakea as surveyed by Webster and cuts off several miles of Kapapala and Keauhou.

Kahue, Wiltse's *Kamaaina* swears that they did not go to a single point on the boundary of Humuula along in the woods and did not put any flags there but that he pointed out some above the woods where he guessed the points were and they sighted to them.

⁸ In regards to hunting, it will be noted that descriptions of traditional hunting practices are limited to native species of birds, including the *ua'u*, *nēnē*, *mamo* and *'ō'ō*; while description of historical hunting practices are limited to goats, which were hunted under contract of *Konohiki*, the Crown, or the Government.

The Piihonua people are very much put out about the survey of **Humuula** as they supposed they had leased Piihonua by the ancient boundaries and the survey of Humuula cuts off a strip several miles wide clear across the head of the land and leaves no wild cattle to speak of for Piihonua. They say they cannot afford to pay \$100 a year for the woods of Piihonua now. [HSA, Crown Lands File]

The Ahupuaa of Humuula

District of Hilo, Island of Hawaii

Boundary Commission, Hawaii, Volume A No. 1:238-240

Honolulu, July 7, 1873

R.A. Lyman, Esq.
Hilo

Dear Sir

Mr. F.H. Harris is authorized by the Commissioners of Crown lands to make application to you as Commissioner of Boundaries to have the boundaries of all Crown lands on the Island of Hawaii defined. He has a list of the lands with him.

I have also authorized Mr. F.H. Harris to make application to you for the settlement of boundaries of all lands belonging to Est. of His late Majesty and Her Excellency, R. Keelikolani.

I expect to be in Kona by the trip of the "*Kilauea*" which leaves here on the 28th inst. Can't you make it convenient to come round as the steamer goes to Hilo on that trip.

I wish also to apply for the settlement of the boundaries of Honohina.

I remain,
Yours Respy.
Jno. O. Dominis

Honorable R.A. Lyman
Boundary Commissioner
for Island of Hawaii, Haw. Is.

The undersigned would herewith make application for the settlement of the boundaries of the following named Ahupuaas or Lands belonging to the Crown, viz.:

Waiakea in the District of Hilo bounded by ***Keaau, OIaa, Kapapala, Humuula, Piihonua.***
Piihonua in the District of ***Hilo***, bounded by Punahoa, ***Waiakea, Humuula*** and Puueo, Paukaa & Alae and other lands

names not known... [page 238]
Humuula in the District of Hilo bounded by
Kapapala, various lands in Kona and Kohala
and Hamakua, and Hakalau, Makahanaloa,
Papaikou, Paukaa, Piihonua and Waiakea
in the District of Hilo... [page 239]
...**Olaa** in the District of Puna, bounded by
Keaau, Wm. C. Lunailo, H. M. **Waiakea**
& **Kapapala**...

Your Honor will therefore please appoint
a day for hearing the evidence
in the foregoing named lands and having
decided upon the same to grant a certificate
to that effect to the undersigned.

Hilo Hawaii, August 16th A.D. 1873

(Signed) Jno. O. Dominis
Crown Land Agent.
by F.H. Harris
atty. at law. [page 240]

Ahupuaa of Humuula
Boundary Commission, Hawaii Volume B:28-59

The *Ahupuaa* of **Humuula**, District of **Hilo**,
Island of Hawaii, 3d J.C.

On this, the 3d day of November A.D. 1873 by adjourn-
ment from the 30th October, the Commission of
Boundaries for the Island of Hawaii, 3d J.C.
met at the Court House in **Hilo**, on the appli-
cation of J.O. Dominis, Agent of Crown Lands
for the settlement of the boundaries of **Humuula**,
situated in the District of **Hilo**, Island of Haw-
aai. Notice personally served on owners or Agents
of adjoining lands, as far as known. Also served
by publication in the Hawaiian Gazette of
_____ and *Kuokoa* of _____.

Present, E.G. Hitchcock for applicant, for
Mrs. L.K. Dominis, Her Ex. R. Keelikolani, the
Estate of Kamehameha V, C.R. Bishop and self,
D. Kamai for Hawaiian Government Lands
in **Hilo**, and D. Alapai.

For Petition see Folio 238, Book A.

Testimony.

J.A. Simmons^K, Sworn:
I have lived on Hawaii for forty two years
and in Hilo, District about half of that time. I
shot wild cattle on Humuula for eight years.

This was soon after I came into the Country, but I have been there since. I used to live with Ned Gurney at Lahohino [Lahohinu], a place above the woods on Humuula...

Makaulaula^{K.} and Opukeike^{K.}, old bird catchers of Piihonua, also pointed out the boundaries to me, when I lived at Pahukea, saw mills on Piihonua... [page 28]

...A great deal of the forest has been killed out by the cattle barking the trees and destroying the underbrush. Therefore the woods do not extend so far mauka as they did twenty years ago.

Know the place called Puuoo, a big hill on the plains of Humuula is now called by that name, but the original Puuoo is a hill covered with *ohia*, and was told it was on the land of **Waiakea**. It is *makai* of the hill on **Humuula**, and I am certain it is not on that land...

Nainoa^{K.} Sworn.
I am a *kamaaina* of Hamakua, at the time of Aipala [famine of ca. 1811], know a part of the boundaries of **Humuula**, as they were pointed out to me by people who are now dead. Li. Kauwila (his father) and Pali, who were *kamaainas* of **Humuula** showed me the boundaries, and told me not to go to certain places... [page 30]

...I went with the *kamaaina*. They told me that **Humuula** was bounded by **Kapapala** of Kau, **Keauhou** of Kona, and **Kaohe** of Hamakua. I have never heard that **Kaalaala** of Kau or **Waiakea** of **Hilo** joined **Humuula**. The old trail from **Humuula** towards **Piihonua** used to run along the *mauka* edge of the woods, near the boundary, not in the woods.

The **Humuula** and **Piihonua** people used to go after water at Kelewa [Kaelewa]... [page 31]

...When I went after birds on **Humuula** Li told me not to catch the birds in *koa* and *mamani*, as they belong to the *makai* lands, and would be taken away by the people of those lands if I caught them... [page 32]

Kahue^K. Sworn:

I was born at **Humuula**, am seventy three years of age, and a *kamaaina* of the land and know its boundaries. Kalaimaka, Mohaiku, Eekamoku (all dead) were *kamaaina* of **Humuula** and pointed out the boundaries to me... [page 33]

...**Kahiliku**, a *lae laau* [a section of forest that extends out from the surrounding forest on to an open area], outside of the woods. Thence to **Mawae**, a crack in the woods that runs from *makai*. I have heard that **Waiakea** joins **Humuula** here, but I do not know which side of the lava flow of 1854 or 1855, the lands join. Thence the boundary of **Humuula** runs to **Kawauwauwai** a *kauhale*; the boundary running to this point in scattering bush. The forest ends at **Elekalua**...[page 34]

...**Kapapala** is said to cut **Humuula** off to **Pohakuhanalei**. Boundary runs near **Puuonioni** on **Humuula**; the boundary is a little beyond. **Wekahuna** [Uwēkahuna] is a hill on **Humuula**. **Waiakea** ends at **Pohakuloa**, and from there **Humuula** is bounded by **Kapapala** to **Pohakuhanalei** (I do not know whether **Kapapala** extends to **Pohakuhanalei**). From **Pohakuhanalei** to Koahe it is bounded by **Kaalaala** of Kau... [page 35]

Witness rested until 10 o'clock tomorrow morning
Nov. 4th 1873.
R.A. Lyman
Com. Boundaries 3d J.C.

Hilo Nov. 4th 1873. Court opened according to adjournment...

[Witness Kahue, continued]:

I went with Wiltse one time when he surveyed the land of **Humuula** [Register Map 668]... [page 36]

I do not know the places called Punaluu (on **Mauna Loa**), **Kaamaumauloa**, **Puuulaula** and **Puu-kulua**, **Puuonioni** and **Wekahuna**. I have not seen, but have heard that they are on the boundaries. **Humuula** does not reach to **Kulani**. **Puuiki** is by the boundary of **Humuula** and **Waiakea**... [page 37]

Waiki^K. Sworn:

I live at **Humuula**, was born there after the battle of Kekuakalani [1819], and know the boundaries of the land. My parents told them to me. Eekamoku was my father and Koapunini my grandfather, they were bird catchers

and canoe makers. Kalaimaka, father of my wife pointed out the boundaries and told them to me... [page 38]

...**Kahiliku kauhale manu** [a bird catcher's house at Kahiliku]; thence to **Kaelewa**, where there is now water. Thence to **Kawauwai** by the edge of the forest. Thence to **Kaieie**; Waiakea and Piihonua join Humu-
ula between these two places. Thence along the edge of the forest to **Kalapaohelo**. I have been there with my parents, an old lava ground. Thence to **Pohakuloa**, a large rock where Kaehu Paki laid down on the side of the mountain towards Kau of Kalapaohelo. There I [page 40] staid with my *kupuna* and they said the boundary runs from here up the mountain to **Pohakuhalei**, a rock on the slope of the mountain towards **Kaleieha**. **Waiakea** bounded it to **Pohakuloa**, but they did not tell me what lands bounded **Humuula** from there to **Pohakuhalei**... [page 41]

Kaaua^K. Sworn.

I was born at **Waiakea Hilo**, at the time of **Akakai Mokuokai** [*Hakaka i Mokuohai*, the Battle of Mokuohai in 1782]. I have always lived there, and know where **Waiakea** joins **Humuula**. I was told by **Olaa kamaaina**, Opuloo and others (whose names I have forgotten) at the time Webster surveyed **Waiakea**. I have always heard that **Waiakea** joins **Humuula** from **Puuhuluhulu** to **Mawai** [Mawae]. Webster set flags on **Puuhuluhulu** when he surveyed **Waiakea**... [page 55]

The Ahupuaa of Kaumana
District of Hilo, Island of Hawaii, 3^d J.C.
Boundary Commission, Hawaii Volume B:1-2

On this 29th day September A.D. 1873...

Kekai^K. Sworn:

Kaiahua, a bird catcher (now dead) showed me the boundaries of Kaumana, **Waiakea** and Piihonua, in the woods. **Kapulu** is at the *mauka* corner of **Kukuau**, and at the junction of **Waiakea** and **Kaumana**. Thence the boundary between **Waiakea** and **Kaumana** runs *mauka* to **Kalapa-lapanui**, an *oioina* [trailside resting place] and place where we used to catch birds; a high ridge on the Hilo side of the lava flow of 1852. There used to be an old road for bird catchers to **Hoaa**, a place on **Waiakea**, where we

used to catch *mamo*. **Kaumana** is on the Hilo side of this ridge; thence *mauka* to **Kapualei**, now covered by the lava flow of 1855. Thence to **Kalaeokoieie**, *lae koa* [a section of *koa* forest extending onto a lava flow] mostly destroyed by the lava flow. **Kaumana** ends at the *mawae* [fracture], *makai* of this place, and *mauka* of the tall woods, at the junction of **Piihonua** and **Waiakea**. Thence the boundary of **Kaumana** runs *makai* [page 1] along **Piihonua** to **Kapili**, an old *kauhale* [house site], now covered by the lava flow; thence *makai* to **Kilohana**, now covered by lava; thence to **Kawauwauwai**; thence *makai* to **Nahaleoelele**, the *mauka* corner of **Ponohawai**.

C.X.'d... [page 2]

The Ahupuaa of Keaau

**District of Puna, Island of Hawaii, 3^d J.C.
Boundary Commission Testimony – Volume A. No. 1:191-198
June 4, 1873**

Uma^K. Sworn: I was born at Keauhou at Keaau Puna, at the time of the return of Kamehameha 1st from Kaunakakai, Molokai [ca. 1791], I have always lived there and know the boundaries between Keaau and Waikahekahe. My parents pointed them out to me when we went after birds and sandal wood... [page 191]

...Alaalakeiki, which is the end of Waikahekahe Iki and Kahaualea joins Keaau. This place is at an old *kauhale manu* [bird catchers compound] (opposite a rise of ground, above the seventeen mile post, on the Volcano Road, about two miles above Kanekoa), thence *mauka* to Palauhulu, an *ahua* [rise] on the road to Kilauea, at the place where the road to Panau branches off. The boundary between Keaau and Kahaualea is on the South east side of Palauhulu about as far away from Hilo Court House to seashore. Thence the boundary runs *mauka* to Omaolaulau (*he oioina* [a resting place] on *pahoehoe*) near the woods at Reeds bullock pen... thence *mauka* to Keekee, *Kauhale kahi olona* [house for stripping *olonā* bark for cordage] in Olaa. The boundary is a short distance from the Government road on the South East side. Thence to Kauwaanahunalii (*he oioina*) this place is on Keaau and the boundary runs to the South East side of it. This is at the high ground where you can look down in the woods where the bullock pen is, thence to Kawaiaee

a large water pond (South East side of the road). The boundary of Keaau and Kahaualea is close to the pond, on the south east side, thence *mauka* to Kalaninauli, the land on the south east side being only about six chains wide thence to Puenaena (large *ohia* trees on the road *makai* of the *koa* woods) a short distance South East of the Government road. Thence the boundary runs *mauka* to a place called **Pohakuloa**, a small cave south east of the Government road, and a very short distance above the *koa* woods, on the Government road to Kilauea. Thence Keaau is cut off by **Keauhou**. **Olaa** bounds Keaau on the north west side. Keauhou cuts Keaau off to Government road to Kilauea, then runs *makai* along the old [page 192] Government road, through the *koa* woods. **Olaa** being on the North side of the road and Keaau on the South east side. Thence down the road passing these points **Palauhulu** and to **Kapueuhi**, thence *makai* to Kahooku thence to Kanekoa, the houses on the South East side of the road are on Keaau, those on the other side are on **Olaa**, thence to Kamahiki (14 mile post). Thence to Kalehinapuoa (where there is a *mauka* road which goes to Hawelu's) thence to Kaahakanaka, on the outer road passed Hawelu's thence to Kaluakaiole (Kaakeakaiole) *mauka* of where Haanio road to Kuku leaves the present traveled road, thence to Mahinaakaaka on the outer road, out side of Kahuku, thence down to where Kahopuaku's houses used to be (Makaulele) along the old road, this is as far as I know the boundaries between **Olaa** and Keaau. Kahopuaku's houses were on **Olaa**... [page 193]

Kanoi^K. Sworn: I was born at Kapapala in Kau, at the time of the building of Kiholo [ca. 1811] lived there until a few years since; know the land of Keaau and the boundaries on the mountain adjoining Kahaualea. The upper end of Keaau is bounded on the South East-side by Kahaualea, and on the *mauka* side by **Keauhou** and on the Northwest side by **Olaa**; Kaheana, Kaihe Kaheana², and Makanui my *Kupuna* showed me some of the boundaries of these lands. Kaheana was from Panau, Puna, and Kaihe was from Kau. These two men, with others from Kapapala showed me boundaries between Keauhou and Kahaualea where we went after the *oo* on **Keauhou**. Went after sandalwood on Kahaualea. **Keauhou** cuts Keaau off at

Pohakuloa, the *huina alanui* [road intersection], where the marks or sign board is at the junctions of the Hilo and Puna [196] roads this side of the Kilauea House, the name of this place is Halemaumau. The boundary of Keaau runs *makai* along the Puna road to Kaluaiki, a small crater, at a place where the road runs between two craters. Onto the *mauka* side of crater Kaluaiki, said crater is on Kahaualea and Keaau is on the South side of the road. Keaau and Kahaualea lay side and side, from Kaluaiki to Nawailoloa, a place on the road from Palauhulu to Panau. Kaluaiki is about as far Pohakuloa as from Hilo Court House to Kaina's house at Alenaio. Nawailoloa and Kilohana, two ponds of water, on the road to Panau from Palauhulu, from Nawailoloa the boundary between these two lands runs *mauka* to a grove of *Ohia* trees called Namauu-kalahili, thence *mauka* to Puukea a hill in the woods where we used to go after sandal wood, thence *mauka* to Namamokalei where we used to catch *uwao* ['ua'u]. This place is opposite to Kauanahunahu, *mauka* of Keekee about a mile. Thence to Kaluaiki. I have often been to these points from **Waiuli** to **Pohakuloa**. I have always heard that the old Government road to Kilauea is the boundary between Keaau and Olaa, I do not know the *makai* boundaries...

Nailima^K Sworn: (same witness as for Olaa) I was born at Olaa, and know the boundaries between Olaa and Keaau. My *kupuna*, now dead, showed them to me. Keaau ends at Halemaomao at the junction of the Hilo and Puna road. Olaa on the Hilo side of the road and Keaau on the Puna side. Thence *makai* to Pohakuloa, thence *makai* to Puenaena (big *ohia* trees) thence to Kalaninauli, so called by Nahienaena. Thence to Waiaiai, thence to Kauailehulehu, thence to Keanapapa at the 24 mile post thence to Kauwanahunalii, thence to Keekee, thence to Omaolaulau (at *ohia* woods, and the bullock pen) thence to **Pohakuloa**, thence to Palauhulu, thence to Kawaikahooia. Thence to Kawaa, thence to Kaialuawai, thence to Kaluamanuahi, to Kaleinakeakua, which is at the 18 mile post, thence to Pahookui, thence to Pohakuloihi, to Punahaha, 17 mile post, thence to Kapuamau page 196]. Thence to Kawaiaiai, thence to

Kapae, 16 mile post, thence to Kanekoa, thence to Mokuhaaheo, thence to Mahiki, to Kahau, to Puualae, to Kaleiki, to Kanukea, thence to Umihali at the fifteen mile post, thence the boundary runs to Kalehuapua, *mauka* of the road to Hawelu's house (thence to Kaahakanaka, outer road to Hawelu's house). Thence follow the outer road to Popoiwi, where Haanio's road branched off to go to Kukulu. Thence follow the outer road to Mahinaakaaka, opposite Kahuku, thence to Kapuhu, and *ohia* grove, where the road turns towards Hilo on the *makai* side, thence to Ahuapuu, a *puuhala* tree by the road, thence to Makaulele, a little *makai* of this place, Keaau road joins at this point the boundary leaves the Hilo road, and turns *mauka* along **Olaa**, to Kilohana, an *ahua* or mound with orange trees. Thence the boundary runs up *mauka* along *awaawa* on Kau side of Kilohana, up a hill covered with *puu hala*, thence to *pali* Puuaehu, the boundary on the brow of *pali*, this side of Keaani, which is the name of an *ohia* grove on the side of the *pali*, some distance *mauka* of Haanio's road, thence to Kaanamanu a place inside the woods. I have never been there and only heard of this place. Thence to Kaaipuaa, an old village, where people used to live. Thence to Waiaeli [also written Waiaele in text], a pond of water with *aweoweo* growing in it. Said pond is on the old road from Olaa to Pooholua. Have heard **Waiakea** joins **Olaa** and Keaau at Waiaele, Mawae is near there and have always heard that it is the boundary between Keaau and Waiakea. From the Government road to Olaa, seashore Kawiakawaa is at sea shore... [page 197]

The Ili of Keauhou, Ahupuaa of Kapapala
District of Kau, Island of Hawaii
Boundary Commission, Hawaii, Volume A, No. 1:245-246

Honorable R.A. Lyman
Boundary Commissioner
for Island of Hawaii

The undersigned would herewith make application for the settlement of the Boundaries of the following named Ahupuaas or lands belonging to the Estate of the Kekuanaoa & V. Kamamalu, viz...;

...Keauhou Ili of **Kapapala**, District of Kau Hawaii adjoining lands **Kapapala**, Apua... [page 245]

...Your Honor therefore will please appoint a day for the hearing of said application, and grant a certificate in accordance therewith,

(sig) J.O. Dominis, admts.
J.F.H. Harris, Atty at Law
Hilo August 16th A.D. 1873 [page 246]

***Keauhou, Ili of Kapapala Ahupuaa
District of Kau, Island of Hawaii
Boundary Commission, Hawaii, Volume A No. 1:444-446***

The *Ahupuaa* of **Keauhou**, District of Kau, Island of Hawaii, 3d J.C.

On this, the 24th day of October A.D. 1873 the Commission of Boundaries for the island of Hawaii, 3rd J.C. met at the Volcano House, Kilauea, Kau on the application of J.O. Dominis, acting for Administrator of the Estate of M. Kekuanaoa, for the hearing of the testimony in regard to the settlement of the boundaries of Keauhou, situated in the District of Kau, Island of Hawaii.

Notice personally served on J.G. Hoapili and L. Kaina; Agents for the owners of adjoining lands. Present: W.K. Moi in place of J.G. Hoapili, for applicant and for Agent of Crown lands and Kau Lands. J.N. Gilman for L. Kaina for Agent of Crown lands in Puna.

For Petition see Folio 246

Testimony

Kenoi^K. Sworn
I was born at **Kapapala**, Kau at the time of Kiholo mua [ca. 1811], and lived on said land or adjoining lands until about Eleven years since. Am a *kamaaina* of **Keauhou** and know its boundaries. My Father, Kaheana (now dead) told them to me when we used to go after uwau and geese.

Kapapala bounds Keauhou on the South side; Commencing at the seashore at a *heiau* called Makoloa, thence the boundary between these two lands runs *mauka* to Lapo (Kuhalu is a small *pali* on **Kapapala** near the boundary). Lapo is the lower *pali* of the two; thence to Haleolono, a hill above the *pali*; thence to **Pohakuloa**, to an *ohia* tree on the *pahoehoe*;

thence to **Kulanaokuaike**, a *pali kahua-manu* [bird catcher's flat], where Kaina's man jumped off; thence to **Aiaawa**, *ohia* trees and *awaawa*; thence to **Kaaiwaa** or **Ahuahoiwale**, a *puu* and *ahu*; thence to **Kamokukolau**, an *ohia* grove [page 444]; thence the boundary runs to the South side of the crater, **Keanakakoi**; thence to **Wekahuna** [Uwekahuna], crossing the crater of **Kilauea** a little to the South west of the highest part of the bluff (highest bank of the crater). Thence to **Kilomoku**, a small grove of *koa* and *ohia*, the large grove to the South west being on **Kapapala**, thence to **Ohinale**, a long grove of trees in *aa*; thence to **Keakanaloo**, passing up the center of the *aa* flow; thence along the Hilo side of the *aa* to **Puukulua**, two small hills, the boundary passing between the two; a little toward Hilo of **Puuulaula**. (As I came along over the road today, and was looking at the mountain, I saw I had made a mistake in saying **Puuulaula** was the boundary.) From **Puukulua** (I do not know what land cuts if off, Waiakea perhaps) the boundary runs towards Hilo to **Kaa-mamauloo**, an *aa* flow on the Hilo side of the mountain. Cannot say where it is exactly as it is a long time since I have been there.

There the boundary turns *makai* towards Kilauea, to the South west side of Kipu, the hill mauka of Kulani; thence *makai* along Olaa to Kaloulukea, a *pili a*; thence to Kaloi, an open spot in the woods; thence to Kaolapalapa, a *pali* at the road; thence along the road to Pohakuloo junction of the roads to Hilo and Keauhou; thence along the road along Keaau to Kaluaike, a crater on the East side of the road & on Kahaualea. Thence along Kahaualea, along the road to Namanuakalei, a large *ohia* on the Kau side of the road, thence *makai* along the road to Kilohana; junction of Keauhou and Puna roads; thence along the land of Apua, along the road to Ohiakuapu, a cave; thence through the bush to Kuelua, a cave on the road from Kau to Panau, thence to Opuohao, a cave; thence to Pali o Keawaa to a *kukui* tree on the side of the *pali*; thence to Keamoku, a small flow of *aa*, on the *pahoehoe*, the *aa* on Apua Boundary, is on the South west side of it; thence to Ninanuhi, a *pali* from which you can see the seashore; thence down the *pali* to Kealaakahewahewa, an *ahu* at the *makai* road to Puna and Kau; thence to Okiokiaho a pile of stones at the sea shore; two piles of stones and a *mawae* [page 445].

The land of Keauhou is bounded on the *makai* side by the sea, and has ancient fishing rights extending out to sea... [page 446]

***Ili of Keauhou Ili, Ahupuaa of Kapapala
Boundary Commission, Hawaii, Volume B:302-304***

The *Ahupuaa* of Keauhou, District of Kau
Island of Hawaii, 3d J.C.

Case continued from October 27, 1873.
See Folio 446, Book A

On this, the 8th day October A.D. 1874 the Commission of Boundaries for the Island of Hawaii, 3d J.C. met at the Court House in Hilo for the examination of witnesses as to the boundaries of Keauhou, situated in the District of Kau, Island of Hawaii. Due notice personally served on owners or agents of adjoining lands as far as known.

Present: L. Kaina on part of applicant and
Crown Agent in Puna, E.G. Hitchcock for Crown lands
in Hilo.

Testimony

Keliilohi^K. Sworn.

I was born at ***Keauhou, Ili of Kapapala*** at the time of *Okuu* [ca. 1804], and lived there till eight years since. I now live in Hilo. Am a *kamaaina* of ***Keauhou*** and know the boundaries. My *kupuna* and parents (Kaialii was my Father) told me the boundaries...

...***Keauhou***, I have always been told is bounded by Kahaualea; thence the boundary runs up the road to a large *ohia* tree and two mounds on each side of the road; this place is called [page 302] ***Namanuakalei***; thence to ***Kilohana***, a resting place *palipali* and *ohia* tree; thence to ***Mawae holopa***, a crack in the road where sticks are laid across to form a bridge; thence to ***Kaluaiki***, a crater on the Hamakua side of the road. I have heard that this crater is on ***Kahaualea***; thence to ***Pohakuloa*** which is the junction of the Hilo, Puna and Kau roads. Thence along the land of ***Olaa*** towards ***Kulani hill*** to a place called ***Kaloi***. Two open spots in the woods about as large as the Court House yard; the one toward Hamakua being the smallest, covered with *hapu* and ferns; thence to ***Kaloulukea***, a palm tree; thence to ***Kulani hill***; thence to ***Namaunamaka***, a place where

we used to catch birds; thence along the land of **Waiakea** to **Kiipu** [Kipu], a hill; thence to **Kaamamauloa** aa about as far as from here to Kalepolepo, above the woods. This is as far as I know the boundaries. I have heard that **Waiakea** bounds it on the Hamakua side.

There is a large *Mawae* there that runs *mauka* and *makai*. Thence the boundary runs up the mountain to **Puumahoe**, called **Puuula-ula** and **Puuiki** at the junction of **Keauhou** and **Kapapala**. **Kapapala** bounds this land on the Kau side. The boundary at shore is at the Eastern base of a hill called **Kuhalu**; thence to **Lapo**, thence to **Kalakuono**; thence to the Kau side of **Haleolono**; thence to **Limahina**; thence to **Kapuuwai**, a water cave; thence to **Kulanakuaiki**, where Kaina's man was killed by jumping off of the *pali*. Thence to **Aiaawa**; thence to **Kahaualea** at the old road to **Kilauea**; thence to **Wepiipaa**, a *pali* on the Kau side of **Keanakaakoi**.

Kamokukolau is on **Keauhou**; thence to **Kilauea** passing around the South end of the crater, **Wekahuna**; Thence *mauka* towards the mountain to **Puaulu aa**, to **Kauhiulii**; the *aa* belonging to **Kapapala**, and *aa* to this land.

Thence to **Kahiolo**, *aa*, thence to **Mokuloa**, a large *aa* flow; thence to **Kapuna**, a grove of small *koa* in the *aa*; thence to **Kahoaka**, a grove of *koa* above **Keawewai**; thence to **Puulaula** between this and **Puuike**.

C.X.d.

I went with Lydgate when he surveyed Keauhou. [page 303]
He surveyed from **Pohakuloa** to Okiokiaho and to the points I have testified to today...

...**Keauhou** is bounded *makai* by the sea and has Ancient fishing rights extending out to sea.

L. Kaina on the part of the Agent for Crown lands in Puna states that he accepts the boundary between **Keauhou** and **Apua** as surveyed to boundary between this land and **Kahaualea**, and **Olaa** to the top of **Kulani hill**, and from thence the boundary between **Waiakea** and **Keauhou** to **Kipu**; thence as surveyed by W. Webster to **Kamaamauloa**, and also the survey between **Kapapala** and **Keauhou**.

Given under my hand at Hilo, Hawaii,
This Twenty-first day of January, A.D. 1875

R.A. Lyman
Commissioner of Boundaries 3rd J.C.

Boundaries of **Keauhou**

Commencing at a pile of stones on the sea shore at place called [page 118] **Oki-oki-aho**, at the East corner of this land, and running thence along the land of **Apua**, Magnetic bearings; North 11° 15' West 19392 feet; to an *ohia* tree marked by two notches and standing on the brow of the **Poliokeawe pali**, at the lower end of a point of *ohia* just East of the **Keauhou road**;
North 20° 40' West 13250 feet;
to an *ohia* marked † at **Ohiakua-puu**, a large water cave;
North 11° 03' East 8200 feet;
to *ohia* tree marked †† at **Kaloi**, the junction of the Puna and Keauhou roads. Thence along the land of **Kahaualea**;
North 35° 15' West 16100 feet;
to **Kaluaike** crater on the volcano and Puna road;
North 6° 40' West 3600 feet;
to **Pohakuloa Koa** grove on the Hilo and Volcano road; thence along **Olaa**;
North 38° 20' West 37400 feet;
to top of large hill known as **Kulani**. Thence along land of **Waiakea**;
North 59° 45' west 17400 feet;
To above and opposite a small hill in the edge of the woods called **Kipuu** [Kipu];
North 33° 00' West 17,800 feet;
Along **Waiakea** in accordance with Webster's survey;
South 45° 00' West 31100 feet; [page 117] along **Humuula** to a double hill on the mountain called **Puuulaula**, which presents somewhat this appearance from the volcano;



Thence down along the land of
Kapapala;
South 57° 00' East 17,200 feet;
to an island in the *Aa* flow.
Thence down this lava flow, which is
the well defined boundary between
this land and **Kapapala**;
South 53° 35' East 46,000 feet;
To a pile of stones by the side of
the Volcano and Kau road 1556 feet
South West of a pile of stones on the
top of the **Wekahuna** [Uwekahuna] bluff;
South 55° 00' East 5140 feet;
to **Halemaumau** lake in the crater.
This is the old South Lake;
South 75° 30' East 6670 feet;
to a pile of stones a little South
of **Keanakaakoi** crater;
South 8° 50' East 7300 feet;
To pile of stones on *ahua* at
Kamokukolau;
South 24° 30' East 11150 feet;
To a pile of stones on **Kulanaokuaike**
pali and on the edge of the Puna [page 118]
and Kau road;
South 16° 40' East 30220 feet;
To pile of stones on the sea shore at
place called **Makoloa**, an old *Heiau*.
This place is 6111 feet East of the top
of **Kapukapu** hill. Thence along the
sea shore to point of Commencement.

Containing an Area of 50,740 Acres

R.A. Lyman
Commissioner of Boundaries 3d, J.C.

Surveyed by J.M. Lydgate... [page 119]

The Ahupuaa of Kukuau 1st (bounding Waiakea)
District of Hilo, Island of Hawaii
Boundary Commission, Hawaii Volume B:160-165

Kaikamahine^K. Sworn. [page 160]
...the boundary runs to **Kanekaulukaau** an old
planting place in the woods, belonging
to **Waiakea**. **Palaa** is the name of the
adjoining planting place on **Kukuau**.
Thence to the **Hilo** side of **Ohuliipe**, a
heiau belonging to **Waiakea**. This *heiau*
is on a hill and from it you can see the sea.
The boundary line is some distance from
this hill, it follows up a ridge that runs
mauka and *makai*, and is the dividing line;
it is where *painiu* [*Astelia*] grows. Thence

from the ridge to ***Nehuiki*** where we used to get canoes eight fathoms long; very large *koa* grows there; thence to ***Kailio*** where *koa* and *ohia* grow together; thence to ***Kalaiholona***; thence to ***Kailiholei***, where the bird catchers used to catch *oo*; thence to ***Muanui***, another bird catchers place. This is as far as I know the boundaries of Kukuau 1st.

C.X.d... [page 161]

Boundary Commission opened and case continued on the 17th of December A.D. 1873 according to adjournment from the 16th inst.

Kaaua^K. Sworn.

I was born at ***Waiakea uka*** at the time of ***Akakai Mokuakai*** [The battle of Mokuohai, 1782]. I know a part of the boundaries between ***Kukuau*** 1st and ***Waiakea***. Kuakaahalawa and Keike, who were bird catchers and canoe makers and old settlers on the land, and who knew all the boundaries, told them to me... [page 163]

... ***Niaheakealahau*** where Waiakea takes all the road and Kukuau 1st is confined to the tall *ohia*; thence the boundary runs to the Hilo side of a bathing place called ***Kuawai***; this place is on Kukuau 1st; thence to ***Kahuakamo*** (In olden times a noted place for cock fighting); thence the boundary runs along the line of the old road (now used for drawing down wood) to ***Kuaiaina***, where the roads from Kukuau and Waiakea join. The *pahoehoe* and trees on it belong to Waiakea, and the forest on the Hilo side to Kukuau 1st. Thence to ***Kaipopolo***, a place where *popolo* now grows.

Note.

Witness states that Mr. Webster marked a tree, on the opposite side from Kaipopolo, as the true boundary between the two lands, but as he objected to that boundary Mr. Webster changed the survey to Kaaipopolo.

There is a large tree with a blaze on it at this place; thence to ***Kahamouli***; thence to ***Ohuliipii*** [Ohuliipee], a hill on Waiakea. I do not know of there being a *heiau* [page 164] there in olden times; thence to a place called ***Kanoa***; thence to ***Nehuiki***, an old canoe

building place; thence to **Kaileo**, another canoe building spot where *koa* trees are growing. I have lived there; thence to **Kalaihologna**, a canoe building place; thence to **Kailihelele**, a grove of *koa* trees; thence to **Muanui**, a great bird catching place; thence to **Hoaa**, the boundary is on a line with Hoaa, but the place itself is way inside of Waiakea. I have always been told that Kukuau ends at Piliiki. I do not know what other lands join above it. Opuloa^K and Nahua (now dead) and Kaawa from Olaa were the *kamaaina* with Webster. Kahaole Opunui now living in Hamakua was a *kamaaina* of Kukuau 1st.

C.X.d... [page 165]

The Ahupuaa of Olaa
District of Puna, Island of Hawaii
Boundary Commission, Hawaii Volume B:305-306

The *Ahupuaa* of **Olaa**, District of Puna
Island of Hawaii

On this, the 8th day of October A.D. 1874, the Commission of Boundaries for the Island of Hawaii, 3d J.C. met at the Court house in Hilo, on the application of F.H. Harris, Attorney at Law for J.O. Dominis, Agent of Crown Lands for the settlement of the boundaries of **Olaa**, situated in the District of Puna, Island of Hawaii. Due notice of hearing personally served on all owners or agents of adjoining lands, as far as known. Present: L. Kaina for all parties concerned.

For Petition see Folios 238 and 240, Book A.

Testimony

Nailima^K. Sworn.

I was born at **Olaa** at the time of the death of Kekua-kalani [1819] and lived there until about a year ago when I moved to Hilo. I am a *kamaaina* of **Olaa** and know the boundaries of the land. Kapuna, an old *kamaaina* of **Olaa** told them to me. Commencing at **Pohakuloa** the junction of the Hilo and Puna roads to Kilauea at the *mauka* corner of **Olaa** and **Keaau** on the boundary of **Keauhau**; thence the boundary of **Olaa** runs *makai* along the old road through the edge of the *koa* grove; thence *makai* still along the road through the woods to **Keekee** to **Palauhulu**, junction of the **Panau** and **Hilo** road.

Certificate of the boundaries of **Olaa**,
District of Puna, island of Hawaii,
3rd J.C.

Upon the application of "J.O. Dominis,
Agent for Crown lands, and by virtue
of the authority vested in me by law
as sole Commissioner of Land
Boundaries for the island of Hawaii,
3rd J.C., I hereby decide and certify
the boundaries of the *Ahupuaa*
of **Olaa**, situated in the District
of Puna, Island of Hawaii, to be as
hereinafter set forth.

Given under my hand at Hilo, Hawaii,
This Twenty-first day of January A.D. 1875.

R.A. Lyman
Commissioner of Boundaries, 3^d J.C.

Boundaries of **Olaa**.
Commencing at the top of a wooded
Hill known as **Kulani** at the West
corner of this land and running
thence along the land of **Keauhou**,
magnetic bearings South 38° 20' East [page 109]
37,400 feet to a point on the **Hilo**
and Volcano road at **Pohakuloa Koa**
grove about 1730 feet from the junction
of the **Hilo** and Puna roads. Thence
along the land of **Keaau** North
46° 38' East 10,230 feet; North 56° 15' East
9400 feet to **O** cut in the *pahoehoe*
on a little rise in the road, about
a mile and a quarter above the
Omao woods; North 69° 18' East 6400 feet
to **O** cut in the *pahoehoe* on the
road in the belt of woods at **Omao**;
North 40° 42' East 13,070 feet to **K** cut
in the road at **Kuhalau**; North
29° 12' East 12,140 feet to **A** cut in the
road at place called **Kahooku** where
Neneleau trees are growing and from
where the houses at **Kanekoa** can first
be seen in coming down from the
Volcano; North 24° 00' East 23,810 feet
to a pile of stones on a small *ahua*
by the side of the road (East side) a
little below **Waiuli**; North 42° 10' East
12,350 feet to a pile of stones at the upper
edge of little point of *ohia* through
which the road runs; North 13° 05'
East 5600 feet to a large pile of stones at the

lower side of the road at **Makaulele**;
North 16° 10' East 985 feet to **O** cut in the
road at the extreme East corner of this
Land. Thence still running along the
Land of **Keaau**; South 85° 00' West
4250; South 72° 20' West 25,800 feet [page 110]
to a place where the Land of **Keaau**
is cut off and this land joins the
Land of **Waiakea**; South 54° 45' West
60,400 feet along the land of **Wai-
akea** to the hill at the point of
Commencement. Containing 54,260 Acres.

R.A. Lyman
Commissioner of Boundaries, 3^d J.C.

Surveyed by J.M. Lydgate... [page 111]

The Ahupuaa of Waiakea

**Waiakea Ahupuaa, District of Hilo,
and Olaa Ahupuaa, District of Puna, Hawaii.
Boundary Commission Volume A No. 1 pages 238-240**

Honolulu, July 7, 1873

R.A. Lyman, Esq.
Hilo

Dear Sir

Mr. F.H. Harris is authorized by the
Commissioners of Crown lands to make appli-
cation to you as Commissioner of Boundaries
to have the boundaries of all Crown lands on
the Island of Hawaii defined. He has a list of
the lands with him.

I have also authorized Mr. F.H. Harris
to make application to you for the settlement
of boundaries of all lands belonging to Est. of
His late Majesty and Her Excellency, R.
Keelikolani.

I expect to be in Kona by the trip
of the "*Kilauea*" which leaves here on the 28th
inst. Can't you make it convenient to come
round as the steamer goes to Hilo on that trip.
I wish also to apply for the settle-
ment of the boundaries of Honohina.

I remain,
Yours Respy.
Jno. O. Dominis

Honorable R.A. Lyman
Boundary Commissioner
for Island of Hawaii, Haw. Is.

The undersigned would herewith make application for the settlement of the boundaries of the following named Ahupuaas or Lands belonging to the Crown, viz.:

Waiakea in the District of Hilo bounded by **Keaau, Olaa, Kapapala, Humuula**, Piihonua... [page 238]
Humuula in the District of Hilo bounded by Kapapala, various lands in Kona and Kohala and Hamakua, and Hakalau, Makahanaloa, Papaikou, Paukaa, Piihonua and Waiakea in the District of Hilo... [page 239]

... **Olaa** in the District of Puna, bounded by **Keaau**, Wm. C. Lunalilo, H. M. **Waiakea & Kapapala**...

Your Honor will therefore please appoint a day for hearing the evidence in the foregoing named lands and having decided upon the same to grant a certificate to that effect to the undersigned.

Hilo Hawaii, August 16th A.D. 1873

(Signed) Jno. O. Dominis
Crown Land Agent.
by F.H. Harris
atty. at law. [page 240]

The metes and bounds of **Waiakea** were decided by testimonies and surveys of adjoining lands—‘Ōla‘a and Kea‘au, Puna; Keauhou and Kapāpala, Ka‘ū; and Humu‘ula on the mountain lands of Hilo; thus, no further commission proceedings were conducted under the heading of Waiākea.

The “Kulani Triangulation Station”

In the 1890s, the Government Survey Division undertook a series of surveys to map out the interior lands on the island of Hawai‘i. Through several communications between field surveyors and W.D. Alexander, Surveyor General, we learn that Pu‘u Kūlani was chosen as a triangulation station for the surveys, and of the great difficulty in reaching the location. Almost no *kama‘āina* could be found in the early 1890s to lead the survey party to the *pu‘u*.

Hilo, Hawaii

April 27, 1891

E.D. Baldwin; to Professor W.D. Alexander:

...I arrived in Hilo last Saturday night from Puakala. We have had fairly good success at Aahuwela, having measured the angle between Alala and **Kulani** also nearly finished the angle between Halai and **Kulani** also Alala and Halai. The 8 inch is a very slow instrument to work with, there being a great deal of lost motion in setting. But by a great deal of care in setting, I believe we have managed to do very fair work with it. The measurements of the Alala Halai angle so far close the triangle within 4”.

We had a very rough trip up the mountain; it raining steady all of the three days on our way to Puakala. Thrum started the day before I did and reached Hale-Loulu just at dusk; and was unable to start a fire, everything was so wet. He had a great deal of trouble with the pack animals in the woods. Two of our animals were completely used up by the trip, and I am afraid will be unfit for use any more.

I will start back early tomorrow morning. I send down any April accounts; the laborers pay roll, I will send down next month... [HSA Interior Department, Survey]

Hilo, Hawaii

May 30, 1891

E.D. Baldwin; to Professor W.D. Alexander:

...We are sharing a very tedious time of it upon the mountain; the weather has been very fair below, but the fog and clouds hang just over Aahuwela, so that for the last three weeks we have done almost nothing.

I have given up the idea of trying to see Kapoho or the other Puna stations from Aahuwela as they are always covered with a cloud, and I am afraid we will have to wait until doomsday to see them. I am going to send a heliotrope to Kaloli point – a short ways beyond Keaau, and devote myself to the large quadrilateral Aahuwela, Alala, **Kulani** and Kaloli, and work on through Puna from the base, **Kulani** to Kaloli which will form good triangles with my other Puna stations.

We hope to finish with Aahuwela soon if the weather permits, at any rate I am going to finish the topographical work around the base of the mountain to Kalaieha and a little beyond, and leave Thrum to watch at Aahuwela. We have been on Aahuwela for the last four weeks, every morning at day light, and then gone up before noon, and remained until there was no hopes of its clearing, without accomplishing any thing on the Hilo station with the exception of **Kulani** and **Puu Ulaula** which are always clear in the morning.

Kulani is just below the almost perpetual cloud line, so that I think it will not take us long there.

I have no suitable map tin to send the Hilo map down in; and think rather than run any risk of damaging the map, I will bring it down with me, as I intend to go to Honolulu on June 22nd and attend the Punahou Jubilee.

I send part of my accounts for the month of May, that is all but the labor items. Can you please turn over to H. Chamberlain \$72.00 on my account.

We need all the animals we can get, but they must be strong and in fairly good condition to stand our hard trips. If the Molokai horses are in good condition, I think we had better have them up here... [HSA Interior Department, Survey]

Hilo, Hawaii

August 23, 1891

E.D. Baldwin; to Professor W.D. Alexander:

...I returned last Thursday, having stopped over a trip on Maui. Thrum saw Chamberlain's heliotrope at Kaloli, and has obtained a few angles between it and **Kulani**, as Alala was invisible; he then came to Hilo, and notified Horace that he was *pau* with Kaloli. Horace has gone up the mountain with Thrum to help him down with camp. Also I am having Thrum fix a few points along the 1855 flow as he comes down; which will not take long and can be easily done now as we have flags on all the prominent Mauna Kea cones which he can sight to.

I expect Thrum & Chamberlain down the latter part of this week; and have everything ready to move right away to **Kulani**. From **Kulani** we will move to Kaloli point, and by occupying these two points first – will fix many points along the Puna ridge. We hope before long to be well into Puna; at any rate I shall try and push the Puna work, so that we can have something to show, for the next Legislature.

The Molokai animals are doing well, so far. They have been some-what used-up by some of the trips, but seem to be tough animals and pick up readily.

The Humuula boundary case came up last Thursday, and as it will probably be referred to the Boundary Commissioner to settle upon where the line should go, I thought you would probably wish me to wait until we get his decision – before making out notes of survey from Pohaku o Hanalei to Kaupakuhale. I am now plotting up any mountain work to a scale of 2000 feet to the inch, which will take in all we have done around the base of Mauna Kea. I would like to get Lyon's location of Kaupakuhale, in Hinahina, Kaloaloo, and some of his boundary points this side of Kaloaloo station, so that I can put them on the map, and finish up the map.

I noticed that the few clear nights that we had at Aahuwela, it was also clear during the morning, but I think it will be a good idea to have the large lanterns you speak of ready, so that if necessary we can try them. Our instrument seems to have no lamp to light the cross hairs; also we will want some dark lanterns. [HSA Interior Department, Survey]

Hilo, Hawaii

September 2, 1891

E.D. Baldwin; to Professor W.D. Alexander:

...Thrum and Chamberlain arrived this evening from the mountain. I wrote to Thrum to give up locating any points below Lydgates **Mawae** on the 1855 flow, so that we might push on to **Kulani**. We will make a start for **Kulani** next Monday. In regard to the location of those five points – I understood that you wished the notes of survey from Kaupakuhale on to Pohaku o Hanalei, and as supposed that Lyon's had located Kaupakuhale & did not relocate it again; and after receiving your letter a month ago; wrote by return steamer for Lyon's location of Kaupakuhale, so that I could get the distance and bearing from Kaupakuhale to Kole from my map. Lyon's has not as yet sent me the location of Kaupakuhale; but wrote by last steamer that he would like the coordinates of four of the points referred to Aahuwela, which I have sent him by this steamer.

We have been making up a lot of oil-skin clothes and bags, also we made a fly and tarpoling for our small tent, which accounts for the large amount of canvas duck we have been buying.

Our large tent and fly are nearly all to pieces. Can you please send us up another large tent and fly. Also I would like a lot of blank vouchers and a large calculation book.

Can you please pass H. Chamberlains pay over to W. Frear \$79.85. And deposit \$300.00 in the Postal Savings Bank for me, and please send the balance to me...[HSA Interior Department, Survey]

Kulani Trig. Station

November 24, 1896

J.S. Emerson; to W.D. Alexander

...After 8 ½ days of severe labor, my party of 4 strong and experienced wood cutters, yesterday completed the road through the *Koa* forest and *Pulu* jungle to this point. We started a blazing fire at 4:30 this morning. At 8:30 our party, with 5 good pack mules, left the *Kipuka* and at 10:50 we had reached the base of this noble hill. About 40 minutes of this time was spent in cutting away some obstructions in the path, leaving 1 hour and forty minutes for travelling time. While the mules are resting in an *akala* thicket at the base of the hill. My men are climbing the ascent with loads that surprise me. I found it hard work to lug a gun and overcoat, and my handwriting shows the

eddicts of the exertion on my nerves and muscles. The weather continues almost perfect. We have been most fortunate in having two weeks of such unusually clear weather. I have never known it better since I began my work last July. At the moment (12:25), Mauna Kea is clouding in, while M. Loa has only two small specks of clouds just forming. Last Sunday was the finest day of the season. A heavy frost covered the ground when we awoke in the morning. My men who had never seen anything of the kind before, the guide was not among them, tasted to see if it was salt, and asked me what it was. All that day the sun shone from a cloudless sky. We went to **Keawewai** to bathe, and the view of the mountain and coast was wonderfully fine. I can't expect such weather to last. **Kulani** signal is in distress. A few tattered rags here and there all over the tripod, a bare pole with a rag or two on it, the whole surrounded by a jungle of brush 6 feet high, with a few bare trunks of *lehua* trees near by, easily mistaken for the signal, that is all. No wonder I have had trouble to see anything to sight on.

Kamaki flagged the signal as he had been taught. The system or lack of system was all wrong. Of course heliotropes have to be used to supply the defects of such signals... [HSA –Survey DAGS 6]

Travel and Access in the 'Ōla'a-Waiākea Forest Lands

Because of the remote nature of the 'Ōla'a and Waiākea forest lands which comprise the present-day Pu'u Maka'ala NAR, no government communications pertaining to historic trails or government road projects exist for the region. The Boundary Commission testimonies cited above, describe trails through the forest lands, rising from the lowlands of Waiākea, 'Ōla'a, Keauhou and Humu'ula. Based on the native traditions and *kama'āina* testimonies, as those above, it is likely that "practitioner" trails existed throughout the forest region. Features such as "*kauhale manu*" (bird-catcher's shelters), "*kahua kalaiwaa*" (canoe-makers clearings), "*oioina*" (trailside resting places and shelters), the "*ala hele*" (trails), and other features associated with traditional and customary accesses, would leave little evidence in the present-day, as the traditional features and uses generally had minimal impact on the natural landscape. Those things left behind, not cared for or maintained, were simply reabsorbed into the landscape.

We do know that by 1847, the Kingdom undertook a program of developing the *Alanui Aupuni*, or Government Road system. The "roads" were generally laid out on, or near traditional alignments, though as the system matured, and greater need for roads which could support transportation of goods evolved, new and straightened alignments were developed. One of the earliest communications documenting this process on the island of Hawai'i, is found in a letter from Governor Kapeau to Premier and Minister of the Interior, Keoni Ana on August 13, 1847:

Aloha oe e ka mea Hanohano –

...I have a few questions which I wish to ask you. Will the police officers be required to pay, when they do not attend the Tuesday (*Poalua*) labor days? How about parents who have several children? What about school teachers and school agents? Are they not required to work like all other people when there is Government work on the roads and highways? I believe that school agents, school teachers and parents who have several children, should only go and work on the weeks of the public, and not on the *konoiki* days...

...The roads from Kailua and down the *pali* of Kealakekua, and from Kailua to Honokohau, Kaloko, Ooma, the place where our King was cared for, and from thence to Kaelehuluhulu [at Kaulana], are now being surveyed. When I find a suitable day, I will go to Napoopoo immediately, to confer with the old timers of that place, in order to decide upon the proper place to build the highway from Napoopoo to Honaunau, and Kauhako, and thence continue on to meet the road from Kau. The road is close to the shore of Kapalilua. Also, the road that is to go *makai* of Kukalaula, below Keauhou [Ka'ū], and then continue to the shore of Puna and Hilo, will probably begin at Keaiwa.

The width of the highways round Hawaii, is only one fathom, but, where it is suitable to widen where there is plenty of dirt, two fathoms and over would be all right. For the town of Hilo, I have appointed some road overseers, being B. Pitman, Frank W. Wood, maybe Koana [Titus Coan], Halai, Luhilea, Kaiana. Three natives and three foreigners. They get no pay for this work which has been placed upon them, they give their services free to this work because of their desire to improve the land.

If the roads are put into proper condition, there are a lot of places for the strangers to visit when they come here. The Kilauea volcano, and the mountains of Maunaloa, Maunakea, Hualalai. There is only one trouble to prevent the building of a highway all around, the steep gulches at Waipio and Pololu, but this place can be left to the very last. The palis at Hilopaliku are also very bad, but another and better place has been found, it is a little *mauka* of that, that is what the old timers living at Kulaimanu say. A foreign carpenter has proposed to me that he build the bridge over Wailuku completely, all the material to be his and also the labor, and to pay him two thousand dollars. I did not pay much attention to this, because, I do not believe that it can be built for that money, it will take three thousand dollars to finish it, and maybe it will go into four thousand... [HSA Interior Department, Roads; translation modified by Maly]

As described in the preceding letter, no roads across Keauhou, the 'Ōla'a-Waiākea forest lands, into Humu'ula were planned. By the late 1800s, and through the 1940s, the primary users of trails in the *mauka* lands were ranchers, traveling between Humu'ula and Pu'u 'Ō'ō to Keawewai and Keauhou, and those traveling on to Kapāpala and Kahuku.

In 1932, as a part of the Land Court Application of W.H. Shipman for the land of Kea'au, testimonies of two elder *kama'āina* were recorded, documenting primary routes of travel in Kea'au, and the relationship of native residents with 'Ōla'a and neighboring lands. The testimony, viewed in the collection of W.H. Shipman, Limited, shares the same concepts of traditional and customary access as described in traditional texts and historical testimonies cited above.

Affidavit of David Malo

DAVID MALO, of Keaukaha, S. Hilo, Hawaii, being first duly sworn and upon his oath, deposes and says as follows:

I was born in the year 1852, at Makuu, Puna, Hawaii.

I am 80 years old.

I was brought up in Makuu, Puna, and lived there for many years, up to the time when my father died. I was then about 18 years old.

The King Highway or Main Public Highway starts from Puumaile, Waiakea, and goes through Waiakea, Keaau, Kapoho, Kalapana along the seacoast and on Panau to the Volcano...

The old Volcano Highway starts from Hilo and goes through Puuainako, Waiakea, and goes on to the present 4 mile bridge, thence it turns off to the right or *mauka* side of the 4 mile bridge and goes on till it crosses the present main public highway about 7 miles, thence it goes on till it meets again the present main public highway at 8 miles, thence it goes on to 9 miles Olaa, thence it goes on to Kuolo, and on the *pahoehoe* to Mahinaakaka, and on to Waiuli where Hawelu's Hotel was located, thence it goes on to Kalehuapua, Kapae, Kapueuhi, and on to Kekee where Shipman's cow pen is, where it meets with the present highway, thence it goes on to the Volcano. The old Volcano Highway separates Keaau from Olaa.

The people that were living in Oloo were tenants at will (*Komo Kino*) while under Queen Emma. My father was the Queen's *Konohiki*. The people that were living in Keaau paid money for living on the land. Only tenants were allowed to go on the land. The people of Waiakea were not allowed to go on Keaau without permission...

There was a big village *mauka* of Keaau in Oloo.

The only main trail or main Public Highway that was used by everybody at that time is the trail that starts from about 12 miles Oloo, and goes down to Waipahoehoe, and on to Makuu till it meets the King Highway.

There were many other trails running down to the King Highway and the beach, some of them were made by cowboys for driving cattle, and some of them were made by cows...

Subscribed and sworn to before me this 15th day of December, A.D. 1932.

Affidavit of Mai Keoki [George Mai]

MAI KEOKI, of Keaau, Puna, Hawaii, being first duly sworn and upon his oath, deposes and says as follows:

I am 64 years old.

I was born May, 1868, at Paki, Keaau, Puna, Hawaii.

I have lived in Keaau, Puna all my life time.

Only one Keaau.

When Keaau came into Mr. Shipman's possession, the people that were living in Keaau became tenants at will (*Komo Kino*).

The people of Oloo lived in Oloo and the people of Keaau lived in Keaau...

Hawelu's Hotel was on Oloo. Mr. Hawelu was Mr. Shipman's foreman.

The trail or road from Oloo to Makuu is the main road upon which the *kamaaina* and strangers travelled from Makuu to the old Volcano Road, and from Oloo to Makuu. This main trail is the road which David Malo had described.

Another small trail starts at 12 miles Oloo and goes down to Keakuamakakii, where it passes Hilo of the Stone Crusher *makai* of the Pahoia Highway, thence it goes on to Lopaiki, and on to two cocoanut trees, thence it goes on to Kaikoo where it branches off. One branch goes down to Keauhou and another branch goes down to my place. On this trail the people of Oloo came down to my place.

During Obed Spencer's time there were no tenants at will. Since the fence was put up along the Pahoia Road, this trail has not been used by anybody. Nobody has used this trail since 1910 or 1911. When the people were made tenants at will, the people have not used this trail since...

Subscribed and sworn before me this 17th day of December, A.D. 1932.

It appears that it was not until the late 1940s, that a road was cut up through the Waiākea-‘Ōla‘a forest lands, and this in conjunction with the opening of the Kūlani Prison Farm. In the early 1950s an access road was cut from the Kūlani facility to the summit region of Mauna Loa for a weather observatory. At one point, the program manager, Tom Vance, proposed that the road be planted with the trees of the world, as a scenic drive to Mauna Loa (H. Ellis, pers comm. 2004; and HSA Series GOV 9-7).

While Mr. Vance’s idea was a grand one, looking to the economic benefit of Hawai‘i Island, we can be thankful that the plan never unfolded. The toll of an influx of alien species on the native ecosystems that are now a part of the Pu‘u Maka‘ala NAR would have been significant.

NĀ ULU LĀ'AU A ME NĀ KINI KINO LAU O LOKO (THE FORESTS AND MULTITUDES DWELLING THEREIN)

As discussed in earlier sections of this study, Hawaiian traditions and beliefs, shared spiritual and familial relationships with the natural resources around them. Each aspect of nature from the stars in the heavens, to the winds, clouds, rains, growth of the forests and life therein, and everything on the land and in the ocean, was believed to be alive. Indeed, every form of nature was a body-form of some god or lesser deity. As an example, in this context, and in association with lands which are part of, or adjoining the landscape of the Pu'u Maka'ala NAR, we find that the god Kū-ka-'ōhi'a-Laka, is represented as a deified 'ōhi'a; Kū-lili-ka-ua, formed the mists and protected the forests of this upland region; and Ua-kuahine is given as the name of another goddess whose body form is that of the mists that settle on the forest. Tradition also tells us that the gods and goddesses of the forests were very protective of them. In olden times, travel through them was accompanied by prayer, and care. Many a careless traveler, or collector of resources, found themselves lost in a maze of overgrowth and dense mists, for disrespectful and careless actions. In the Hawaiian mind, such nature body forms of plant, animal, and weather, were believed to be "*kino lau*," the myriad body-forms of the gods and creative forces of nature that gave Hawaiians life.

In this context, care for each aspect of nature, the *kino lau* of the elder forms of life, was a way of life. This concept is expressed by Hawaiian *kūpuna* (elders) through the present day, and is passed on in many native families. When discussing the relationship of native families with the lands and resources around them, it is not uncommon to hear *kūpuna* express the thought — "*E mālama i ka 'āina, a e mālama ho'i ka 'āina iā 'oe! E mālama i ke kai, a e mālama ho'i ke kai iā 'oe!*" (Care for the land, and the land will care for you! Care for the sea, and the sea will care for you!). This concept is one that is centuries old and is rooted in the spirituality of the Hawaiian people. Importantly, the converse is that when one fails to care for, or damages nature—the *kino lau*—around them, they are in-turn punished. This is expressed in many traditional sayings, one being, "*Hana 'ino ka lima, 'ai 'ino ka waha!*" (When the hands do dirty-defiling work, the mouth eats dirty-defiled food!). In this cultural context, anything which damages the native nature of the land, forests, ocean, and *kino lau* therein, damages the integrity of the whole.

Of course, since traditional times, many things that were a part of the native Hawaiian natural and cultural landscape have disappeared—being destroyed by changes in land tenure, changes in residency and subsistence practices, and by the introduction of tens-of-thousands of alien species which have overrun the formerly balanced and fragile bio-systems that made Hawai'i unique.

Writing in the late 1860s and early 1870s, native historian, S.M. Kamakau, related to readers some aspects of the Hawaiian association and understanding of the mountain lands and forests. While describing traditional knowledge of the divisions of land, Kamakau wrote:

Here are some other divisions of the islands, together with their descriptive names.

Heights in the center or toward the side of a land, or island, are called *mauna*, mountains, or *kuahiwi*, "ridge backs." The highest places, which cover over with fog and have great "flanks" behind and in front (*kaha kua, kaha alo*)—like Mauna Kea—are called *mauna*; the place below the summit, above where the forests grow is the *kuahiwi*. The peak of the mountain is called *pane po'o* or *piko*; if there is a sharp point on the peak it is called *pu'u pane po'o*; if there is no hill, *pu'u*, and the peak of the mountain spreads out like the roof of a house, the mountain is described as a *kauhuhu mauna* (house ridgepole mountain); and if there is a precipitous descent, *kaolo* [from the peak] to the *kauhuhu mauna* below this is called a *kualo* ("block"). If there are deep ravines (*'alu ha'aha'a*) in the sides of the mountain it is called a *kahi po'ohiwi mauna* ("shoulder edge" mountain). A place that slopes down gradually (*hamo iho ana*) is called a *ho'oku'u* (a "letting down"); a sheer place is called a *pali lele koa'e* (cliff where

koa’e birds soar), or a *holo* (“slide”), or a *waihi* (a “flowing down”). Rounded ridges that extend from the mountains or “ridge backs” or hills are called *lapa* or *kualapa* or *mo’o*—and, if they are large, *’olapalapa* or *’omo’omo’o*. Depressions between *lapa* or *mo’o* are *awawa*, valleys.

Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi*. A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (*’ano*). The part directly in back and in front of the summit [Kamakau 1976:8] proper is called the *kuamauna*, mountaintop; below the *kuamauna* is the *kuahea*, and *makai* of the *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele*. *Makai* of this region the trees are tall, and this is the *wao lipo*. *Makai* of the *wao lipo* is the *wao ’eiwa*, and *makai* of that the *wao ma’ukele*. *Makai* of the *wao ma’ukele* is the *wao akua*, and *makai* of there the *wao kanaka*, the area that people cultivate. *Makai* of the *wao kanaka* is the *’ama’u*, fern belt, and *makai* of the *’ama’u* the *’apa’a*, grasslands.

A solitary group of trees is a *moku la’au* (a “stand” of trees) or an *ulu la’au*, grove. Thickets that extend to the *kuahiwi* are *ulunahale*, wild growth. An area where *koa* trees suitable for canoes (*koa wa’a*) grow is a *wao koa* and *mauka* of there is a *wao la’au*, timber land. These are dry forest growths from the *’apa’a* up to the *kuahiwi*. The places that are “spongy” (*naele*) are found in the *wao ma’ukele*, the wet forest.

Makai of the *’apa’a* are the *pahē’e* [*pili* grass] and *’ilima* growths and *makai* of them the *kula*, open country, and the *’apoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the *’ae kai*, the water’s edge.

That is the way *ka po’e kahiko* named the land from mountain peak to sea. [Kamakau 1976:9]

Among the native terms listed by Kamakau above, is one which stands out in reference to the Waiākea-’Ōla’a forest lands of the Pu’u Maka’ala NAR—this zone is the *wao akua* (zone or region of the gods and deities). The *wao akua* is so named because of the pattern of cloud cover and precipitation which settles upon the mountain slope—this covering was interpreted as concealing from view the activities of the gods and deities therein (cf. David Malo 1959:16-18; and M.K. Pukui, pers. comm. 1975).

In the traditional context above, we find that the mountain landscape, its’ native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property. It’s protection, and the continued exercise of traditional and customary practices, in a traditional and customary manner, are mandated by native custom, and State and Federal Laws (as those establishing the ’Ōla’a and Waiākea Forest Reserves, the Pu’u Maka’ala Natural Area Reserve, and the Endangered Species Act).

In this discussion, protection does not mean the exclusion, or extinguishing of traditional and customary practices, it simply means that such practices are done in a manner consistent with cultural subsistence, where each form of native life is treasured and protected. *Kūpuna* express this thought in the words, “*Ho’ohana aku, a ho’ōla aku!*” (Use it, and let it live!).

Transitions in the Health and Value of The Hawaiian Forests Following Western Contact

We find that shortly after western contact—the introduction of alien herbivores, and financial value being placed upon resources of the forests and mountain lands—the health and integrity of the resources began to decline. After western contact, the forests were primarily evaluated in the terms of

the western economic system. While in the centuries prior to the arrival of westerners in 1778, and subsequently into the reign of Kamehameha I, the system of land tenure and management mirrored the natural landscape of the islands, later management systems focused on what, and how much could be gotten from the land.

Immediately, upon western contact, foreigners looked at the land—first as a source of provisions for ships; and second as a means for earning money, through the trade of natural resources such as *'iliahi* (sandalwood). In 1778, European boars, goats, rams, and ewes were introduced by Captain Cook. While offered as a “gift,” one of the motivating factors was that leaving the animals behind would produce a breeding stock to supply other foreign ships (Beaglehole 1967:276, 578-579). Later, in 1793, cattle were brought to Hawai'i by Captain Vancouver. Given as gifts to Kamehameha I, the cattle were first let off at Kawaihae (then at Kealakekua), and were placed under a ten-year *kapu* to protect them and allow them to reproduce (Kamakau 1961:164). Between 1793 and ca. 1811, new stock was added, and the numbers of cattle had increased dramatically. The introduced cattle, goats and sheep rapidly became a problem to the native population and forests.

While the introduced animals were making their way into the higher elevations, other economic pursuits also led to the clearing of large tracts of land. In the early 1800s (ca. 1810-1829), tens-of-thousands of pounds of *'iliahi* (sandalwood) were cut from the forests above Waiākea and Keauhou, Ka'ū (cf. Kamakau 1961, and Ellis 1963).

Describing the collection of *'iliahi* in 1823, from the uplands of the Waiākea region, Ellis wrote:

In Hilo, the party was under the care of the chief Ma'alo (written Maaro), Ellis and companions offer the following narratives, describing the land there about and activities of the people, among which included hundreds of residents being required to go to the mountains above, and gather sandalwood for their chiefs:

...we overtook Maaro, the chief of Waiakea, and three or four hundred people, returning with sandal wood, which they had been cutting in the mountains. Each man carried two or three pieces, from four to six feet long, and about three inches in diameter. [Ellis 1963:214] The bark and sap had been chipped off with small adzes, and the wood appeared lighter in colour than what is usually sold at Oahu, probably from its having been but recently cut down.... Although a plant of slow growth, it is found in abundance in all the mountainous parts of the Sandwich Islands, and is cut in great quantities by the natives, as it constitutes their primary article of exportation.

It is brought down to the beach in pieces from a foot to eighteen inches in diameter, and six or eight feet long, to small sticks not more than an inch thick and a foot and a half long. It is sold by weight, and the merchants, who exchange for it articles of European or Chinese manufacture, take it to the Canton market, where it is bought by the Chinese for the purpose of preparing incense to burn in their idol temples. ...Dense fogs and heavy rains are more frequent at Waiakea, and over the whole division of Hiro, than in any other part of the island... [Ellis 1963:215].

By the 1830s, the forest had been stripped of sandalwood and many other plants of the forest were impacted by the clearings made for collection and transportation of the *'iliahi*. Another reason that large sections of the lower forests were cleared, was to develop lands on which western-introduced food crops could be cultivated and harvested for sale to visiting ships.

In this part of the discussion, it is appropriate to note that the European boar was significantly larger, and thus stronger, than the Polynesian introduced *pua'a*, or pig (Beaglehole 1967:579). Our review of more than 60,000 native Hawaiian land documents dating from 1846 to 1910 revealed many references to *pua'a* (pigs), but nearly every reference was in the context of them being near-home and as being cared for (raised), not hunted. In the same review of the native Hawaiian land

documents and a large collection of writings from native authors (e.g., D. Malo, 1951; J.P. Ii, 1959, S.M. Kamakau 1961, 1964 & 1976), every reference to traditional collection or “hunting” (a word seldom used in the historical records), was in the context of native birds—those used either for food or from which feathers were collected for royal ornaments and symbolic dress.

After ca. 1815, we find that when native Hawaiians went hunting in the uplands—as described in testimonies and historical texts of the time—they were hunting bullocks, goats and other introduced grazers, and this was generally done on the demand of their landlords, and later for the growing ranches being established in the islands. The first full-scale efforts of western-style hunting in the Humu’ula-Waiākea and Keauhou (Ka’ū) region does not appear in reference until around 1840 (cf. Kamakau, 1961; Government Communications in this study). Those early outings were focused on collection of hides and tallow; and controlling wild herds of animals that were a threat to travelers, agricultural fields, residences, and forest resources.

Immersion of Hawaiian Forestry Programs

So significant was the threat of these animals to the Hawaiian landscape, that on September 19, 1876, King David Kalākaua signed into law, an Act for the Protection and Preservation of Woods and Forests. By this Act, the Minister of the Interior was authorized to set apart and protect from “damage by trespass of animals or otherwise, such woods and forest lands, the property of government...best suited for the protection of water resources...” (Hawaii Laws Chapter XXX:39). The Minister of the Interior was authorized to appoint a superintendent of woods and forests:

...who shall, under the direction of said Minister, enforce such rules and regulations as may be established to protect and preserve such reserved woods and forest lands from trespass. Said superintendent shall have charge of the construction of fences and barriers required to protect the said woods and forest lands, and shall be responsible for their being kept in good condition... (ibid.).

The above Act was further defined by an Act of the Legislature of the Hawaiian Kingdom, approved by Queen Lili’uokalani on January 4, 1893, which established the Bureau of Agriculture and Forestry. Among the Bureau’s goals was the “preservation of forests.” On June 14, 1900 (then organized under the newly formed Territorial Government), the members and functions of the Bureau were absorbed by the Board of Commissioners of Agriculture and Forestry (Hawaii State Archives – Com 2, Box 11). The Board then set about the task of establishing forest reserves on all the islands; among the first being development of the Hilo Forest Reserve, which was needed to “protect the headwaters of the streams, which play so important a part in the success of the various plantations” (Wm. Hall 1904:277). On August 9, 1904, the Commissioners approved the recommendation that “all government and other lands in the district of Hilo, Island of Hawaii, lying above a line approximately 1750 feet above the sea, be set apart as a forestry reservation” (Hall 1904:282). The lands extended from Laupāhoehoe to Pi’ihonua, adjoining the land of Waiākea.

In 1905, the Board set in motion plans to set aside and protect portions of the ‘Ōla’a and Waiākea forest lands, the result being establishment of a forest band around the northeastern portion of the island of Hawai’i.

Regarding the forestry movement in the islands, C.S. Judd, Superintendent of Forestry, wrote the following account of forests and forestry in the Hawaiian Islands to Governor Farrington (October 10, 1924). Eighty years later, his words still present readers with an important frame work for the on-going efforts in protection of Hawai’i’s native forests:

Forestry is practiced in the Territory of Hawaii primarily, not for timber production, but for the conservation of water. Probably in no other section of the world is the relation between a satisfactory forest cover on the mountains and the supply of water for domestic and agricultural uses better or more ably demonstrated...

The chief product, and, the most valuable, coming from the main forested and mountainous regions of the Territory, comprising about one-fourth of the total land area of the eight islands (4,099,860 acres) is water. Because of the comparatively limited terrain, short and steep water sheds, heavy rainfall in certain regions and the great need for irrigating the dry but fertile, sun-warmed lowlands, the value of this liquid product of the forest, on which domestic needs and prosperity of the community depend, is most highly appreciated and every effort is being made to conserve and maintain its sources in the forests.

Character of the Native Forest.

The forest of comparatively small trees found growing naturally on the mountain slopes is admirably suited to prevent erosion and to convert surface runoff into underground drainage, the desideratum in water conservation. The happy combination of small trees, brushes, ferns, vines and other forms of ground cover keep the soil porous and allow the water to percolate more easily into the underground channels. The foliage of the trees breaks the force of the rain and prevents the impacting of the soil by rain drops. A considerable portion of the precipitation is let down to the ground slowly by this three-storied cover of trees, bushes, and floor plants and in this manner the rain, falling on a well-forested area, is held back and instead of rushing down to the sea rapidly in the form of destructive floods, is fed gradually to the springs and streams and to the underground artesian basins where it is held for use over a much longer interval.

Protection of the Forest.

Forest practice in the Territory of Hawaii, therefore, resolves itself into what is known as "forest protection" and the main efforts of the foresters are exerted in maintaining and build up the native forests on the mountains so that they will function to the highest degree in conserving the rainfall.

The native forest, however, is peculiarly constituted in that it is readily susceptible to damage. The shallow-rooted trees depend for proper moisture and soil conditions on the undergrowth of bushes and ferns and when the latter, the first to be attacked by stock, are injured or removed, the tree roots dry out, the trees are weakened and begin to decline, and an opening is made in the forest for the invasion of destructive insects and fungi and of the more vigorously-growing foreign grasses and other plants which choke out native growth and prevent tree reproduction. It is always dangerous for this reason to make any opening in the native forest and the only safe way to preserve it and keep it healthy and vigorous is to maintain it inviolable from all attacks and keep the ground well shaded and dark.

Damage to the Forest.

The chief damage to the native forest is done by cattle and other grazing stock which first attack the toothsome ferns and other plants which give the shallow-rooted trees the protection which is necessary to their existence.

The fencing of exposed forest boundaries to keep out stock and the extermination of wild stock where it exists in the forest constitutes an important item in forest work in the Territory...

Forest Reserves.

Forest lands devoted to the purpose of water conservation have been officially recognized under the law and set apart as forest reserves by proclamation of the Governor. In this manner during the past two decades 50 of such forest reserves have been set aside on the five largest islands of the group. These embrace a total area of 840,984 acres of which 579,905 acres or 68 per cent is land belonging to the Territory... (Hawaii State Archives – Com 2, Box 15)

Dedication of the ‘Ōla‘a and Waiākea Forest Reserves

As noted above by 1904, the Territory set in motion plans to protect Hawaiian forests by designating select tracts of land as forest reserves. While the primary perceived value of the forest reserves was economic—forests that produced water for agriculture, or forests from which wood and other natural resources could be harvested and sold—large tracts of land, upon which important Hawaiian ecosystems existed were set aside. Among these tracts were lands of the Hilo and Puna Districts, portions of which now make up the Pu‘u Maka‘ala NAR.

By 1905, the reports of the Board of Commissioners of Agriculture and Forestry begin describing the forests of ‘Ōla‘a, and in the following years, through the 1920s, we see the development of a system of forest reserves through ‘Ōla‘a, Waiākea, and Keauhou (the adjoining land in Ka‘ū). The following narratives and notes of survey describe the nature of the reserve lands, their resources, and the thoughts behind protection and management of these unique systems. The records focus on the founding history of the reserves, and come from the collections of the Division of Forestry and Wildlife, Survey Division, and Hawaii State Archives. The records are given by land and reserve area, and date of record.

The ‘Ōla‘a Forest Lands

The following documents focus on the development of the various facets of the ‘Ōla‘a Forest Reserve, and early descriptions of the resources therein.

***Honolulu, T.H., April 7, 1905.
OLAA REMNANT, PUNA, HAWAII.***

Committee on Forestry,
Board of Commissioners of Agriculture and Forestry.
Honolulu, T.H.

Gentlemen:—On March 22 you referred to me a letter from Mr. J.W. Pratt, Commissioner of Public Lands, under the date of February 10, requesting the suggestions of the Board in regard to certain lands on the Island of Hawaii.

Three of the four tracts mentioned are in Hamakua. These I expect to visit during my next trip to Hawaii, after which I shall be ready to report upon them.

The other land called for I have the honor to report upon herewith. It is “that tract of land constituting the remnant of Olaa, below the surveyed part of Olaa New Tract, and between Keaau and Waiakea, forming a long narrow triangle and marked on the map of Hawaii as “Government Tract.” [see *Figure 2*] The lower point of the tract comes practically to the Volcano Road, not far above the seven mile post. The upper end of the Remnant adjoins Lots 229 to 232 of the Olaa New Tract, at an elevation of about 1,600 feet.

While I have not made a personal examination of this tract I am familiar with the general character of the section from visits made to the adjoining lands.

This knowledge, with additional information concerning the tract obtained from Government officials and other trustworthy sources, is the basis on which I make the following report and recommendations.

The greater part, if not the whole, of the Olaa Remnant is covered by old *a-a* lava, known as the Kukulu Flow. It is this flow which the Volcano Road crosses between the four and eight mile marks.



Figure 2. Detail of the 'Ōla'a-Waiākea Forest Lands (Hawaii Territorial Survey, 1901)

The Kukulū Flow consists of large rocks, covered in part by good soil, but the surface is too rough to admit of plowing or cultivation. The upper part of the Remnant is shown on the map of the Olāa Lots, compiled by Mr. E.D. Baldwin in 1899.

Covering the entire Olāa Remnant is a dense forest of the same character as that on the remainder of the Olāa Tract. *Ohia Lehua* is the predominant tree with a heavy undergrowth of [page 132] tree and other ferns, climbing vines and the tangle of tropical vegetation that goes to make up the native Hawaiian forest.

Were it is possible to develop the Olāa Remnant for agricultural purposes there would be no objection to clearing and opening up the land for settlement. But as the land is too rough to be cultivated, about the only profitable use to which this tract could now be put would be the cutting and marketing of the *Ohia* trees for timber, ties or fuel. Whatever value the Olāa Remnant at present possesses is largely because of the forest thereon, and unless there is a decided change in the economic conditions its greatest value in the future will be that it can produce timber trees.

Provided an assured market for *Ohia* wood existed, there would be no impropriety in logging the Olāa Remnant, provided always that the work were done in such a way that the Government would receive a fair return from the wood cut and that the forest were left in good producing condition.

But if a revenue is to be derived from the sale of forest products from Government land, the Government itself and not some individual should receive the chief benefit. To this end, when Government forest land is to be lumbered a special form of contract should be entered into, containing such directions and regulations as to how the work shall be done as may be deemed necessary.

In the case of the Olāa Remnant it is difficult to say for what the land could be profitably used at this time unless the idea is to cut wood.

I, therefore, recommend that the Board of Commissioners of Agriculture and Forestry advise the Commissioner of Public Lands not to lease the Olāa Remnant or to let it pass out of the control of the Government, until the forest on the tract can be put on the market at a fair profit or until the local economic conditions are such that the land can be used to better advantage for purposes other than that of producing timber trees.

Very respectfully yours,

RALPH S. HOSMER,
Superintendent of Forestry.
[Hawaiian Forester and Agriculturalist, 1905:133]

Eight years later, in 1913, based on a report by Territorial Forester, R.S. Hosmer, the Board set aside additional lands in the 'Ōlā'a Tract, "The Upper 'Ōlā'a Forest Reserve," described below:

Honolulu, June 18, 1913.

Gentlemen:—I have the honor to submit as follows, the recommendation that the remainder of the *mauka* portion of the government land of Olāa, to the north and west of the various subdivisions of homestead lots in the district of Puna, island and county of Hawaii, be set apart as a forest reserve [see *Figure 2*]. This land all belongs to the government. It is not now under lease. The area is 92.80 acres.

Object.

The reasons for the reservation of the Oloo forest remainder are largely the same that prompted me a short time since to recommend the reservation of the adjoining forest land of Waiakea, *mauka* (see report, dated June 6, 1913). Indeed, these two tracts, forming a continuous forest, are really to be considered together. They are only reported on separately because, for purposes of description, it was found desirable to treat them as two units rather than one.

No running water comes from the Upper Oloo forest. Its reservation as a forest reserve is justified, rather, because of the fact that the question may some time arise of exploiting its timber. It is none to soon to make provision against that time. One essential reason for setting the land apart now is that it may be brought under the care and control of the Territory's forest department. [page 304]

Like Waiakea, the upper portion of Oloo bears a heavy stand of forest. *Ohia-lehua* is the predominating tree, but with it in mixture are many other species. On its western edge the Upper Oloo forest joins the Bishop Estate land of Keauhou, on which is a heavy stand of the tallest and largest *koa* in the Territory. A section of Keauhou some seven miles long by one mile in width has for 10 or 12 years been held by that estate as a private forest reserve.

The heavy *koa* forest does not extend much, if any, on to Oloo, but near the Keauhou boundary, on the government land, is a fine stand of large tree-ferns (*Cibotium*) of perhaps as large size as any to be found in the Territory. These give at least a botanical interest to this region.

Some five years ago *ohia-lehua* railroad ties were, for a time, cut on the McKenzie lots, one of the homestead subdivisions of upper Oloo. Other than this, except as certain areas of forest have been cleared on other adjoining homestead lands and sold as firewood, there has been no commercial development of the upper Oloo forest.

Description.

The official description of the proposed Upper Oloo forest reserve, prepared by the Government Survey Office as C.S.F. No. 2476, accompanies this report.

Recommendation.

For the reasons given above I do now recommend that the Board approve the setting apart of this tract as the Upper Oloo forest reserve, and that the governor be called upon to hold the hearing and thereafter to issue the proclamation incident thereto.

Very respectfully,

RALPH S. HOSMER
Superintendent of Forestry.
[Hawaiian Forester and Agriculturalist, 1913:305]

1913

Proclamation of Forest Reserves In the Districts of Hilo and Puna, Island and County of Hawaii, Territory of Hawaii.

UNDER and by virtue of the authority vested in me by the provisions of Chapter 28 of the Revised Laws of Hawaii, as amended by Act 65 of the Session Laws of 1905, and by Act 4 of the Session Laws of 1907, and of every other power me hereunto enabling, I, Ernest A. Mott-Smith, Acting Governor of Hawaii, with the approval of a majority of the Board of Commissioners of Agriculture and Forestry, having held the hearing of

which notice has been duly given as in said Acts provided, do hereby, subject to the existing leases, Set Apart as forest reserves, to be called respectively the Upper Waiakea Forest Reserve and the Upper Oloo Forest Reserve, those certain pieces of government land in the Districts of Hilo and Puna, Island and County of Hawaii, Territory of Hawaii, which may be described roughly as being the block of native forest on the lower slopes of Mauna Loa lying above the agricultural land back of Hilo and to the north and west on the various Oloo homestead subdivisions, and containing, respectively, areas of 51,800 acres and 9280 acres, more or less, more particularly described by and on a map made by the Government Survey Department of the Territory of Hawaii, which said map is now on file in the said Survey Department marked Government Survey Reg. Map No. 1808, and "Upper Waiakea" and "Upper Oloo Forest Reserves," and descriptions accompanying the same, numbered respectively C.S.F. Nos. 2430 and 2476, which said descriptions, now on file in the said Survey Department, are as follows...:

Upper Oloo Forest Reserve.

***Portion of the Government Land of, Oloo, District of Puna,
Island of Hawaii.
C.S.F. No.2476.***

Beginning at the Government Survey Trig. Station "Kulani" (marked by a copper bolt in a concrete post) at the intersection of the lands of Oloo, Keauhou, and Waiakea, as shown on Government Survey Reg. Map No. 1808, and running by true azimuths:

1. 243° 20' 12,694.0 feet along the land of Waiakea;
2. 318° 32' 30" 26,210.0 feet along the Southwest side of Cross Road No. 8 to a point on the Northwest boundary of Lot IV of the Otto Rose Settlement Association Lots;
3. 59° 31' 4492.0 feet along Lots IV and V of the Otto Rose Settlement Association Lots; 4. 149° 31' 3000.0 feet along Lot V of the 27 ½ Mile Tract;
5. 59° 31' 5858.0 feet along Lots V and VI of the 27 ½ Mile Tract;
6. 329° 31' 6000.0 feet along Lots VI and VII of the 27 ½ Mile Tract ;
7. 59° 31' 2950.0 feet along Lots VII, VI and V of the Kilauea Settlement Association Lots and across Wright Road;
8. 329° 31' 1000.0 feet along the Southwest side of Wright Road to the North corner. of Lot IV of the Kilauea Settlement Association Lots;
9. 59° 31' 4356.0 feet along Lots IV, III, II and I of the Kilauea Settlement Association Lots;
10. 149° 31' 30,575.0 feet along the land of Keauhou to the point of beginning.
Area, 9,280 acres.

In Witness Whereof, I have hereunto set my hand and caused the Great Seal of (the Territory of Hawaii to be affixed. (Seal)

DONE at the Capitol in Honolulu, this 13th day of October, A. D. 1913.

E. A. MOTT-SMITH,
Acting Governor of Hawaii.
[Hawaiian Forester and Agriculturalist, 1913:333]

1914
Olaa Forest Park.

REPORT OF THE SUPERINTENDENT OF FORESTRY.

Honolulu, Hawaii July 15, 1914.

Board of Commissioners of Agriculture and Forestry, Honolulu.

Gentlemen:—I have to recommend as follows the creation of a small forest reserve in the Olaa section, Puna district, Hawaii, to be known as the “Olaa Forest Park Reserve.”

The purpose of this project is to preserve for its beauty, its scenic interest and its scientific value the last remaining strip of the heavy native Hawaiian forest along the Volcano road, together with a grove of *koa* trees facing the road at 29 Miles. The former area consists of the untaken Olaa homestead lots bordering the Volcano road, *mauka* of Glenwood, between the twenty-three and the twenty-five mile posts. It is the one place in the Territory where without effort or exertion the visitor to the Islands can still see the dense native forest in its primitive condition.

The Glenwood Forest.

The area proposed to be set apart consists essentially of lots Nos. 363, 364, 277 to 380, and 389 to 391 of the original Olaa Tract homestead subdivision, a total of 374 acres. All of these lots still vest in the government. The majority of them were never taken up. Those that were have since reverted to the Territory. All are covered with heavy forest, consisting of a stand made up principally of large *ohia lehua* trees with a dense undergrowth of ferns, vines and shrubs. The lots named form a solid block across which runs the Volcano road. Adjoining this block are a number of privately-owned lots, on which the forest cover is of like character. It is the intention of the owners of these lots to continue to protect the forest on them. In effect this increases the size of the proposed reserve and insures the perpetuation of a block of forest large enough to maintain itself. [page 278]

The government lots, especially those to the south of the road, are said to be extremely rocky, so that their value for agriculture would at best be but small. On the other hand the forest on these lots makes them, because of their location, of unique value to the Territory.

Ever since the Volcano road was first built, the Hawaiian forest along its course has been one of the most exploited features of the Island of Hawaii. With increasing attention to building up the tourist trade in the Territory it is strictly a business proposition to preserve and develop all places of special scenic attraction. From the tourist point of view the drive from Glenwood to the Volcano is a distinct asset.

“But this forest is not alone of interest from the superficial standpoint of the passing tourist. With the opening up of the surrounding country, it will have increasing scientific interest from a botanical standpoint, while it may also well serve as a refuge for some of the remaining Hawaiian birds.”

These being the objects of the reservation, it is to be regarded as a forest park rather than as a regular forest reserve. But for purposes of administration it can best be handled if set apart under the Board of Agriculture and Forestry.

“The second area proposed to be included in the reserve is located further up the road at 29 Miles, a small block of forest, of seven and a half acres, that I believe should also

be reserved, say as Section B of the Olaa forest park. This is the stand of *koa* trees nearly opposite Mr. W.H. Shipman's mountain place, that was held out of the "Olaa Summer Lots" subdivision as a special "*koa* reserve." This *koa* grove is an interesting feature of the Volcano road. As the trees grow older it will be of interesting value as a part of the park.

Volcano Road Strips.

While this matter is under consideration by the board, I should like to bring forward one more suggestion which may result in increasing the area of the proposed forest park. I bring it up separately, as it involves a question of policy.

When the original Olaa tract was laid out, narrow strips of forest were reserved along the Volcano road between the twelve and the twenty-four mile posts, with the idea of preserving the forest, just as is now proposed on a smaller scale. Unfortunately the strips were not made wide enough. When the land behind them was opened up many of the trees on the strips died. The result was that below about the eighteen-mile post the former "forest reserve" strips are now merely remnants of open land, which are now and for years have been subject to trespass; sources of annoyance to all concerned.

Mauka of the "Peck Road" at eighteen miles there is still a fair [page 279] stand of forest on some of the strips, increasing in density toward and above Glenwood. But even where the native trees have pretty much gone there exists here, should the board deem it wise to take advantage of it, good opportunity for the planting in their stead of introduced trees of suitable species.

At present the government probably has no funds that it would care to use for such work, but in time conditions may so change as to make such planting possible. For this reason it seems to me desirable that these remnants be added to and set apart as portions of the Olaa forest park.

The Board of Agriculture and Forestry has, of course, no authority or control over these strips, nor voice as to their disposition, other than as a matter of general government policy. As concerns those below eighteen miles, my personal recommendation as superintendent of forestry is that they no longer be held for forest purposes, but disposed of under the law, as the Department of Public Lands may see fit, as agricultural land. Below eighteen miles the original forest is gone. The strips there can in my judgment be used to better advantage for agriculture than for tree planting.

I believe it would be good business for the government to clean up in this way what is now an unsatisfactory land muddle.

For the reason set forth I do therefore now recommend that the board approve the project of setting apart as the Olaa forest park reserve the three sections of government land above described, and that the board request the Governor to take the necessary steps to have the lands so set apart.

Very respectfully,

RALPH S. HOSMER,
Superintendent of Forestry.
[Hawaiian Forester and Agriculturalist, 1914:280]

1914

***Proclamation of Forest Reserve In the District of Puna,
Island and County of Hawaii, Territory of Hawaii.***

Under and by virtue of the authority vested in me by the provisions of Chapter 28 of the Revised Laws of Hawaii, as amended by Act 65 of the Session Laws of 1905, and by Act 4 of the Session Laws of 1907, and of every other power me hereunto enabling, I, Lucius E. Pinkham, Governor of Hawaii, with the approval of a majority of the Board of Commissioners of Agriculture and Forestry, having held the hearing of which notice has been duly given as in said Acts provided, do hereby set apart as a forest reserve to be called the Olaa Forest Park Reserve, those certain pieces of government land in the District of Puna, Island and County of Hawaii, Territory of Hawaii, which may be roughly described as the remaining area of government land along the Volcano Road under a stand of heavy Hawaiian forest, and containing an area of 531 acres, more or less, more particularly described by and on maps made by the government survey department of the Territory of Hawaii, which said maps are now on file in the said survey department marked Government Survey Reg. Maps Nos. 2250, 2411 and 2577 and "Olaa Forest Park Reserve," Sections A, B, and C respectively, and descriptions accompanying the same in two parts numbered C.S.F. 2538 and 2544 (the description of Section C, the road strips, appearing directly on Map No. [page 282] 2577), which said descriptions now on file in the said Survey Office are as follows:

***OLAA FOREST PARK RESERVE.
Olaa, Puna, Hawaii.***

Section A.

Including Lots 363, 364, 377, 378, 389, 390, 391, and portions of Lots 379 and 380, of the Olaa Reservation Lots.

C.S.F. No. 2538.

Beginning at the East corner of Lot 365 of the Olaa Reservation Lots (Grant 4345 to E.G. Hitchcock) at the junction of 30-foot side road with the Volcano Road, the coordinates of which point are 47,311.24 feet South and 37,490.65 feet West of Government Survey Trig. Station "Olaa," as shown on Government Survey Registered Map No. 2250, and running by true azimuths:

1. 304° 12' 2975.0 feet more or less across Volcano Road and along the Southwest side of a 30-foot road to a point in middle of old Volcano Road;
Thence along the land of Keaau along the middle of the old Volcano Road, the direct azimuths and distances being:
2. 55° 15' 2720.0 feet more or less;
3. 39° 20' 1477.0 feet more or less;
4. 63° 00' 930.0 feet more or less;
5. 124° 12' 4905.0 feet more or less along the Northeast side of a 30-foot side road, across the Volcano Road to the West corner of Lot 389 of the Olaa Reservation Lots;
6. 214° 12' 1200.0 feet along Lot 1 of the Brughelli Settlement Association lots;
7. 304° 12' 561.0 feet along Right of Purchase Lease No. 155 to Mrs. B. Bergstrom (Olaa Reservation Lots);
8. 249° 45' 976.0 feet along Right of Purchase Lease No. 155 to Mrs. B. Bergstrom (Olaa Reservation Lots);

9. 304° 12' 2689.0 feet along Right of Purchase Lease No. 155 to Mrs. B. Bergstrom (Olaa Reservation Lots) to the Volcano Road;
10. 211° 49' 430.0 feet along the Northwest side of the Volcano Road to the North corner of the Volcano Road and a 30-foot side road;
11. 124° 12' 150.0 feet along the Northeast side of a 30-foot side road to the South corner of Grant 4547;
12. 211° 49' 601.0 feet along Grant 4547 to Mrs. J.C. McStay;
13. 304° 12' 150.0 feet along Grant 4547 to Mrs. J.C. McStay;
14. 211° 49' 400.0 feet along Grant 4547 to Mrs. J.C. McStay along the Northwest side of Volcano Road;
15. 124° 12' 150.0 feet along Grant 4547 to Mrs. J.C. McStay;
16. 211° 49' 200.0 feet along Grant 4547 to Mrs. J.C. McStay;
17. 124° 12' 309.0 feet along Grant 4547 to Mrs. J.C. McStay to the South corner of Grant 4345 to E.G. Hitchcock;
18. 214° 12' 801.0 feet along Grant 4345 to E.G. Hitchcock;
19. 204° 12' 213.0 feet along Grant 4345 to E.G. Hitchcock;
20. 211° 50' 400.0 feet along Grant 4345 to E.G. Hitchcock to the point of beginning; Area, 380 acres, more or less.

Excepting and reserving there from that portion of the Volcano Road passing through this tract (area, 6 acres), leaving a net area of 374 acres, more or less.

SECTION B.

Being the Koa Grove Reservation in the Olaa Summer Lots Subdivision.

C.S.F. No. 2544

Beginning at the West corner of the Volcano Road and Kalanikoa Road, [page 283] the coordinates of which point referred to Government Survey Trig. Station "Kulani" are 34,351.6 feet South and 20,278.6 feet East, as shown on Government Survey Registered Map No. 2411, and running by true azimuths:

1. 50° 98' 310.0 feet along new line of the Volcano Road;
2. 33° 04' 245.8 feet along new line of the Volcano Road;
3. 149° 31' 707.7 feet along the land of Keauhou to an *ohia* post;
4. 239° 31' 525.9 feet along Lot 2, Block C, of the Olaa Summer Lots (Grant 5645 to Thos. E. Cook), to an *ohia* post;
5. 329° 31' 547.6 feet along Kalanikoa Road to the point of beginning. Area, 7 32/100 acres.

AREAS.

Section A-	374	acres
Section B-	7.32	acres
Section C-	<u>150</u>	<u>acres</u>
	531.32	acres

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Great Seal of the Territory of Hawaii to be affixed. Done at the Capitol in Honolulu this 20th day of August, A.D. 1914.

Lucius E. Pinkham
Governor of Hawaii... [Hawaiian Forester and Agriculturalist, 1913:284]

1918
Olaa Forest Reserve.

Honolulu, Hawaii, Nov. 26, 1918.
Board of Commissioners of Agriculture and Forestry, Honolulu.

GENTLEMEN :

I have the honor to recommend the setting apart as a forest reserve of a portion of the government land of Olaa, Puna, Hawaii, consisting of 20,030 acres, more or less, as shown on the attached blueprint map.

The whole area is covered with a heavy forest of native trees such as the *ohia*, *olapa*, *koa*, *loulou* palm and tree ferns with their accompaniment of a heavy undergrowth of ferns and vines and is situated between the Upper Waiakea Forest Reserve on the north, the Upper Olaa Forest Reserve on the west, and Section A of the Olaa Forest Park Reserve and homestead lots on the south. It includes a vast wilderness of heavy forest, situated between the elevations of 1700 and 3800 feet, which is impenetrable except for the roads and trails which have been cut through it.

Over fifteen years ago the tract was surveyed into homestead lots with the idea that they would be settled upon by coffee planters. Coffee cultivation was a failure here owing to the [page 492] shallowness of the soil and other unfavorable factors, and although homesteads have repeatedly been taken up in this region and a lot of money spent in improving them, no one has' been successful in raising any crops.

With this demonstration in view, and with the idea of making some use of the land, four leases have been made during the past two years by the Land Office of a part of the land at the lower or *makai* end, consisting of a total of 8,886 acres, at nominal rentals, with the idea that cattle could be raised on the land. All of these leases are held by Japanese, who are about the only people who will live in this wet region. In connection with one of these leases, the largest, consisting of 8589 acres, portions of the land have been subleased to four other Japanese. These men are making an unsuccessful attempt at raising a few head of scrubby cattle in the forest. At the time the first lease was assigned to a second party in April, 1918. 175 head of cattle were supposed to have been turned over with the lease, but on account of the heavy growth of forest the assignees have been able to find only 100 head.

Recently an application was made for a lease of the balance of this forest land for grazing purposes, but at my request the application has been held up. If further extended grazing is permitted on the land it will, in time, become similar to adjacent lands *makai*—a useless waste of dead trees, fallen logs and Hilo grass. Such a large stretch of forest cannot help but exert a favorable influence on the surrounding climate, and this is of importance to the Olaa Sugar Plantation just below, which suffered from the effects of drought two summers ago.

As stated above, the soil throughout the region for the most part is shallow and is best suited to forest growth. Continued grazing in the region on any scale will in time reduce the forest to a useless waste.

Sufficient land has been left out of the area recommended to be set aside to provide for the need of additional homesteads at the *makai* or lower end where soil conditions are more favorable, and a sufficient area at the high elevation near the upper end, not far from the Volcano House, has been reserved for additional summer lots.

For the reasons above set forth, I recommend that the Board approve the project of creating the Oloo Forest Reserve, as described above, and that the Governor be requested to take the necessary steps toward this end.

Respectfully submitted,
C. S. JUDD,
Superintendent of Forestry. [Hawaiian Forester and Agriculturalist, 1918:493]

Withdrawal of Land From Oloo Forest Park Reserve.

Honolulu, Hawaii, Nov. 27, 1918.

Board of Commissioners of Agriculture and Forestry, Honolulu.

GENTLEMEN:

I have the honor to submit, as follows, a report recommending the withdrawal of 30,000 square feet or 0.69 acres of land from a part of Section C of the Oloo Forest Park Reserve on the Volcano Road above Glenwood, in Oloo, Puna, Hawaii, for the purpose of exchange with Mr. F. G. Snow for an equal area of privately owned forest land in the immediate vicinity which it is desired to include in the above reserve. The two areas, each 200 feet by 150 feet in size, are shown on the attached maps.

This section of the Oloo Forest Park Reserve, which was set aside on August 20, 1914, consists of narrow strips of land, only 150 feet deep, fronting on both sides of the Volcano Road. On some of the homestead lots these reserve strips occupy most of the frontage and in some cases have caused great inconvenience.

In this case, the piece desired by Mr. Snow is opposite his frontage area across the road, and he desires to use it as a driveway between his two opposite lots. There is only a scant covering of dying tree ferns and dead *ohia* trees on this piece, whereas on the piece of equal size which he desires to give the government in exchange, and which is already protected by a fence, there is a heavy forest of *ohia* and tree ferns in good condition.

The government will thus benefit by the exchange and, for this reason, I recommend that the Board approve the withdrawal of the 30,000 square feet and that the Governor be requested to take the necessary further action to perfect the exchange.

Respectfully submitted,
C. S. JUDD, Superintendent of Forestry. [Hawaiian Forester and Agriculturalist, 1918:494]

***Proclamations of Forest Reserve in the District of Puna,
Island and County of Hawaii, Territory of Hawaii.***

Under and by virtue of the authority vested in me by the provisions of Chapter 37 of the Revised Laws of Hawaii of 1915, and of every other power me hereunto enabling, I C.J. McCarthy, Governor of Hawaii, with the approval of a majority of the Board of Commissioners of Agriculture and Forestry, having held the hearing of which notice has been duly given as in said laws provided, do hereby set apart as a forest reserve to be called the Oloo Forest Reserve, subject to existing rights, a portion of that certain piece of government land called Oloo, in the District of Puna, Island and County

of Hawaii, Territory of Hawaii, containing an area of 20,030 acres, more or less, more particularly described by and on maps made by the Government Survey Department of the Territory of Hawaii, which said maps are now on file in the said Survey Department marked Government Survey Reg. Map No. 2250 and "Olaa Forest Reserve" and description accompanying the same number C.S.F. 3026, which said description now on file in said Survey Department, is as follows:

Olaa Forest Reserve.

Portion of the Government Land of Olaa, Olaa, Puna, Hawaii.

C.S.F. 3026

Beginning at the West corner of this reserve, and the North corner of UPPER OLAA FOREST RESERVE, the true azimuth and distance from Government Survey Trig. Station "Kulani" being 243° 20' 12,694 feet, as shown on Government Survey Registered Map No. 2250, and running by true azimuths:

1. 243° 20' 50,151.7 feet along WAIAKEA FOREST RESERVE;
2. 318° 39' 30" 1848.9 feet along government land;
3. 48° 39' 30" 12,070.0 feet along Lots 229 to 214 inclusive, Olaa New Tract, to the West corner of Lot 214;
4. 38° 41' 50.5 feet across Road No. 2, to the North corner of Lot 213, Olaa New Tract;
5. 48° 32' 30" 3010.9 feet along Lots 213 to 210 inclusive, Olaa New Tract, to the West corner of Lot 210;
6. 138° 32' 30" 724.9 feet along Lot 264, Olaa New Tract;
7. 48° 32' 30" 3055.0 feet along Lot 264, Olaa New Tract, and across Road No. 3, to the North corner of Lot 265, Olaa New Tract;
8. 318° 32' 30" 6583.2 feet along West side of Road No. 3 to the North corner of Lot 119A, Olaa New Tract;
9. 48° 32' 33" 18,130.0 feet along Lots 119A, 118, 117, 116, 115, 120, 121, 129 and 130, Olaa New Tract, and across Road No. 6, to the East corner of Lot 53, Olaa New Tract;
10. 318° 32' 30" 3.6 feet along Southwest side of Road No. 6;
11. 302° 21' 5759.2 feet along Southwest side of Road No. 6, to the North corner of Lot 99, Olaa New Tract;
12. 34° 08' 30" 11,016.5 feet along Lots 99 to 85 inclusive, Olaa New Tract;
13. 318° 32' 30" 2998.0 feet along Lot 85, Olaa New Tract;
14. 34° 08' 30" 384.0 feet, more or less, along Northwest side of a road;
15. 304° 12' 5539.0 feet, more or less, across road, and along the Southwest side of a 30-foot road;
16. 214° 12' 1230.0 feet across a 30-foot road, and along Lot 387, Olaa Reservation Lots; [page 505]
17. 304° 12' 2069.0 feet along Lots 380 and 381, Olaa Reservation Lots;
18. 34° 12' 1230.0 feet along OLAA FOREST PARK RESERVE and across a 30-foot road;
19. 304° 12' 3930.0 feet, more or less, along Southwest side of a 30-foot road, to the West corner of said 30-foot road and Volcano Road;

20. Thence along the Northwest side of Volcano Road, the direct azimuth and distance being: 45° 10' 1644.0 feet, more or less;
 21. 149° 16' 602.7 feet along government land;
 22. 88° 00' 573.7 feet along same;
 23. 117° 47' 1244.6 feet along same;
 24. 134° 18' 507.3 feet along same;
 25. 69° 01' 860.7 feet along same;
 26. 87° 39' 911.9 feet along same;
 27. 87° 35' 421.9 feet along same;
 28. 87° 55' 400.2 feet along same;
 29. 57° 22' 424.1 feet along same;
 30. 160° 31' 30" 213.3 feet along same, and across Kilauea Road to the South corner of Lot 2B, Brughelli Settlement Association;
 31. 59° 31' 13,218.0 feet along the Northwest side of Kilauea Road, to the North corner of said Kilauea and Hinano Roads;
 32. 149° 31' 15,000.0 feet along the Northeast side of Hinano Road, and along the Kilauea Settlement Association Lots and UPPER OLAA FOREST RESERVE;
 33. 239° 31' 5858.0 feet along UPPER OLAA FOREST RESERVE;
 34. 329° 31' 3000.0 feet along same;
 35. 239° 31' 4492.0 feet along same;
 36. 138° 32' 30" 26,210.0 feet along UPPER OLAA FOREST RESERVE, to the point of beginning.
- Area, 20,030.0 acres, more or less.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Great Seal of the Territory of Hawaii to be affixed.

Done at the Capitol in Honolulu, this 31st day of December, A.D. 1918.

C.J. McCarthy
 Governor of Hawaii.
 By the Governor:

Curtis P. Iaukea,
 Secretary of Hawaii. [Hawaiian Forester and Agriculturalist, 1918:506]

***Proclamation of Withdrawal of Certain Land From
 the Olaa Forest Park Reserve, District of Puna,
 Island and County Of Hawaii, Territory Of Hawaii.***

UNDER and by virtue of the authority vested in me by the provisions of Chapter 37 of the Revised Laws of Hawaii of 1915, and of every other power me hereunto enabling I, C.J. McCarthy, Governor of Hawaii, with the approval of a majority of the Board of Commissioners of Agriculture and Forestry, having held the hearing of which notice has been duly given all as in said laws provided, do hereby withdraw and eliminate from Section C of the Olaa Forest Park Reserve, in the District of Puna, Island and County of Hawaii, Territory of Hawaii, created and set apart by the Proclamation of the Governor of Hawaii on August 20, 1914, that certain portion of the government land called Olaa, containing 30,000 square feet, in the District of Puna, Island and County of

Hawaii, [page 506] Territory of Hawaii, more particularly described by and on maps made by the Government Survey Department of the Territory of Hawaii, which said maps are now on file in the said Survey Department marked Government Survey Reg. Map No. 2577 and "Territory of Hawaii to F.G. Snow, Portion of the Forest Reserve Between the Volcano Road and Lot 328 of the Oloo Reservation Lots," and a description accompanying the same numbered C.S.F. 3027, which said description now on file in the said Survey Department is as follows:

TERRITORY OF HAWAII TO F.G. SNOW,

Portion of the Forest Reserve between the Volcano Road and Lot 328, of the Oloo Reservation Lots, Oloo, Puna, Hawaii.

C.S.F. 3027.

Beginning at the South corner of this piece, on the Northwest side of Volcano Road, said point being 214° 12' 660.8 feet from the North corner of Volcano Road and a 30-foot side road, the coordinates of said point of beginning referred to Government Survey Trig. Station "Oloo" being 42,654.0 feet South and 34,468.3 feet West, as shown on Government Survey Registered Map No. 2577, and running by true azimuths:

1. 124° 12' 150.0 feet along Forest Reserve (government land);
2. 214° 12' 200.0 feet along Lot 328, Oloo Reservation Lots;
3. 304° 12' 150.0 feet along Forest Reserve (government land);
4. 34° 12' 200.0 feet along Volcano Road to the point of beginning.
Area, 30,000 square feet.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Great Seal of the Territory of Hawaii to be affixed.

Done at the Capitol in Honolulu, this 31st day of December, A.D. 1918.

C.J. McCarthy
Governor of Hawaii.

By the Governor:
Curtis P. Iaukea,
Secretary of Hawaii. [Hawaiian Forester and Agriculturalist, 1918:507]

Pu'u Kūlani and Vicinity Described in 1919

Botanist, Joseph Rock described the make up of the forest around Pu'u Kūlani, as it existed in 1919. Interestingly, at that time, he called for fencing as a means of protecting the unique biological system from depredation of wild cattle and pigs:

One Government Forest Reserve Lands at Kulani, Hawaii, Described.
By Joseph F. Rock, Consulting Botanist.

The whole forest reserve area at Kulani, Hawaii, is covered with a decidedly uniform and, geologically speaking, rather young forest. The border below 29 Miles contains more of a mixture of trees than the area further up toward Kulani proper. Near 29 Miles we find that trees are more numerous, especially *ohia* lehuas with occasional *mana* [*maua*] trees, *Xylosma Hillebrandii*, of which the writer encountered large individuals.

Dispersed throughout that region is a very beautiful native fan palm with large orbicular fruits described by the writer as a new species under the name of *Pritchardia Beccariana*. *Olapa*, *Cheirodendron*, *Gaudichaudii*; an occasional *aiea*, *Nothocestrum*; *kopiko*, *Straussia*; *olomea*, *Perrottetia*; *pilo*, *Coprosma*; and *manono*, *Gouldia*, form the rest of the arborescent growth.

The forest is, however, mainly a tree-fern forest interspersed with an occasional tree of the species mentioned. An acre of this forest land may contain perhaps five or six mature trees, of which four may belong to the genus *Metrosideros* (*ohia lehua*). The remainder is all tree ferns composed of the two common types—*Cibotium Chamissoi* and *Cibotium Menziesii*. Undergrowth is mainly composed of *Cyrtandrae*, *Broussaia*, [page 39] *Cyanea tritomantha*, *Cyanea pilosa*, *Rubus*, *Phyllostegia*, etc. Ferns are of course very numerous. The whole forest is in splendid condition, but the undergrowth is much disturbed by the ravages of wild pigs. The uniformity of the forest makes exploring rather uninteresting for a botanist.

Kulani proper is a densely wooded volcanic cone, the forest being exceedingly uniform and of the rain forest type. Palms are entirely absent. A gap was cut at the summit to permit a view of the surrounding region. The land toward Keauhou lies considerably lower than that over which Kulani was approached, or, in other words, the slopes of Kulani towards Keauhou are rather steep, giving the cone quite a formidable appearance both in height and size. The summit appears as two cones, but in fact the central valley or ridge, densely wooded, is nothing but an ancient volcanic fissure dividing the cone in two. The ground is covered with fallen trunks of both trees and tree-ferns which are covered with numerous epiphytes such as ferns *Stenogyne*, *Clermontia parviflora*, *Astelia veratroides*, *Selagruella*, *Lycopodium*, etc. The soil is mostly black loam, and the ground quite hummocky, which, besides fallen trunks and the absence of a trail, made progress quite slow. If properly fenced and protected from cattle and wild hogs, this forest reserve is certainly one of the finest on Hawaii, and deserves protection from cattle and hogs. [Hawaiian Forester and Agriculturalist, 1919:40]

The Waiākea Forest Lands

Following the development of the Hilo Forest Reserve in 1904, and the addition of portions of the Ōla'a Tract to the reserve system in 1905 and 1913, the board also set aside the upland portions of Waiākea as a reserve. Thus, making a contiguous line of forest across the Hilo District, and adjoining the Puna District. The following documents are among those recorded as a part of the dedication of the Waiākea forest lands to the reserve system.

Honolulu, June 6, 1913.

The Upper Waiakea Forest Reserve.

Reports of the Superintendent of Forestry.

Gentlemen:—

I have the honor to submit as follows the recommendation that a forest reserve be created to cover the central forested portion of the government land of Waiakea, district of Hilo, island and county of Hawaii:

Location, Object and Area.

Waiakea is a large government land stretching from the sea at Hilo bay well up on the slopes of Mauna Loa. Much of the lower portion is in cane; the extreme upper part is more or less open grazing land, crossed by lava flows. Between is a section of heavy forest. The present recommendation is that the forested portion be set apart as a forest reserve, with the objects (1) of bringing the land under the management of the department of the Territory especially equipped to care for it, so that (2) it may be

wisely administered in any way not inconsistent with its maintenance as a forest that may in the future be deemed best. [page 302]

Owing to the geological formation of the island of Hawaii there are no running streams south of the 1855 and 1881 lava flows that come down the side of Mauna Loa back of Hilo town on lands lying immediately to the north of Waiakea. It is quite possible that springs and water holes may later be discovered in the Waiakea forest; for at present almost nothing is known accurately about the interior of this tract; but there are no running streams coming from it.

The question of stream protection does not, therefore, figure on Waiakea, but there are other reasons why it is important that existing areas of forest should receive the care and protection of the government. Until many more scientific data than are now available have been collected, it is impossible to tell how far-reaching may be the influence exerted on the country immediately surrounding large bodies of continuous forest, but it is evident that such influence does exist and that it is beneficial. Particularly is this true in the tropics and sub-tropics.

Further, on Waiakea it may happen that in time the question may arise of devoting portions of this forest to commercial utilization. To safeguard the interests of the government in all these ways and to be ready for any sort of development that may come about, it is desirable that the Waiakea forest become the Waiakea forest reserve.

The area proposed to be set apart is 51,800 acres. Of this 600 acres is a part of the land of Piihonua, a remnant mainly covered with lava, between the boundaries of the Hilo forest reserve and Waiakea. Piihonua is now under lease No. 103 to Hon. John T. Baker, expiring on March 21, 1921.

At the present time all of the land of Waiakea is under an expiring 30-year lease to the Waiakea Mill Co. (No. 124) that runs out on June 1, 1918. No use is at present made of the forest. Beyond the general clause against waste, common to the leases of that time, the lessees are not obligated to protect the forest.

The forest on Waiakea is practically unexplored region. It is a dense stand of the rain-forest type. *Ohia-lehua* is the predominating tree. Along its lower side, where the forest is crossed by the Olaa flume, are numerous groups of *loulou* palms, growing in company with great tree ferns. And throughout, so far as the interior is known, there is a dense stand of the undergrowth characteristic of this type of Hawaiian forest.

Boundaries.

The upper and lower boundaries of the proposed Upper Waiakea forest reserve have been somewhat arbitrarily fixed by drawing lines across the land from known points on the outside boundaries, but it is believed that they serve the purpose at this time as well as if they had been run out on the ground. The *makai* line very nearly parallels the flume constructed to carry water [page 303] from upper Kaumana to the Olaa plantation. The upper line leaves out of the reserve the area suitable for grazing above the native forest.

The elevation of the *makai* boundary is approximately 1800 feet; that of the *mauka* line varies from 5000 feet at Puu Kulani to 4500 feet at the 1855 lava flow, where the proposed reserve joins and forms a continuation of the existing Hilo forest reserve.

Description.

A technical description of the boundary, prepared by the Government Survey Office as C.S.F. 2430, accompanies this report.

Recommendations.

For the reasons above set forth I do now recommend that the Board approve this project and call upon the governor of the Territory to set apart this government land as a forest reserve to be known as the Upper Waiakea forest reserve.

Very respectfully,

RALPH S. HOSMER

Superintendent of Forestry. [Hawaiian Forester and Agriculturalist, 1913:304]

1913

Proclamation of Forest Reserves in the Districts of Hilo and Puna, Island and County of Hawaii, Territory Of Hawaii.

UNDER and by virtue of the authority vested in me by the provisions of Chapter 28 of the Revised Laws of Hawaii, as amended by Act 65 of the Session Laws of 1905, and by Act 4 of the Session Laws of 1907, and of every other power me hereunto enabling, I, Ernest A. Mott-Smith, Acting Governor of Hawaii, with the approval of a majority of the Board of Commissioners of Agriculture and Forestry, having held the hearing of which notice has been duly given as in said Acts provided, do hereby, subject to the existing leases, SET APART as forest reserves, to be called respectively the Upper Waiakea Forest Reserve and the Upper Oloo Forest Reserve, those certain pieces of government land in the Districts of Hilo and Puna, Island and County of Hawaii, Territory of Hawaii, which may be described roughly as being the block of native forest on the lower slopes of Mauna Loa lying above the agricultural land back of Hilo and to the north and west on the various Oloo homestead subdivisions, and containing, respectively, areas of 51,800 acres and 9280 acres, more or less, more particularly described by and on a map made by the Government Survey Department of the Territory of Hawaii, which said map is now on file in the said Survey Department marked Government Survey Reg. Map No. 1808, and "Upper Waiakea" and "Upper Oloo Forest Reserves," and descriptions accompanying the same, numbered respectively C.S.F. Nos. 2430 and 2476, which said descriptions, now on file in the said Survey Department, are as follows:

UPPER WAIAKEA FOREST RESERVE

Portions of the Government lands of Piihonua and Waiakea,
District of Hilo, Island of Hawaii.
C.S.F. No. 2430.

Beginning at the Government Survey Trig. Station "Kulani" at the intersection of the lands of Oloo, Keauhou, and Waiakea, as shown on Government Survey Reg. Map No.1808, and running by true azimuths:

1. 162° 58' 56,790 feet, more or less, along the land of Waiakea to a point at lower Mawae, near a small island in lava flow; [page 332]
2. Thence along the HILO FOREST RESERVE along edge of lava flow of 1855 to the Northwest corner of the Land of Punahoa 2nd, the direct azimuth and distance being: 256° 27' 33,580.0 feet, more or less;
3. 341° 00' 7000 feet, more or less, along the land of Punahoa 2nd;
4. 93° 20' 5230.0 feet, more or less, along the land of Kaumana;
5. 1° 00' 640.0 feet, more or less, along the land of Kaumana;
6. 29° 30' 2750 feet, more or less, along the land of Kukuau 2nd;

7. 350° 00' 1150 feet, more or less, along the land of Kukuau 1st to a point a little South of the lower end of a small branch of the lava flow of 1855 at a place called Kapualei;
 8. 285° 30' 24,500 feet, more or less, along the land of Kukuau 1st;
 9. 309 ° 21' 26,710.0 feet, more or less, across the land of Waiakea to the North corner of Lot 232 of the Olaa New Tract Lots ;
 10. 63° 20' 62,845.7 feet, more or less, along the Olaa New Tract Lots, and the Land of Olaa to the point of beginning.
- Area, Waiakea, 51,200 acres; Piihonua, 600 acres. Total area, 51,800 acres...
[Hawaiian Forester and Agriculturalist, 1913:333]

In 1923, the boundaries of the Upper Waiakea Forest Reserve were modified, by survey of 1922, and recorded in C.S.F. 3876:

C.S.F. 3876
Upper Waiakea Forest Reserve,
South Hilo, Hawaii.
(revised)

June 13, 1922

Including the upper portion of the land of Waiakea [see *Figure 3*].

Beginning at "Kulani", a Government Survey Triangulation Station, at the South corner of the land of Waiakea and the Northwest corner of the land of Olaa, and on the East boundary of the land of Keauhou, and running by true azimuths:—

1. 133° 18' 05" 19346.9 feet along the land of Keauhou to a spike in large upright stone near Kipu Hill;
 2. 159° 33' 17" 49478.2 feet along the lands of Keauhou and Humuula to "Kahiliku Boundary" Point;
 3. 288° 24' 33" 15744.0 feet along the land of Piihonua to "Mawae" Trig. Station;
 4. 271° 41' 28484.0 feet along same;
 5. 4° 33' 30" 535.0 feet along the land of Kaumana;
 6. 52° 30' 2750.0 feet along the land of Kukuau 2nd;
 7. 340° 25' 1150.0 feet along the land of Kukuau 1st;
 8. 284° 51' 27258.0 feet along same;
 9. 308° 23' 24802.0 feet along Waiakea Forest Reserve;
 10. 63° 20' 62845.7 feet along Olaa and Upper Olaa Forest Reserves to the point of beginning.
- Area 63,150 Acres.

Excepting and Reserving there from the following Tracts or parcels of land, to-wit:—

Part 1, Portion of Waiakea. Beginning at a point called "Kahiliku Boundary", on the boundary of Humuula, Waiakea and Piihonua, the direct azimuth and distance of said point of beginning from Government Survey Trig. Station "Puu Oo" being 355° 40' 55" 16092.7 feet, and running by true azimuths:—

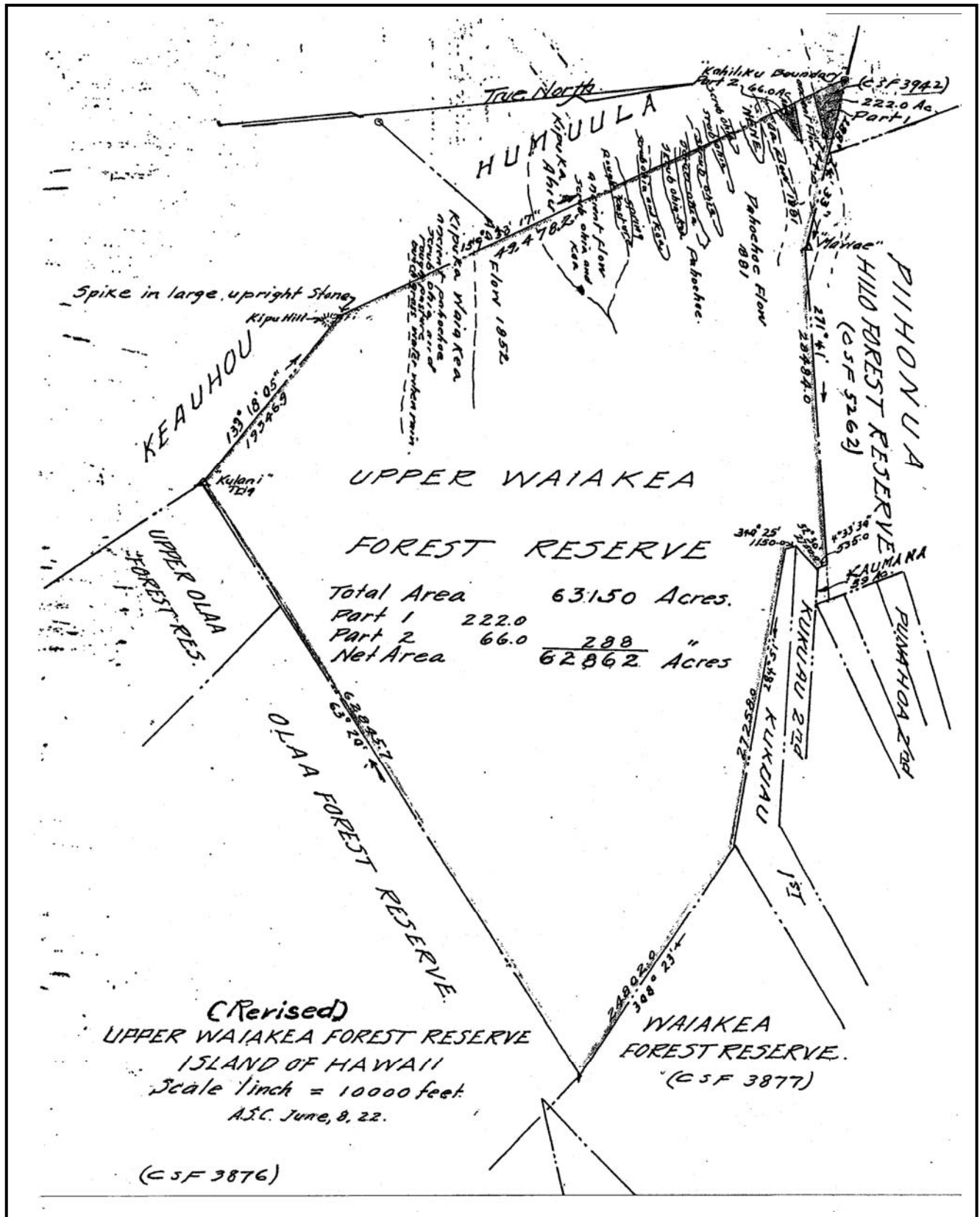


Figure 3. Plan of the Upper Waiakea Forest Reserve; C.S.F. 3876 Hawaii Territorial Survey, 1922)

1. 288° 24' 33" 7500.0 feet along Piihonua;
2. 83° 00' 6005.0 feet;
3. 159° 33' 17" 3309.0 feet along Humuula-Waiakea boundary to the point of beginning.

Area 222-00/100 Acres.

Part 2. Portion of Aina Hou Kipuka in Waiakea. Beginning at a point on the Humuula-Waiakea boundary, the coordinates of said point of beginning referred to Government Survey Trig. Station "Puu Oo" being 21021.4 feet South and 3081.3 feet East, and running by true azimuths:—

1. 268° 00' 3500.0 feet;
2. 59° 00' 3370.0 feet;
3. 159° 17' 33" 1725.0 feet to the point of beginning.

Area 66-00/100 Acres.

LEAVING A NET AREA OF 62,862 ACRES.

Compiled from Gov't. Survey Records & Survey of E.W. Hockley, by A.S. Chaney, Assistant Government Surveyor. [State Survey Division]

[See also Plat 788; R.M. 2682, Dated Jan. 3, 1923; and C.S.F. 2430, 3942, 9193, 16633, 21210-21213.]

The Hawaii National Park, taking in portions of Keauhou and neighboring lands in Puna, was established on August 1st, 1916. In 1926, an addition to the park, connected the Kīlauea and Mauna Loa Sections of the park (C.S.F. 4625, State Survey Division). In 1928, the Kilauea Forest Reserve, comprised of a portion of Keauhou, adjoining the 'Ōla'a and Waiākea Forest Reserve lands was established, thus extending the forest reserve tracts from Hilo, through Puna, and into Ka'ū (C.S.F. 4842) (*Figure 4*). While the land of Keauhou had been leased out to ranching interests since 1860, some control over the cattle had been maintained. The leases specifically stipulated that care would be taken of the forest resources (Bureau of Conveyances Liber 13:56-57). Apparently, based on the early records of the reserve, only minimal intrusion by wild stock into the denser 'Ōla'a-Waiākea forests occurred.

Following establishment of the 'Ōla'a, Waiākea and Kīlauea Forest Reserves, management of the lands and forest resources fell under the jurisdiction of the Territory, and then the State of Hawai'i. During the years from establishment of the reserves to the 1950s, little work occurred within the deep reserves. Some fencing along leasehold boundaries occurred, and cattle continued to be moved on the upper Humu'ula and Keauhou sections of the adjoining lands. Hunting wild cattle and pigs in the reserve lands and neighboring ranch lands was almost entirely limited to ranch hands, territorial game wardens and personnel, and the occasional poacher. It was not until after World War II ended that the Territorial Fish and Game Division began a program of conducting guided hunting trips, and developing camps from which hunters could access the public lands for hunting pigs in the region—this being a way to control damage done to the forest reserve resources.

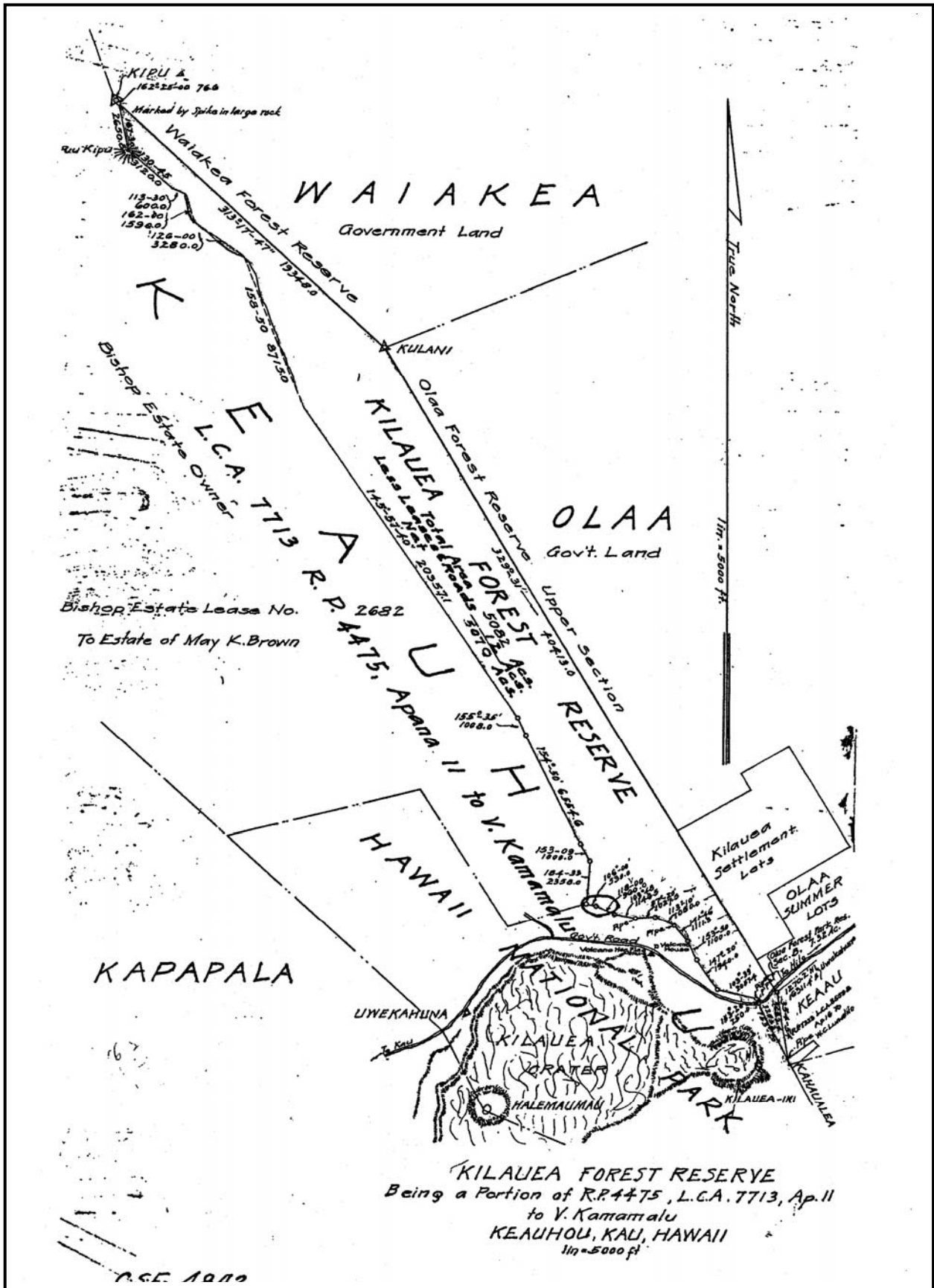


Figure 4. Plan of Kilauea Forest Reserve; C.S.F. 4842 (Hawaii Territorial Survey, 1927)

The “Kulani Prison Farm”

One additional activity began in the forest lands in the 1940s, in the vicinity of what is now the Pu‘u Maka‘ala NAR. This was the relocation of the Waiakea Prison Camp from the Hilo Airport to the remote, Kūlani site. Howard Ellis, former employee and manager of the Mauna Loa Weather Station, began working on Mauna Loa in 1961. During the early years on Mauna Loa, Mr. Ellis was close friends with Tom Vance, who opened the Kūlani Prison Farm (later, the Kulani Honor Camp); the access roadway (Stainback Highway); and the Mauna Loa Observatory.

Government survey records document that on January 8, 1948, the lands for the Kulani Prison Site were confirmed by the survey below (*Figure 5*):

C.S.F. 10,543

January 8, 1948

Kulani Prison Site

South Hilo and Puna Island of Hawaii

Being portions of Upper Waiakea Forest Reserve and Upper Oiaa Forest Reserve to be withdrawn by Governor’s Executive Order and set aside under the control of the Board of Institutions as a prison site.

Being portions of the Government (Crown) lands of Waiakea and Oiaa.

Beginning at the Government Triangulation Station “Kulani” and on the common boundary of the lands of Keauhou, Waiakea and Oiaa as shown on Government Survey Registered Map 2765, and running by azimuths measured clockwise from True South:-

1. 133° 18’ 05” 5000.00 feet along the land of Keauhou;
2. 180° 00’ 7500.00 feet along portion of the Upper waiakea Forest Reserve;
3. 90° 00’ 3400.00 feet along the Upper Waiakea Forest Reserve;
4. 159° 33’ 30” 9600.00 feet along Upper Waiakea Forest Reserve;
5. 105° 40’ 4500.00 feet along Upper Waiakea Forest Reserve;
6. 156° 10’ 6410.70 feet along Upper Waiakea Forest Reserve;
7. 249° 33’ 3247.00 feet along Upper Waiakea Forest Reserve;
8. 336° 10’ 3849.20 feet along Upper Waiakea Forest Reserve;
9. 285° 40’ 7500.00 feet along Upper Waiakea Forest Reserve;
10. 339° 33’ 30’ 5500.00 feet along Upper Waiakea Forest Reserve;
11. 285° 52’ 11493.30 feet along Upper Waiakea Forest Reserve;
12. 360° 00’ 800.00 feet along Upper Waiakea Forest Reserve;
13. 56° 11’ 30” feet along Upper Waiakea Forest Reserve;
14. 360°00 19300.00 feet along portions of the Upper Waiakea and Upper Oiaa Forest Reserves;
15. 149° 31’ 9000.00 feet along the land of Keauhou to the point of beginnig.

Area 5,600 Acres. [State Survey Division]

Governor Ingram M. Stainback, issued Executive Order No. 1224 on March 4th, 1948, formally removing the Kulani Prison site lands from the Upper Waiakea and Oiaa Forest Reserves, and setting aside the land for use by the Department of Institutions for the Kulani Prison Farm (Governor’s Executive Order No. 1224).

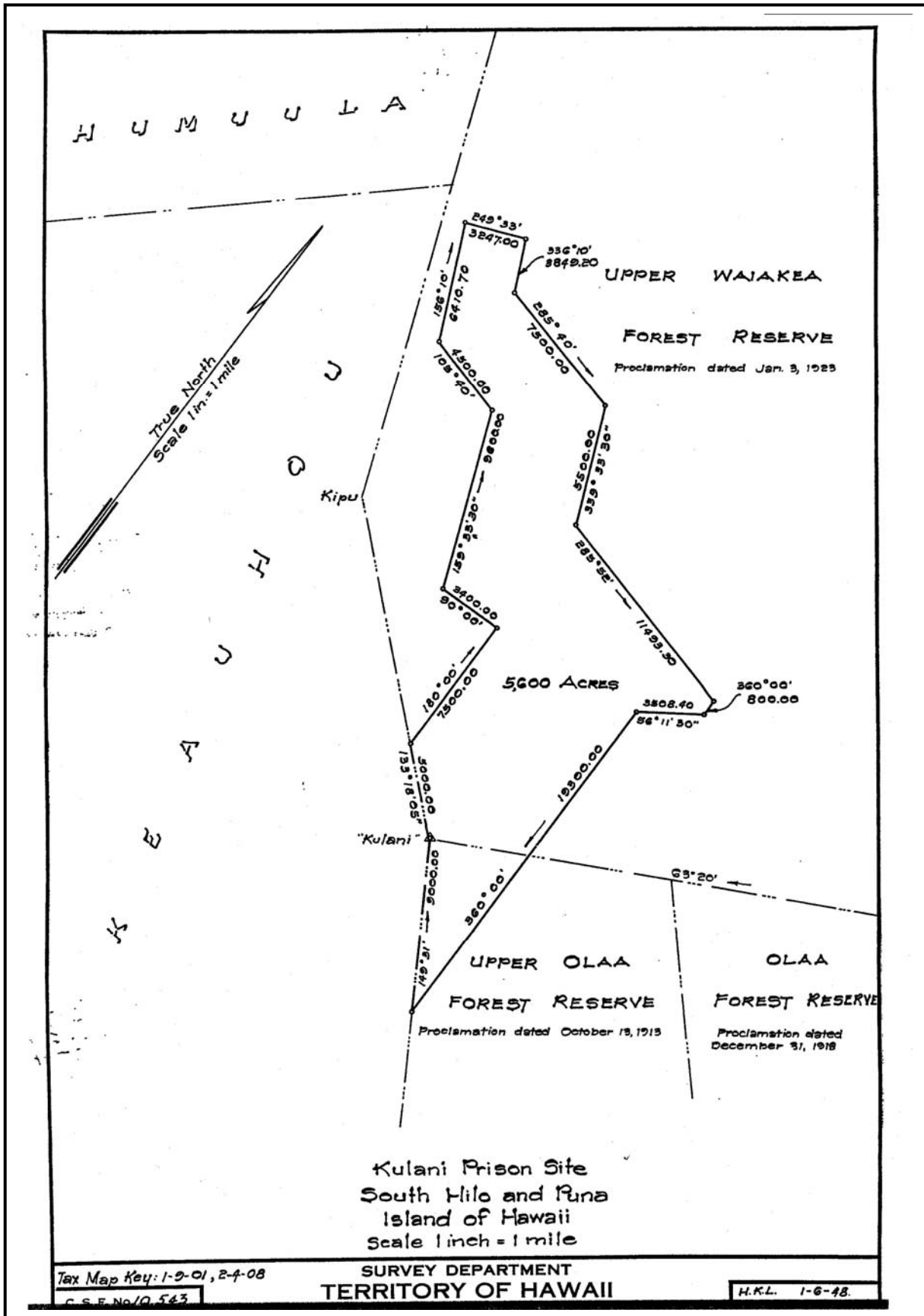


Figure 5. C.S.F. Map No. 10,543; The Kulani Prison Site (January 8, 1948)

In 1952, the Kulani Prison Farm site was modified, taking in an additional 4,461.99 acres of forest land from the Upper Waiakea and Olaa Forest Reserves. C.S.F. No. 11,550 lays out the mete and bounds and map of the addition (see *Figure 6*). Governor, S.W. King. Sigid Executive Order No. 1588, on October 16th, 1953, setting aside the additional land for the facility and support programs.

From Tom Vance, Howard Ellis learned first-hand accounts about the Kūlani facility and access across the forest lands in the 1940s to 1950s (pers comm. H. Ellis, 2004). *Figure 7*, HTS Plat No. 788-A (A.S. Chaney, surveyor, dated 1922); with additions to 1956, provides the locations of sites and facilities described by Mr. Ellis, who wrote of his recollections in 1988:

In 1951, a weather station was set up by the Weather Bureau (WB) near the summit of Mauna Loa... An instrumented building was dedicated there as the Mauna Loa Observatory on December 12. [page 1] On June 28, 1956, a larger building at 11,150 feet was dedicated as the Mauna Loa Slope Observatory, which in time became known as the Mauna Loa Observatory...

Mr. Tom Vance came... to Hawaii to teach school in the 1930s... On an early hike over the trail from Puu O'o across the lower slopes of Mauna Loa on the Hilo side to the Volcano area, he dreamed that some day he would be in a position to cause the great resources he found along the trail to be utilized. He found "great ash [page 2] deposits of deep fertile soil and beautiful stands of *koa* trees, many of which were falling to the ground and slowly rotting away."

Mr. Ingram M. Stainback, a prominent attorney in the islands...helped Mr. Vance establish the Waiakea Prison Camp near Hilo for the purpose of forming an airstrip by hand labor using only picks, shovels and wheelbarrows.

When the war started, the military took over this airstrip, expanding it, making it a Navy Air Station only to realize that virtually in its center there was a prison camp... [page 3] With concern for their safety and with his philosophy that if any person is to be retrained to function in society he must be given constructive work and a chance to learn a trade, he set his sights up the slope in the direction of the summit of Mauna Loa to that area where he had seen that rich soil and huge *koa* trees. It was a long way off and partly through a rainforest. They started out packing in with each cutting the trail with a cane knife.

[Mr. Vance] ...said that people thought him crazy to do this... They finally made it to the base of the Kulani Cone where the Territorial Board of Agriculture had come in from the other side, up the Puu O'o trail from the Volcano area, and built a pig hunter's cabin to encourage the reduction of damage to the forest by pigs.

Mr. Vance had found that the territorial government's half million acres in the area they had cut through were ideal not only for forests, which could foster a lumber and furniture industry, but the mile high area provided a climate ideal for temperate zone agriculture.

He felt that as soon as the prison industry was thought to be competitive with private industry, there would be a legislation that would be passed to stop the activity. However, they [page 4] might be safe in their isolation up there, he thought. There were 17 miles of road to be built through dense jungle with little likelihood of special appropriations since it was during war time.

He began by sledding in supplies a short distance, establishing camp, working the road back down, and repeating these steps over again. Mr. Stainback had now been appointed Governor of the Territory and when the commander of the U.S. Navy

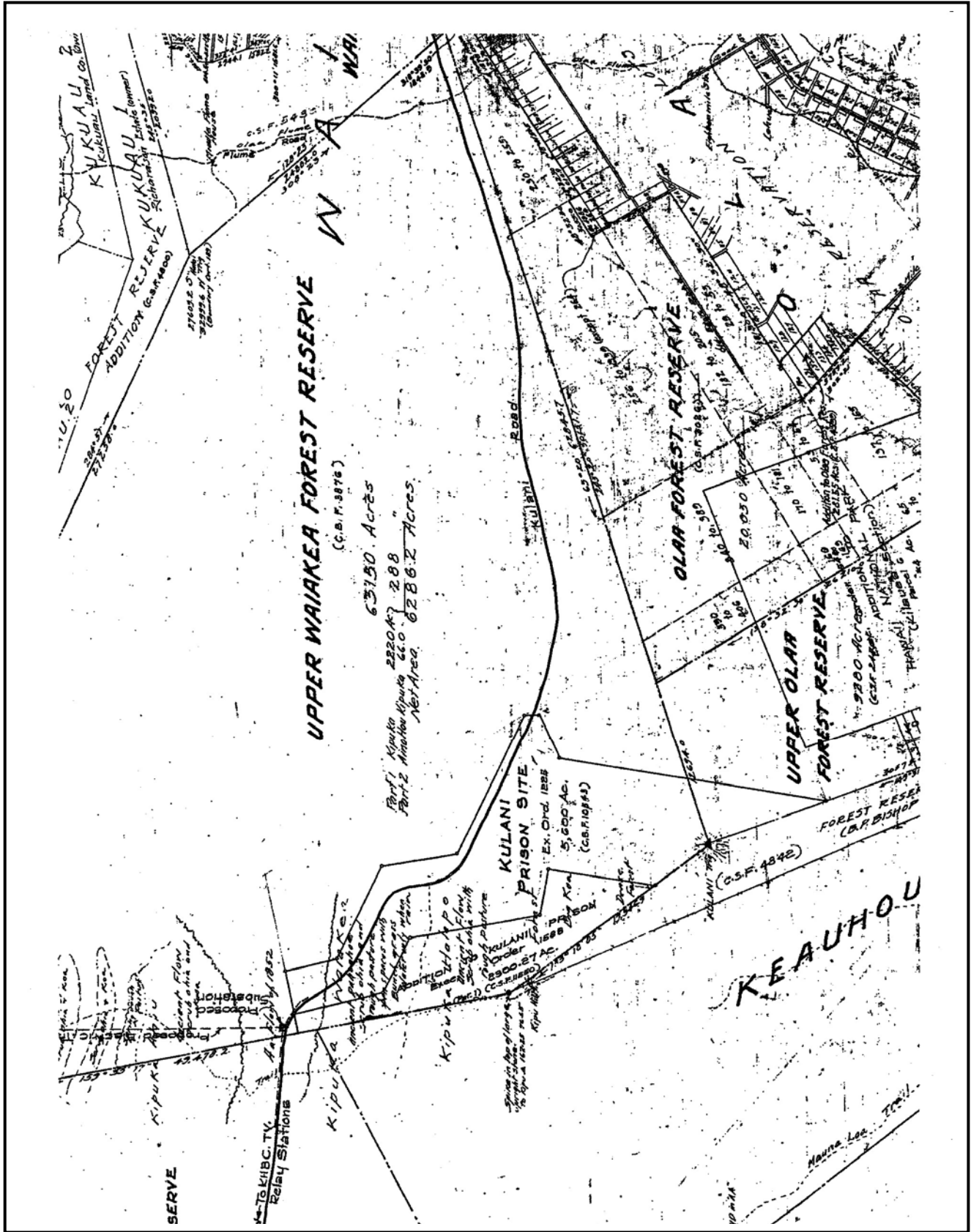


Figure 7. Portion of HTS Plat No. 788-A, Depicting Features and Boundaries of the Kulani Prison Site (A.S Chaney, 1922; additions to 1956)

Seabees requested the use of land for practice in road building to be soon used in the war on Pacific islands and in jungles, he knew just where to send them.

Things were going great for about three miles when a big *ohia* tree fell on a bulldozer operator. He might have died but the prisoners quickly wrested the big trunk away. The Seabees gave up, but Mr. Vance didn't.

When the immediate threat of enemy landings on the island subsided, some portable barracks that had been used by guard units at various places around the island were left surplus. Mr. Vance obtained and used some of these for his camps as he continued to push up further toward Kulani.

He had many plans and tried to tie them all together. He planned a road all the way to the summit of Mauna Loa with a median strip where he thought all the plants of the world could [page 5] find a supporting climate³. It was to be called the "Gardens of the World." The road was named "Stainback Highway," leaving it open for later jokes about "Strainback Highway."

The reason Mr. Vance gave for choosing Mauna Loa was the resources of the Kulani area. Since Mauna Kea, at any given elevation above 6,000 feet is about five times smaller in area than Mauna Loa, and being of almost equal height, it is easier to see. With great pride, he pointed out how he had laid out the road in several places above Kulani so as to frame Mauna Kea with his great *koa* trees on both sides of the road. His pride was indeed justified because such an effect accentuated the majesty [page 6] of Mauna Kea and with a snow-covered top the view was truly breathtaking.

Mauna Loa, with its almost constant and gentle slope all the way from Hilo to the summit, made road building alluring. Drainage ditches along the roadside were not required in the lava fields since there was good natural drainage.

The fact that Mauna Loa had erupted about every ten years since records had begun and that there was no record, legend, or evidence obvious to the average person that Mauna Kea had ever erupted did not disfavor the selection of Mauna Loa. Indeed, providing public access for viewing future eruptions was an added attraction... [H. Ellis, 1988:7]

Ellis' narrative also describe the further development of the road from Kūlani to Mauna Loa. By 1949, the road extended nine miles above Kūlani. Mr. Vance's lead man on the project was the late Henry Auwae (a noted Hawaiian healer), who at the time, was employed at Kūlani as an instructor (Ellis 1988: 11). The Kūlani-Mauna Loa was completed by late 1949, and was used as the route of access to the Mauna Loa summit region until 1963 (Ellis, 1988:15).

Another important part of the program at the Kūlani facility has been its' wood workshop and sales venture. For years, inmates have collected native hardwoods from lands around the facility, and turned it into art and utilitarian items for sale. A part of the income goes to the benefit of the inmates themselves, and provides them with a trade skill.

The 1942 Lava Flow Natural Area Reserve

In 1972, Governor Ariyoshi signed Executive Order No. 2720, establishing one of the early Natural Area Reserves in the islands, it being the 1942 Lava Flow Natural Area Reserve. Land for the 640 acre reserve was withdrawn from the older Waiakea Forest Reserve (by Executive Order No. 2719), and described as:

***C.S.F. 16,634
May 26, 1972***

1942 LAVA FLOW NATURAL AREA RESERVE

Waiakea, South Hilo, Island of Hawaii, Hawaii

Being a portion of the Government (Crown) Land of Waiakea.

Beginning at the west corner of this parcel of land, the direct azimuth and distance from Government Survey Triangulation Station "E 1942 FLOW" being 149° 15' 2035.00 feet, and the coordinates of said point of beginning referred to Government Survey Triangulation Station "KULANI" being 41,481.42 feet North and 18,229.29 feet East, thence running by azimuths measured clockwise from True South:—

1. 228° 46' 5,280.00 feet along Upper Waiakea Forest Reserve, Governor's Proclamation dated January 3, 1923;
2. 318° 46' 5,280.00 feet along Upper Waiakea Forest Reserve, Governor's Proclamation dated January 3, 1923;
3. 48° 46' 5,280.00 feet along Upper Waiakea Forest Reserve, Governor's Proclamation dated January 3, 1923;
4. 138° 46' 5,280.00 feet along Upper Waiakea Forest Reserve, Governor's Proclamation dated January 3, 1923 to the point of beginning and containing an AREA OF 640 ACRES...

The formal designation of the 640 acre reserve was authorized by Governor's Executive Order No. 2720, dated December 2nd, 1974.

The Pu'u Maka'ala Natural Area Reserve

The Pu'u Maka'ala Natural Area Reserve is made up of lands that were originally set aside in the early 1900s as a part of the territorial government's resource conservation program. In 1970, Hawai'i became one of the first states in the country to designate unique natural resources as a part of a system of Natural Area Reserves. In accordance with State Law, the NARS are mandated to "preserve in perpetuity specific land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites, of Hawaii" (HRS 195-1).

In 1981, as a part of the ongoing program to designate unique natural systems as Natural Area Reserves, selected lands of the 'Ōla'a Forest Reserve were withdrawn from reserve. Those lands are described in the following notes of survey:

C.S.F. 18,636
WITHDRAWAL
PORTION OF OLAA FOREST RESERVE [Figure 8]
(Governor's Proclamation dated December 31, 1918)
Olaa, Puna, Island of Hawaii, Hawaii
Withdrawn by E.O. 3095 dated Nov. 2, 1981
(E.O. Folder 67-A)

STATE OF HAWAII
SURVEY DIVISION
DEPT. OF ACCOUNTING AND GENERAL SERVICES
HONOLULU
May 4, 1979

WITHDRAWAL
PORTION OF OLAA FOREST RESERVE
(Governor's Proclamation dated December 31, 1918)
Olaa, Puna, Island of Hawaii, Hawaii

Being portion of the Government (Crown) Land of Olaa.

Beginning at the west corner of this parcel of land, on the boundary between the lands of Waiakea and Olaa, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KULANI" being 5,697.06 feet North and 11,343.77 feet East, thence running by azimuths measured clockwise from True South:—

1. 243° 20' 24,906.00 feet along Upper Waiakea Forest Reserve (Governor's Proclamation dated January 3, 1923), along the boundary between the lands of Waiakea and Olaa.
2. Thence along the contour line 3000 feet above mean sea level, along the remainder of Olaa Forest Reserve (Governor's Proclamation dated December 31, 1918), the direct azimuth and distance being: 353° 48' 52" 15,913.31 feet;
3. 302° 21' 10" 1100.00 feet along the remainder of Olaa Forest Reserve (Governor's Proclamation dated December 31, 1918);
4. 302° 21' 10" 4257.80 feet along Lots 129, 128, 127, 126 and 125, Olaa New Tract Lots;
5. 48° 32' 30" 3057.06 feet along Lot 135-B, Olaa New Tract Lots and along the northwest end of Roadway (50.00 feet wide);
6. 302° 21' 10" 1506.52 feet along the southwest side of Roadway (50.00 feet wide);
7. 34° 08' 30" 7462.10 feet along Lots 99, 98, 97, 96, 95, 94, 93, 92, 91, 90-B and 90-A, Olaa New Tract Lots;
8. 149° 31' 17,853.54 feet along Hawaii Volcanoes National Park, Parcel 6 (Governor's Executive Order 1540);
9. 59° 31' 10,104.01 feet along Hawaii Volcanoes National Park, Parcel 6 (Governor's Executive Order 1540);
10. 138° 32' 30" 8347.71 feet along upper Olaa Forest Reserve (Governor's Proclamation dated October 13, 1913) to the point of beginning and containing an AREA OF 6871 ACRES, MORE OR LESS...

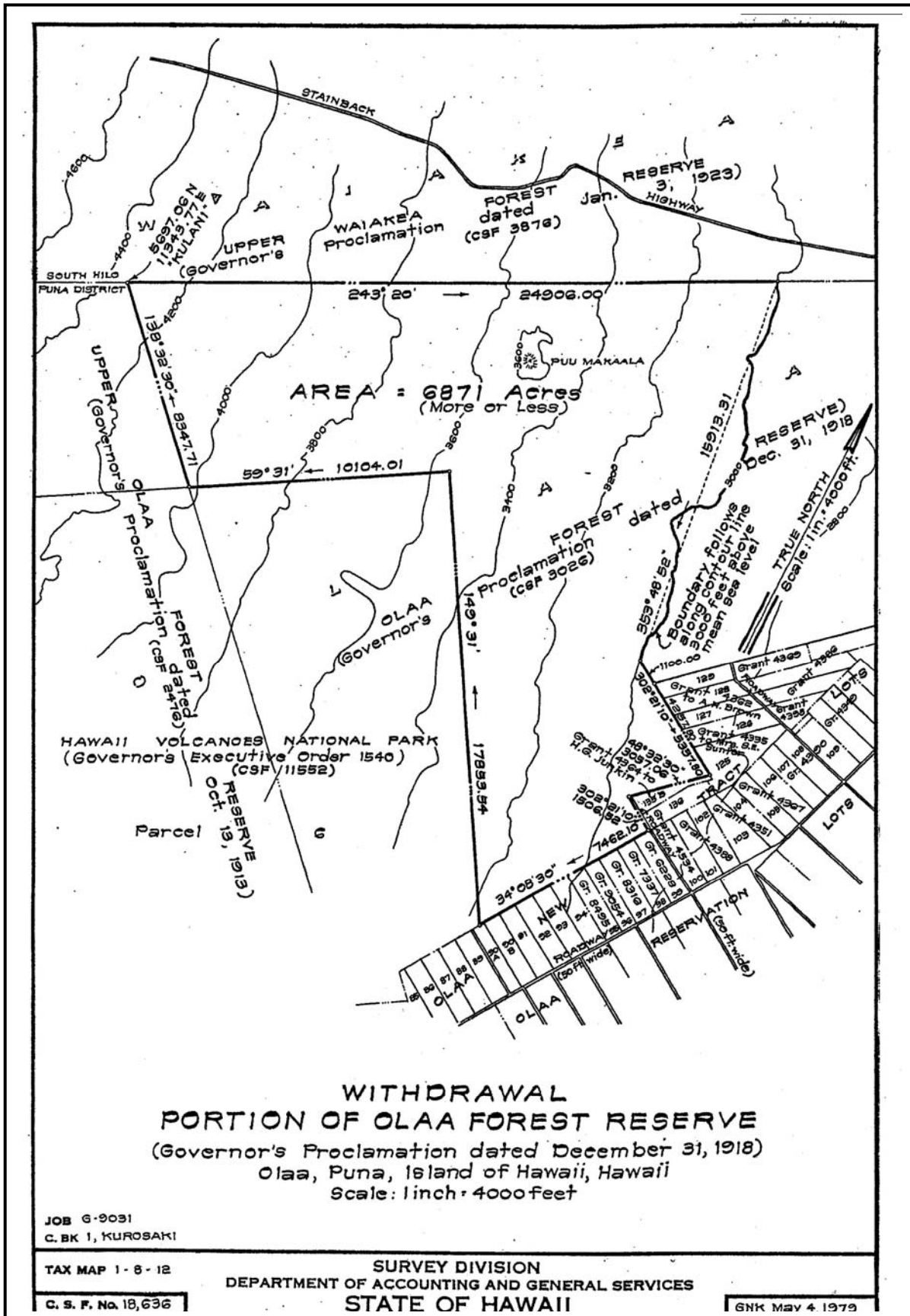


Figure 8. Location of Land Withdrawn From 'Ōla'a Forest Reserve; Pu'u Maka'ala NAR Section (Hawaii State Survey, 1979)

Compiled from data furnished
by N.A.R.S., U.S.G.S. Map,
& Govt. Survey Records. [State Survey Division]

Executive Order No. 3094

November 2nd, 1981

Withdrawal of Land from the Operation of

Governor's Proclamation of Forest Reserves Dated October 13, 1913.

Whereas, by Governor's Proclamation of Forest Reserves in the Districts of Hilo and Puna, Island of Hawaii, Hawaii, dated October 13, 1913, Certain lands situate in the District of Puna, Island of Hawaii, Hawaii, were set aside for Upper Olaa Forest Reserve, to be under the control and management of the Board of Commissioners of Agriculture and Forestry; and

Whereas, portions of said lands were recommended by the Natural Area Reserves System Commission as Natural Area Reserves; and

Whereas, the Board of Land and Natural Resources, at its meeting of November 9, 1978, approved the withdrawal.

Now, Therefore, I, George R. Ariyoshi, Governor of the State of Hawaii, by virtue of the authority vested in me under Section 171-11, Hawaii Revised Statutes, do hereby order that the following described land, more particularly described in Exhibit "A" and delineated on Exhibit "B..." be and the same is hereby withdrawn from the operation of Governor's Proclamation of Forest Reserves dated October 13, 1913... [In Collection of State Survey Division]

C.S.F. 18,635

WITHDRAWAL

PORTION OF UPPER OLA A FOREST RESERVE

(Governor's Proclamation dated October 13, 1913)

Olaa, Puna, Island of Hawaii, Hawaii

Withdrawn by E.O. 3094 dated Nov. 2, 1981

(E.O. Folder 67-A)

STATE OF HAWAII

SURVEY DIVISION

DEPT. OF ACCOUNTING AND GENERAL SERVICES

HONOLULU

May 4, 1979

WITHDRAWAL

PORTION OF UPPER OLA A FOREST RESERVE

(Governor's Proclamation dated October 13, 1913)

Olaa, Puna, Island of Hawaii, Hawaii

Being portion of the Government (Crown Land of Olaa).

Beginning at the west corner of this parcel of land, on the boundary between the lands of Waiakea and Olaa, the coordinates of said point of beginning referred to Government Survey Triangulation Station "KULANI" being 2292.92 feet North and 4565.59 feet East, thence running by azimuths measured clockwise from True South:-

1. 243° 20' 7584.98 feet along Upper Waiakea Forest Reserve (Governor's Proclamation dated January 3, 1923), along the boundary between the lands of Waiakea and Olaa.
2. 318° 32' 30" 8347.71 feet along Olaa Forest Reserve (Governor's Proclamation dated December 31, 1918);
3. 59° 31' 9895.99 feet along Hawaii Volcanoes National Park, Parcel 6 (Governor's Executive Order 1540);
4. 329° 31' 7976.25 feet along Hawaii Volcanoes National Park, Parcel 6 (Governor's Executive Order 1540);
5. 59° 31' 4359.10 feet along Lots 16 and 17, Volcano Farm Lots and along the northwest end of Roadway (50.00 ft. wide);
6. 149° 31' 8016.25 feet along Kilauea Forest Reserve (Governor's Proclamation dated December 22, 1928), along boundary between the lands of Keauhou and Olaa;
7. 180° 00' 10,048.92 feet along Kulani Prison Site (Governor's Executive Order 1225) to the point of beginning and containing an AREA OF 2926.76 ACRES.

Compiled from data furnished
by N.A.R.S & Govt. Survey Records. [State Survey Division]

In 1981, portions of the Waiākea and 'Ōla'a Forest Reserve lands were dedicated to the Pu'u Maka'ala Natural Area Reserve by Governor Waihe'e, in Executive Order No. 3102. The Executive Order provides the following description and purpose of the lands in the NARS:

***Executive Order No. 3102
Setting Aside Land for Public Purposes
November 16, 1981***

FOR NATURAL AREA RESERVE, to be under the control and management of the Department of Land and Natural Resources, State of Hawaii, being the lands situate at Waiakea, South Hilo and Olaa, Puna, Island of Hawaii, Hawaii, and designated as PUU MAKAAALA NATURAL AREA RESERVE, containing an area of 12,106 acres, more or less, all more particularly described in Exhibit "A" and delineated on Exhibit "B", both of which are attached hereto and made a part hereof, said exhibits being a survey description designated as C.S.F. No. 18,646 dated May 4, 1979, and a survey map designated as H.S.S. Plat 933, both prepared by the Survey Division, Department of Accounting and General Services, State of Hawaii...

***Exhibit A
C.S.F. 18,646
May 4, 1979***

***PUU MAKAAALA NATURAL AREA RESERVE
Waiakea, South Hilo and Olaa, Puna
Island of Hawaii, Hawaii***

Being portions of the Government (Crown) Lands of Waiakea and Olaa.

Beginning at the Government Survey Triangulation Station "KULANI" on the common corner of the lands of Keauhou, Waiakea and Olaa, as shown on Government Survey Registered H.S.S. Plat 933 [Figure 9], thence running by azimuths measured clockwise from True South:-

1. 133° 18' 05" 1000.00 feet along Kilauea Forest Reserve (Governor's Proclamation dated December 22, 1928), along the boundary between the lands of Keauhou and Waiakea;
Thence along the south side of Roadway, along the remainder of Kulani Prison Site (Governor's Executive Order 1225) for the next five (5) courses, the direct azimuths and distances between points along said south side of roadway being:
 2. 180° 30' 1260.00 feet;
 3. 244° 45' 1310.00 feet;
 4. 275° 00' 880.00 feet;
 5. 293° 40' 1088.17 feet;
 6. 318° 25' 753.90 feet to the boundary between the lands of Olaa and Waiakea;
 7. 243° 20' 16,520.00 feet along the remainder of Upper Waiakea Forest Reserve (Governor's Proclamation dated January 3, 1923), along the boundary between the lands of Olaa and Waiakea;
 8. Thence along the contour line 4000 feet above mean sea level, along the remainder of Upper Waiakea Forest Reserve (Governor's Proclamation dated January 3, 1923), the direct azimuth and distance being:
167° 09' 12" 6808.36 feet to the south side of Stainback Highway;
 9. Thence along the south side of Stainback Highway, along the remainder of Upper Waiakea Forest Reserve (Governor's Proclamation dated January 3, 1923), the direct azimuth and distance being:
259° 50' 03" 17,874.62 feet;
 10. Thence along the contour line 3000 feet above mean sea level, along the remainder of Upper Waiakea Forest Reserve (Governor's Proclamation dated January 3, 1923), the direct azimuth and distance being:
2° 44' 24" 1761.32 feet to the boundary between the lands of Olaa and Waiakea;
 11. Thence along the contour line 3000 feet above mean sea level, along the remainder of Olaa Forest Reserve (Governor's Proclamation dated December 31, 1918), the direct azimuth and distance being:
353° 48' 52" 15,913.31 feet;
 12. 302° 21' 10" 1100.00 feet along the remainder of Olaa Forest Reserve (Governor's Proclamation dated December 31, 1918);
 13. 302° 21' 10" 4257.80 feet along Lots 129, 128, 127, 126 and 125, Olaa New Tract Lots;
 14. 48° 32' 30" 3057.06 feet along Lot 135-B, Olaa New Tract Lots and along the northwest end of Roadway (50.00 ft. wide);
 15. 302° 21' 10" 1506.52 feet along the southwest side of Roadway (50.00 ft. wide);
 16. 34° 08' 30" 7462.10 feet along Lots 99, 98, 97, 96, 95, 94, 93, 92, 91, 90-B and 90-A, Olaa New Tract Lots;
 17. 149° 31' 17,853.54 feet along Hawaii Volcanoes National Park, Parcel 6 (Governor's Executive Order 1540);
 18. 59° 31' 20,000.00 feet along Hawaii Volcanoes National Park, Parcel 6 (Governor's Executive Order 1540);
 19. 329° 31' 7976.25 feet along Hawaii Volcanoes National Park, Parcel 6 (Governor's Executive Order 1540);

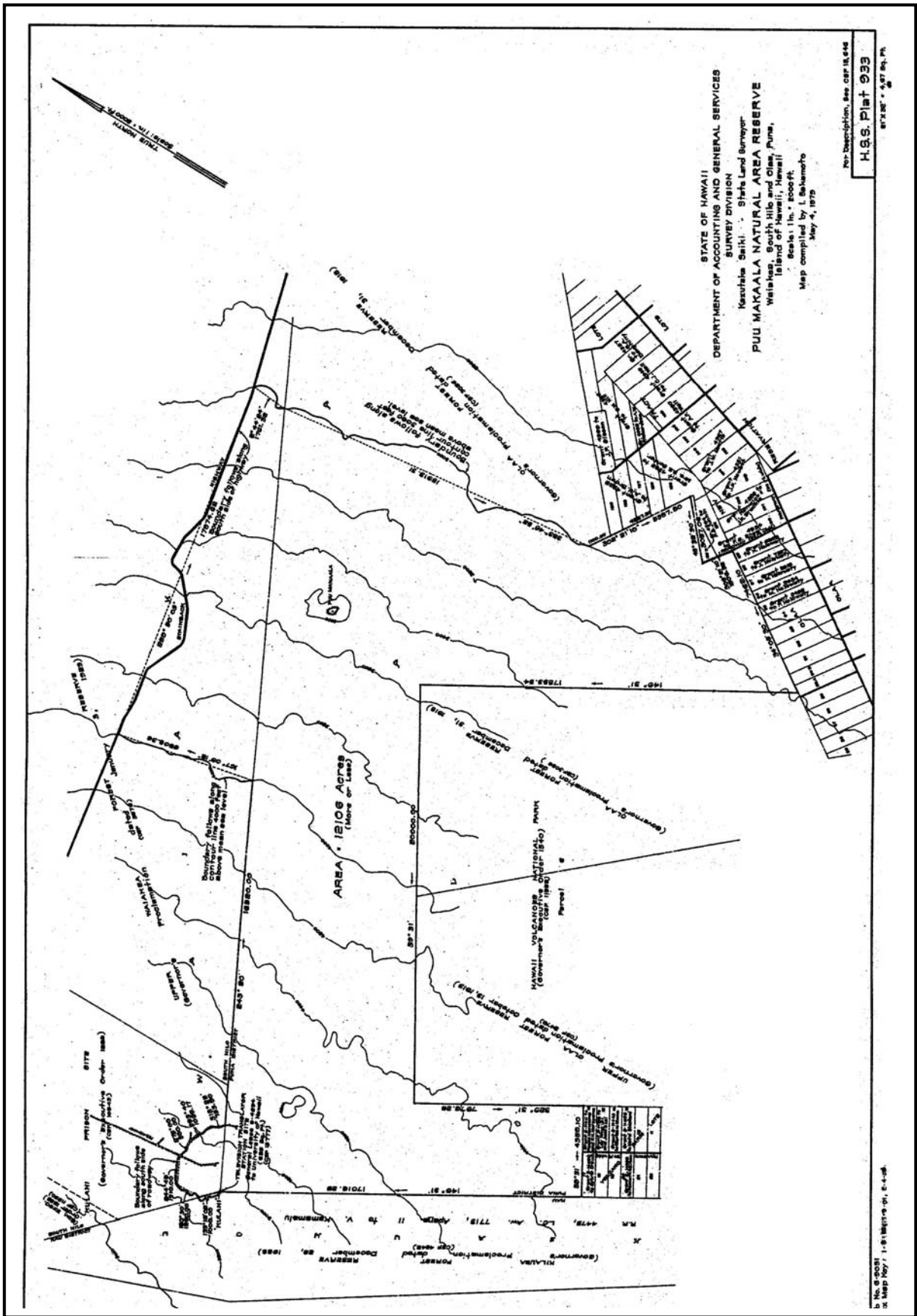


Figure 9. Redcution of Plan of the Pu'u Maka'ala Natural Area Reserve; Plat Map No. 933 (Hawaii State Survey, 1979)

20. 59° 31' 4359.10 feet along Lots 16 and 17, Volcano Farm Lots and along the northwest end of Roadway (50.00 ft. wide);
21. 149° 31' 17,016.25 feet along Kilauea Forest Reserve (Governor's Proclamation dated December 22, 1928), along the boundary between the lands of Keauhou and Olaa to the point of beginning and containing an AREA OF 12106 ACRES, MORE OR LESS.

The above-described PUU MAKAALA NATURAL AREA RESERVE is subject, however, to the following as shown on plan attached hereto and made a part hereof.

1. Television Translator Station Site covered by General Lease S-4234 to University of Hawaii.

Overview of Resources and Management Objectives for the Pu'u Maka'ala NAR

In 1989, the Department of Land and Natural Resources, Natural Area Reserves System office prepared a management plan for the Pu'u Maka'ala NAR. The following narratives describe resources of the Pu'u Maka'ala NAR and program objectives:

A. General Setting

Puu Makaala Natural Area Reserve occupies 12,106 acres in the Puna and South Hilo districts on the island of Hawaii. Elevations range from 2,800-5,500 feet and the average annual rainfall is 100-175 inches (DLNR 1986). Landmarks include Kulani Cone and Puu Makaala. The reserve is bordered by the Upper Waiakea Forest Reserve on the north, the Kilauea Forest on the west, Olaa Forest Reserve on the east, and the Olaa Tract of Hawaii Volcanoes Park (HAVO) on the south. Kulani Correctional Facility lies just outside the reserve's northwest corner. Access to portions of the reserve is generally good via Wright Road and jeep trails, although public access to the reserve's northern boundary via Stainback Highway is restricted by regulations of the correctional facility.

Regionally, the Puu Makaala reserve represents an important conservation parcel. It provides a link between the lower elevation HAVO Olaa Tract and the higher elevation 'ohia (*Metrosideros polymorpha*)/koa (*Acacia koa*) forests of Kilauea, Kulani and Upper Waiakea, protecting the transition between the 'ohi'a and koa forest types. These forest areas contain a full mosaic of different-aged 'ohi'a stands... [DLNR 1989]

B. FLora

Puu Makaala reserve encompasses some of the Big Island's best wet native forest. Four natural communities occur in the reserve; three are dominated by native species.

'Ohia/Hapu'u (*Cibotium spp.*) Montane Wet Forest occupied the majority (11,200 acres or 92%) of the Puu Makaala reserve, meeting with the koa/'ohi'a forest near the western reserve's boundary, and extending east of the reserve. A variety of substrate types, including cinder, 'a'a and pahoehoe flows of variable age, result in a mosaic of different-age stands of 'ohi'a/hapu'u forest. The closed 'ohi'a canopies can exceed 75 feet in height. Other sections of the 'ohi'a/hapu'u forest were in various stages of dieback, ranging from a few senescent trees to sections where all trees are dead and fallen, with only a few snags standing over a 15 to 30 foot canopy dominated by hapu'u and an association of native trees.

The hapu'u, or tree fern layer in this 'ohi'a/hapu'u wet forest is dominated by *Cibotium glaucum*, but *C. chamissoi* and *C. hawaiienses* can be locally abundant. The native

tree association below the 'ohi'a canopy commonly included 'olapa (*Cheirodendron trigynum*); kawa'u (*Ilex anomala*); pilo (*Coprosma* spp.); kolea (*Myrsine lessertiana*); smaller stature 'ohi'a; and occasionally included naio (*Myoparum sandwicense*); manono (*Hedyotis affinis*); loulou (*Pritchardia beccariana*); and 'ohe (*Tetraplasandra* spp.). The vegetation under the hapu'u layer consisted of a mix of native ferns such as *Thelypteris sandwicensis*, ho'i'o (*Athyrium sandwichianum*), 'ama'u (*Sadleria* spp.) and *Dryopteris* spp.; native shrubs such as pu'ahanui (*Broussaisia arguta*), 'ohawai (*Clermontia* spp.), ha'iwale or kanawao ke'oke'o (*Cyrtandra* spp.), *Cyanea* spp., maile (*Alyxia oliviformis*), alani (*Pelea* spp.), and 'ohelo (*Vaccinium* spp.); seedlings of 'olapa, 'ohi'a, kawa'u, kolea and pilo; and herbs such as pa'iniu (*Astelia menziesiana*) and 'ala'alawainui (*Peperomia* spp.). Sedges such as *Carex alligata* and *Uncinia uncinata* were infrequent components of the ground cover. Epiphytic mosses, ferns, herbs and shrubs were present, and occasionally abundant.

Koa/Ohi'a Montane Wet Forest occupied the northwestern edge of the Puu Makaala reserve on cinder and ash substrate. This community encompasses just 460 acres or 3.8 percent of the reserve. The forest type stretched into the reserve's Kulani Cone area from the adjacent Kilauea Forest. Scattered individual koa trees, from 60 to 120 feet in height, emerge from a layer of 'ohi'a 30 to 90 feet in height. Under the koa and 'ohi'a canopy is an association of native trees that commonly included kolea, kawa'u, 'olapa, pilo and young 'ohi'a, but may also include naio and 'ohe.

The 'ohi'a/hapu'u and koa/ohi'a wet forests share many of the same component species. The former, however, had an overall higher diversity by virtue of the greater area and elevational range it occupies. Some genera in Puu Makaala, such as *Pritchardia*, *Trematolobelia*, and *Claoxylon*, as well as species such as *anini* (*Eurya sandwicensis*) and *Cyanea tritomantha*, seem restricted to the 'ohi'a/hapu'u forest.

Carex Alligata Montane Wet Grasslands are scattered throughout the reserve as small but distinct patches occupying low lying water-saturated areas such as cinder cone pits or depressions in the forest. Only a few of the *Carex* grasslands were encountered on the ground survey but many examples were seen during helicopter reconnaissance. This grassland may consist entirely of *Carex* but may also include scattered shrubs of 'ohi'a and patches of wawae'iole (*Lycopodium* spp.), especially in ecotones with surrounding forest. Often associated with standing water, this sedge forms a wide margin around a pond. As the pond ages, the basin may become dominated by *Carex*. The largest examples occupy cinder cone craters on **Kulani** and **Na Lua Mahoe**.

Along the eastern boundary, 360 acres of tropical ash (*Fraxinus uhdei*) plantations constitute the reserve's only non-native dominated community. Amidst the scattered ash trees are elements of the surrounding 'ohi'a/hapu'u forest, as well as a variety of non-native plants. At this time, the ash is not invading adjacent native forest in the reserve. There were many non-native plants found within these four natural communities... [DLNR 1989]

C. Fauna.

Systematic circular plots were used to sample birds along transects 4 and 6; and incidental bird observations were made on all other transects. Only two native birds were commonly seen in the reserve during this survey. The *Apapane* (*Himatione sanguinea*) was abundant throughout, except in areas of extensive 'ohi'a dieback. The Hawaiian Thrush, or 'Oma'o (*Myadestes obscurus*) was less abundant, but ubiquitous, being recorded on nearly all stations.

Two other native forest birds, 'i'iwi (*Vestiaria coccinea*) and 'elepaio (*Chasiempis sandwichensis ridgewayi*) were uncommon. The non-native Japanese White-eye

(*Zosterops japonicus*) occurred in low numbers at most stations, whereas Redbilled Leiothrix (*Leiothrix lutea*) were heard at only a few stations. These findings are similar to those of previous surveys except that densities of 'I'iwi, 'elepaio, White-eye, and Leiothrix were lower (Pratt 1988).

Four endangered bird species have been reported from the Puu Makaala reserve, but only one, the 'io (*Buteo solitarius*, Hawaiian Hawk), was seen during the survey. An 'io was seen carrying nesting materials near **Na Lua Mahoe**, and another was seen during transect 6.

The 'o'u (*Psittirostra psittacea*) is extremely rare and localized on the Big Island and Kauai. **Olaa Tract** and kipukas of **Upper Waiakea Forest Reserve**, above Stainback Highway are thought to be primary habitat for 'o'u on the Big Island. 'O'u were last seen in the southwestern portion of the reserve in 1986.

'Akiapola'au (*Hemignathus munroi*) exist only on the Big Island, with the largest population on the windward side (Scott et al. 1986). Generally observed in *koa'ohi'a* forests in this area, 'Akiapola'au sightings are reported from west of the reserve in the Kilauea Forest, and north of **Kulani Cone**. Observed periodically in the reserve's Disappointment Road area, one record also exists from the western edge of the reserve below Kulani Cone.

Hawaii Creeper (*Oreomystis mana*), known from the Big Island's Kona, Kau and windward areas, is one of Hawaii's more abundant endangered forest birds. Creepers have been reported from the reserve's Disappointment Road complex, and the western area near **Kulani Cone** and **Na Lua Mahoe**, as well as south in **Olaa Tract**, and west of the reserve near **Puu Lalaau**.

Hawaii 'Akepa (*Loxops coccineus*) is an uncommon bird on the Big Island. On the windward side, populations are known from the upper slopes of Mauna Kea and Mauna Loa, preferring closed canopy *koa'ohi'a* forests (USFWS 1982). Though 'Akepa have not been reported within the reserve, sightings of this rare bird are recorded from outside the reserve's western boundary in the Kilauea Forest as recently as 1987.

Although native invertebrates were only incidentally noted, a high diversity of representative native insects, spiders and snails (particularly *Succinea* spp.) was observed in all of the natural communities sampled and on all transects. The general richness of native invertebrates suggests that the native communities of the reserve are generally intact, and that major disruptive factors, such as competition with non-native species, have not greatly affected the native invertebrate biota. A lava tube was found and further study may reveal native cave invertebrates of interest.

Non-native fauna such as pigs (*Sus scrofa*) were seen throughout the Reserve and are specifically discussed in the Ungulate Control program. Other non-native mammals, such as rats (*Rattus rattus*) and mongoose (*Herpestes auropunctatus*) have been reported in the Reserve... [DLNR 1989]

Key Management Concerns

The overall management goal is to protect and maintain the reserve's native character.

Some of the key considerations behind the management programs proposed to achieve this are as follows:

(1) **Puu Makaala** is a very large reserve. At this time it is not economically realistic to intensively manage the entire reserve. Intensive management of key areas are proposed and prioritized based on the biological resources they contain, the extent of current disturbance, the nature of the other biological threats within and near the area, and the feasibility of management (e.g. topography and access).

(2) Pigs constitute the most severe threat currently affecting the reserve. Their rooting and wallowing destroy native plants and the ground cover on the forest floor. Such damage limits effective regeneration of native plants, and creates conditions favorable for mosquitoes and certain non-native weeds throughout the reserve. This in turn degrades the quality and integrity of native plant communities, threatening the existence of species that rely on the forest for survival.

Control of the feral pig population is the essential first step in the restoration and maintenance of native plant communities in the reserve. Strategic fencing to create smaller pig control units and an aggressive ungulate control program are critical for effective long term reduction of the pig population.

Portions of the reserve are utilized for recreational hunting, which should continue to be encouraged year round. This helps reduce pig densities in certain areas. However, as the number of pigs decrease in priority management areas, public hunting becomes less effective as hunters move to areas with more chance of success, and pig control by staff will be necessary. If incentives can be developed for public hunters to continue to hunt in areas where pig numbers are low, then expensive fence construction and staff hunting may not be necessary.

(3) 'Ohi'a dieback continues to have an impact in the reserve, especially in the lower elevations. Dieback is a natural successional phenomenon in which older stands die synchronously, leaving gaps in the forest canopy. Dieback itself is not a "threat" as these gaps provide openings for subsequent 'ohi'a regeneration. The management concern in the dieback areas is the invasion of aggressive non-native weeds, accelerated by feral pigs, which hampers native plant regeneration. Aerial photographs indicate over one-third of the 'ohi'a forests in the reserve have undergone relatively recent dieback.

(4) Many non-native plants observed in the reserve are shade intolerant and pose no major problem as long as the native canopy and ground cover remain intact. There are non-native weed species in the reserve which form monotypic stands and displace native vegetation over large areas, making them priority weeds for management. Weed control activities will focus on these invasive weeds within key management areas, and in localized populations of priority weed species. Biological control efforts for widespread weed species should be supported.

(5) Signs of marijuana cultivation were seen in the reserve. This illegal activity creates a hazard for people in the reserve. Growers destroy native plants clearing patches for cultivation, introducing new weeds to the forest and spreading others.

Management Programs

The following four management programs outline the long-term goals for the reserve. The management activities within each program lay essential foundations for effective protection of the reserve's natural resources. A six-year implementation schedule is recommended. Although the programs are listed by priority, they fit together to form an integrated management package.

Ungulate Control Program (PUM-RM-01) - Priority #1

GOAL: Reduce impact of pigs to a level that prevents further degradation of the reserve's native species and allows the greatest possible recovery of the reserve's native character.

Statement of the Problem: Techniques available for pig control in the reserve include hunting with or without dogs, snaring, baiting and trapping. Current pig control research recommends use of passive control (e.g. snares and traps) before actively controlling with dogs when possible, unless hunting is already established. There is less investment initially, less upkeep, less chance of the program being overly oriented to hunting, and it is more cost effective in remote areas. Hunting can be alternated with snaring, but snares must be removed from areas prior to hunting to avoid catching dogs. Radio transmitters on lead hunting dogs has improved hunting efficiency and trapping can be useful for the first vulnerable animals in an area.

Reduction is the necessary first phase of a control effort. Long-term funding for fence construction, pig control and fence maintenance are needed. Attempts to reduce pig populations to remnant levels in similar terrain without the use of any fences have not been effective due to unimpeded ingress of animals into areas where population densities were reduced. Funds spent on feral pig control will be ineffective unless pig numbers are reduced to remnant populations and not allowed to build back up to damaging levels.

Alternative Actions and Probable Impacts:

- 1) No action. Accept the continuing deterioration of Puu Makaala's native resources. Pigs destroy native plants, alter the structure of native vegetation, and contribute to the spread of non-native plants. Without control, pigs can be expected to degrade native communities, converting most of the reserve to less diverse assemblages of native plants with non-native weeds.
- 2) Attempt control of feral animals without installation of any fences. Damaging impacts of feral pigs under this alternative will probably be roughly the same as alternative #1, except for portions of the reserve where increased hunting activity may protect small areas of forest. Management resources used for control will be less effective without any fences to keep new pig populations from moving into the reserve.
- 3) Control feral pigs with the aid of fences. This method has proven successful in both HAVO and Haleakala National Park. Initial cost is high, but benefits in preservation of native ecosystems are great. Recovery of native vegetation can occur if feral animals are controlled. The advance of non-native weed species can be slowed and at times reversed. Native plant species surviving only as epiphytes because of feral pig disturbance can become reestablished on the forest floor.

Recommended Action: Alternative #3 is recommended. The two large management zones proposed for intensive pig control and fencing in this plan comprise only one-third of the reserve. Public hunting access is essential and encouraged to control pig populations in the rest of the reserve. However, the goal for the Disappointment Road and Kulani Cone Zones is clearly reduction of the pig population to remnant levels, not sustained yield hunting. Three projects are proposed to carry out this alternative:

Project (1) - Construction of a strategic network of 20.3 miles of barrier fences to create five management zones. Goals of the fencing project are to cut off pig access routes

into priority areas and to direct predictable pig movements within intensive control areas. An aggressive snaring and hunting project is essential in conjunction with the fencing project to take advantage of induced pig movements and to avoid creation of "pig pens."

Although there are eight smaller management units within the Disappointment Road and Kulani Cone Zones, they will not be fenced immediately. A progressive fencing strategy will be used. The outside of the management zones will be fenced before individual management units are closed off. This will allow pig control efforts to begin over a larger area. In addition, success of pig control efforts and monitoring of subsequent vegetation recovery may determine that fences to close off the smaller management units may be unnecessary. The fence system will share 2.3 miles of HAVO fence along the Olaa Tract boundary. Cooperative agreements to share maintenance costs of this fence section will be pursued.

Pig control fences will consist of 39 inch high galvanized woven-wire supplemented along the ground surface by one strand of barwire stretched tightly across the ground. Woven wire and barwire will be secured to steel posts placed no more than 10 feet apart. Concreted galvanized pipes may be required to secure the fence line at certain corners. Helicopter transport of fencing materials will be required for remote units...

Strict procedures for clearing fence line will be established to minimize disturbance. Does not include personnel costs for fence line layout and assessment, contract preparation and monitoring. A botanist will walk the flagged fence route to search for rare plants to be avoided by the brushing crew.^[9]

Project (2) - Monthly inspection and maintenance of all fence lines (and after major storms). Inspections will be done in conjunction with other resource management activities such as monitoring and non-native plant control along fence corridors...

Project (3) - Initiate an active pig control program using hunting, trapping, snaring, and other methods as required in the Disappointment Road and Kulani Cone Zones. The goal is to reduce feral pig populations to remnant levels in 4,560 acres of the reserve. Pig control should begin before fence closure in order to chase out populations within the area.

Snares are recommended for the Kulani Cone Zone, where public access is restricted. Snare numbers will increase over time to continue to catch pigs as their densities decrease. The greatest effort is initially setting up the snare groups. These snare groups are left in place, as pigs habitually return to previously used areas. When new areas are found with fresh sign, additional snare groups are set out. Snares in rain forests last six months to a year. Accumulating data on health, sex, and age of captured pigs provides important data in the effectiveness of the snaring program.

Staff hunting is recommended rather than snaring in the Disappointment Road Zone. This will allow time to incorporate interested public hunters into the program. The major limitation with using public hunters is the lack of incentive for hunting an area when the chances of a successful hunt is low. An effective pig control program demands constant hunting pressure, even when pig populations decrease. Incentives such as

⁹ While it is recognized that the natural landscape is a Hawaiian cultural resource, it is recommended as a part of this study, that DLNR-NARS staff and contractors meet with State Historic Preservation staff as a part of the program to plan for the fencing of the Pu'u Maka'ala NAR. The focus of such a meeting should be to discuss types of traditional cultural sites that may be encountered in the field; and to review the laws and protocols for notification and treatment of inadvertent finds of cultural resources.

improved access, contests, and logistical support for volunteer hunters will be offered to maintain public hunter pressure in the Disappointment Road Zone. Contracting out public hunters is also a possibility. If monitoring indicates vegetative recovery from these pig control efforts, snaring will not be used. The use of snares would necessitate closing the area to the public... [DLNR-NARS, 1989]

This study has been undertaken to provide resource managers and the public with important background information, documenting the wide range of cultural values, practices, and knowledge of resources of the Waiākea and 'Ōla'a forest lands. An understanding of the cultural environment will help resource managers and the public ensure that the unique qualities of the Pu'u Maka'ala NAR, remain a healthy and resilient part of the cultural landscape through future generations.

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Hawai'i State Archives
Land Division
Natural Area Reserves System Office (Honolulu)
State Survey Division
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June 9, 2004

Telephone interview with:

Ralph Daehler

The name “Pu’u Maka’ala” was given to the *pu’u* and forest area in 1961 or 1962, when Ralph Daehler was working on the Board of Agriculture and Forestry’s Reforestation Program. Mr. Daehler recalled that at the time, he was working with old quad maps and aerial photos, identifying areas in which reforestation projects could be developed, and through the photos—the *pu’u* did not appear on old quad maps—he noticed this *pu’u*, which looked very interesting to him. From the photo, it appeared to him that the hill would offer anyone who traveled to it, a great view of all the surrounding lands, and out to the coast of Hilo and Puna.

Mr. Daehler looked around for *kama’āina* to see if anyone knew the name of the *pu’u*, but could find no one familiar with it. During this time, L.W. Bryan had been the Forester, and was just retiring, and Max Landgraf took over. Max’s nick name was *Maka* (eye), because he could see things all over. Mr. Daehler found that the word *ala* with *maka*, could mean wide open or imply a lookout point, so he settled on naming the site Pu’u Maka’ala (interpreted as Lookout Hill).

Shortly thereafter, USGS was updating its’ quads and contacted him about the region in which the *pu’u* is situated. He explained that he had found no name for the *pu’u*, but that he had called it Pu’u Maka’ala for the forestry program. He recalled being surprised later, to find that on the next quadrangle, the name Pu’u Maka’ala appeared in print.

Mr. Daehler never had the opportunity to actual travel to the *pu’u*, as he was transferred to Kaua’i a short while later. It had been his goal to establish a trail to the *pu’u*, which he believed would be of interest, and provide travelers with a great view of the region. In his review of the maps and photos, he had determined a couple of possible approaches to the *pu’u*. One of the approaches being from the old Olaa Back Road—which was all overgrown—and which ran out of the old Olaa Homesteads. He recalled also, that while researching the area, he had been surprised to learn that so much of ‘Ōla’a had been subdivided into homestead lots, and that many of the homesteaders had been of Galician origin.

Mr. Daehler also recalled that in those early years, the Board of Agriculture and Forestry had a strong component of land development for agricultural purposes. At the time the Board’s Reforestation Program began, a number of people had been calling for the Pana’ewa-‘Ōla’a forest lands to be cleared for agricultural purposes. The early reforestation program, through planting a number of fast growing introduced species, helped to save much of the area for present-day and future conservation programs and public interest.

Appendix C.

**Pre-Consultation and Draft Environmental
Assessment Mailing List**

Agencies & Organizations Consulted:

Federal:

National Park Service, Hawaii Volcanoes National Park
USDA Forest Service
USDA Natural Resources Conservation Service
US Fish and Wildlife Service, Pacific Islands Field Office
US Geological Survey, Biological Resources Division
USGS Hawaiian Volcano Observatory
Senators (Inouye, Akaka)
Representative (Hirono)

State:

Department of Hawaiian Home Lands
Office of Hawaiian Affairs
Department of Health
Office of Environmental Quality Control
Department of Defense (Youth Challenge Academy)
Department of Public Safety
Department of Business, Economic Development and Tourism
Department of Land and Natural Resources
 Division of Forestry and Wildlife
 Division of Historic Preservation
 Division of Historic Preservation, Hawai'i Island Office
 Land Division
 Office of Conservation and Coastal Lands
 Hawai'i Island Burial Council
 Natural Area Reserves Commission
 Division of Conservation and Resources Enforcement
 State Parks Division
Senator Russell Kokubun
Representative Robert Herkes
University of Hawaii Environmental Center
Libraries (Hilo Public Library, Mountain View, Keaau)

County of Hawai'i:

Office of the Mayor
Department of Public Works
Department of Water Supply
Planning Department
Hawaii County Council
Councilperson Guy Enriques
County Civil Defense
County Fire Dept.

Organizations:

Kamehameha Schools
Three Mountain Alliance
The San Diego Zoo
The Nature Conservancy of Hawaii
Sierra Club, Moku Loa Chapter
Conservation Council of Hawaii
Volcano Community Association
Hawaii Audubon Society
Native Hawaiian Legal Corporation
Kahea
Volcano Art Center
Environment Hawaii
Plant Extinction Prevention Program
SILVERSWORD FOUNDATION
American Forest Management, Inc
Big Island Invasive Species Committee
Mālama O Puna
Edith Kanakaole Foundation
Bishop Museum
Hoopuloa Hawaiian Civic Club
Hawaiian Civic Club of Hilo
Association of Hawaiian Civic Clubs
Hui Malama I Na Kupuna O Hawai'i Nei
American Association of University Women
Earth Justice Legal Defense Fund
Mauna Kea Recreational Users Group
Hawaiian Botanical Society
Big Island Bow Hunters
Prince David Kawanakoa Hawaiian Civic Club
Hawaii Hunting Association
Wildlife Conservation Association of Hawaii, Hilo Chapter
Big Island Bird Hunters
Ka Nohona Pono Inc
Ohana Hoopakele

Other:

Dan Taylor
Mrs. Mary Finely
Fred Stone and Debbie Ward
Jon Price
Becky Ostertag
Pat Hart
Jim Juvik
Jack Jeffrey
Patty Moriyasu

Richard Camp
Eldridge Naboa
John Peard
Chris Farmer
Gregory Santos
Kuulei Killiona
Christina Cornett
Grizzly Yamada
Nick Shema

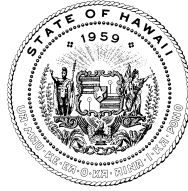
Deborah Chang
Rob Pacheco
J.B. Friday
Pat Conant
Sheila Conant
Richard Hoeflinger
Steven Araujo
Thomas Medeiros
David Duffy
Sierra McDaniel
H. Douglas Pratt
Rhonda Loh
Jim Albertini
Martha Lockwood
Zach Judd
Sam Kaleleiki
Ronald Fujioshi
Steven Hess
Edwin Ung
Danny Li
George DeCosta
Ku'ulei Killiona
Larry Katahira
Rebecca Montgomery
Ms. Elizabeth Martin
Pamela Scheffler
Aha Kiole Council
Tim Tunison
Diane Ware

Ann Kobsa
Janice Palma-Glennie
Shannon Rudolph
Mark Wasser
Karl Magnacca
Joanne Martin
Mardi LaPrade
Ron Terry
Christine Ogura
Lyman Perry
Don Drake
Roberta Brashear
Nani Pogline
Glenn Hisashima
Lydia Garvey
Kat Brady
Brooks Rownd
Tlaloc Tokuda
Alan Burdick
Cory Harden
Paul Banko
Hannah Hedrick
Rick Warshauer
Rob Shallenberger
Sunny Seal-LaPlante
Jon Giffin
Diane Ley
Susan Dursin
Joseph Camara
Chris Junge
Thane and Linda Pratt
Renate Gassman
G.W. Naliko Markel

Appendix D.

Comments received during pre-consultation

LINDA LINGLE
GOVERNOR OF HAWAII



LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

PAUL J. CONRY
ACTING FIRST DEPUTY

LENORE N. OHYE
ACTING DEPUTY DIRECTOR - WATER

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF FORESTRY AND WILDLIFE
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AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

October 11, 2010

TO: INTERESTED AGENCIES, ORGANIZATIONS and INDIVIDUALS

Re: Pre-Consultation on Environmental Assessment (EA) for the Pu'u Maka'ala Natural Area Reserve (NAR) Management Plan (Hawai'i, South Hilo and Puna Districts)

The Division of Forestry & Wildlife is preparing an EA in compliance with Chapter 343, HRS for a Management Plan for Pu'u Maka'ala NAR, including 6,600 acres of forest at Kūlani which was put under NAR management and recommended for designation in September 2010 (map attached).

This Reserve was established to protect native Hawaiian forest for current and future generations. The purpose of this letter is to share information about the project, request your assistance in identifying historic sites or cultural practices that might be impacted by the project, and invite you to share any issues that you wish to be addressed in the EA or any other concerns you may have. The Management Plan will outline planned management actions over the next fifteen years. The overall goal is to protect, maintain, and enhance the Reserve's unique natural, cultural, and geological resources. The proposed project includes fence construction and pig removal to protect forest from feral pigs, invasive weed control, planting of rare native plants, public access and the development of interpretive trails for the public.

The EA will address topics including but not limited to: native plants and animals; invasive species; cultural resources; socioeconomic impacts; and public access. We invite your comments on any of these topics. We would especially appreciate your input on the following issues in the project area:

1. History, land use and cultural sites e.g., historic or archaeological sites, burials;
2. Traditional gathering practices in the project area – both past and present;
3. Cultural associations through traditions, legends, traditional use, or otherwise; and
4. Referrals of kupuna who might be willing to share their cultural knowledge of the area.

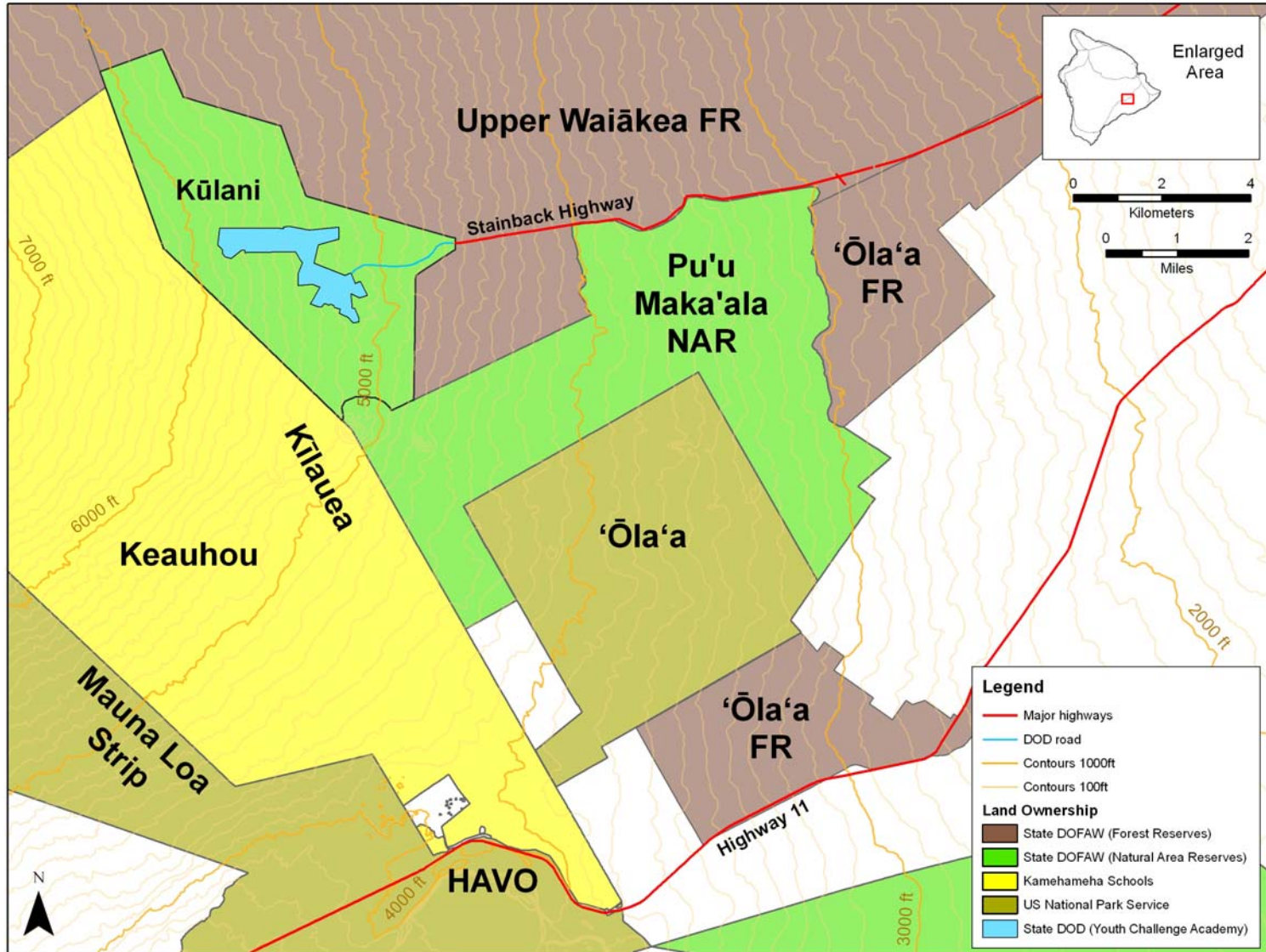
This information will help us determine if there will be any impacts to cultural resources by proposed management actions, ensure that all potential cultural impacts are appropriately considered, and to prevent to the greatest extent possible any negative impact.

Please send comments on the project by November 15, 2010 and indicate whether you wish to receive a copy of the Draft EA. If you have any questions, contact me at 808-587-0027 or email: Tanya.Rubenstein@hawaii.gov. Thank you in advance for your cooperation and for sharing your knowledge!

/s/

Tanya Rubenstein, Natural Area Reserves Project Coordinator

Pu'u Maka'ala Natural Area Reserve



William P. Kenoi
Mayor



Darryl J. Oliveira
Fire Chief

Glen P. I. Honda
Deputy Fire Chief

County of Hawai'i
HAWAI'I FIRE DEPARTMENT
25 Aupuni Street • Suite 2501 • Hilo, Hawai'i 96720
(808) 932-2900 • Fax (808) 932-2928

October 20, 2010

Ms. Tanya Rubenstein
State of Hawai'i, Department of Land and Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, Hawai'i 96813

**SUBJECT: PRE-CONSULTATION ON ENVIRONMENTAL ASSESSMENT
PU'U MAKA'ALA NATURAL AREA RESERVE MANAGEMENT
PLAN
HAWAI'I, SOUTH HILO AND PUNA DISTRICTS**

We have no comments to offer at this time in reference to the above-mentioned pre-consultation on Environmental Assessment.


DARRYL OLIVEIRA
Fire Chief

GA:lpc



William P. Kenoi
Mayor



BJ Leithead Todd
Director

Margaret K. Masunaga
Deputy

County of Hawai'i

PLANNING DEPARTMENT

Aupuni Center • 101 Pauahi Street, Suite 3 • Hilo, Hawai'i 96720
Phone (808) 961-8288 • Fax (808) 961-8742

November 12, 2010

Ms. Tanya Rubenstein
Natural Area Reserves Project Coordinator
Division of Forestry and Wildlife
Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 325
Honolulu, Hi 96813

Dear Ms. Rubenstein:

SUBJECT: Early Consultation for Environmental Assessment
Project: Pu'u Maka'ala Natural Area Reserve (NAR)
Management Plan
Location: Puna, and South Hilo, Hawai'i

Thank you for your letter dated October 11, 2010 requesting comments from this office regarding the preparation of an Environmental Assessment (EA).

There is no County zoning for the project site. The project site is located in the State Land Use Conservation District. In addition, according to the County of Hawai'i General Plan 2005 (amended December 2006), it is designated as Conservation by the Land Use Pattern Allocation Guide. Although, the entire island of Hawai'i is within the Coastal Zone Management Area, the subject area is not located within the Special Management Area.

Several Goals and Policies of the County of Hawai'i General Plan 2005 (amended December 2006) related to Natural Resources are relevant to this EA:

- 8.2 (c) Protect and promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources.
- 8.2 (d) Protect rare or endangered species and habitats native to Hawai'i.
- 8.3 (b) Encourage a program of collection and dissemination of basic data concerning natural resources.

Ms. Tanya Rubenstein
Natural Area Reserves Project Coordinator
Division of Forestry and Wildlife
Department of Land and Natural Resources
November 12, 2010
Page 2

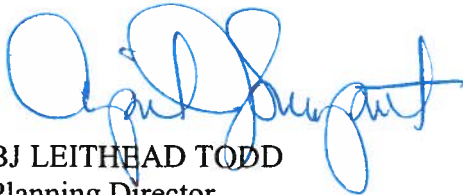
- 8.3 (e) Encourage an overall conservation ethic in the use of Hawai'i resources by protecting, preserving, and conserving the critical and significant natural resources of the County of Hawai'i.
- 8.3 (o) Encourage the continued identification and inclusion of unique wildlife habitat areas of native Hawaiian flora and fauna within the Natural Area Reserve System.

The Puna Community Development Plan (CDP), adopted by Ordinance No. 08-116 effective on September 10, 2008, also mentions the Pu'u Maka'ala Natural Area Reserve and discusses the importance of preserving our native forests and species.

We have no further comments to offer, at this time.

If you have any questions or if you need further assistance, please feel free to contact Bethany Morrison of this office at 961-8138.

Sincerely,



for BJ LEITHEAD TODD
Planning Director

BJM:cs

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STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
DOH/CWB

11033PSS.10

November 10, 2010

Ms. Tanya Rubenstein
Natural Area Reserves Project Coordinator
Division of Forestry and Wildlife
Department of Land and Natural Resources
1151 Punchbowl Street, Room 325
Honolulu, Hawaii 96813

**Subject: Comments on the Pre-Consultation on Environmental Assessment for the
Pu'u Maka'ala Natural Area Reserve Management Plan
South Hilo and Puna Districts, Island of Hawaii, Hawaii**

Dear Ms. Rubenstein:

The Department of Health (DOH), Clean Water Branch (CWB) has reviewed the subject document and offers these comments on the project. Please note that our review is based solely on the information provided in the subject document and its compliance with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at <http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf>.

1. Any project and its potential impacts to State waters must meet the following criteria:
 - a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.
 - b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.
 - c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).
2. You may be required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting the applicable

Notice of Intent (NOI) forms:

- a. Storm water associated with construction activities, including excavation, grading, clearing, demolition, uprooting of vegetation, equipment staging, and storage areas that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. An NPDES permit is required before the start of the construction activities.
- b. Discharges of hydrotesting water.
- c. Discharges of construction activity dewatering.

You must submit a separate NOI form for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI must be submitted 30 calendar days before the start of construction activities. The NOI forms may be picked up at our office or downloaded from our website at <http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html>.

3. For types of wastewater discharges not covered by an NPDES general permit or discharges to Class AA or Class 1 State waters, you may need an NPDES individual permit. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at <http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html>. For your information, in accordance with HAR, Section 11-54-5.1, all water bodies within natural reserves established by the Department of Land and Natural Resources under Hawaii Revised Statutes, Chapter 195 are classified as Class 1.a.
4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage is required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of \$25,000 per day per violation.

Ms. Tanya Rubenstein
November 10, 2010
Page 3

11033PSS.10

If you have any questions, please visit our website at <http://www.hawaii.gov/health/environmental/water/cleanwater/index.html>, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,



ALEC WONG, P.E., CHIEF
Clean Water Branch

SS:ml

c: DOH-EPO #I-3383 [via e-mail only]



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2011-TA-0010

NOV 15 2010

Ms. Tanya Rubenstein
Natural Area Reserves Project Coordinator
Hawaii Department of Land and Natural Resources
1151 Punch Bowl Street, Room 325
Honolulu, Hawaii 96813

Subject: Environmental Assessment Preparation Notice for the Puu Makaala Natural Area Reserve Management Plan, South Hilo and Puna, Island of Hawaii

Dear Ms. Rubenstein:

The U. S. Fish and Wildlife Service (Service) has reviewed the Environmental Assessment Preparation Notice for the Puu Makaala Natural Area Reserve Management Plan. The plan will outline management actions for the next fifteen years for the Puu Makaala Natural Area Reserve and 6,000 acres of forest at Kulani. The plan is being developed by the State of Hawaii's Division of Forestry and Wildlife. We received your letter soliciting our comments on October 13, 2010. The proposed management actions include fence construction and pig removal, invasive weed control, planting of rare and native plants, public access, and the development of interpretive trails.

We have reviewed the project information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program and the Hawaii GAP Program. A list of federally threatened and endangered plant and animals, and critical habitat are found in Enclosure 1. We recommend you address potential impacts to the sensitive native ecosystems and these listed species and critical habitat discussed below, and include measures to minimize adverse impacts to these resources in your Draft Environmental Impact Statement (DEIS).

Hawaiian hoary bats roost in both exotic and native woody vegetation and leave their young unattended in "nursery" trees and shrubs when they forage. If trees or shrubs suitable for bat roosting are cleared during the bat breeding season (May to August), there is a risk that young bats could inadvertently be harmed or killed. To minimize impacts to the endangered Hawaiian hoary bat, woody plants greater than 15 feet tall should not be removed or trimmed during the bat birthing and pup rearing season (May 15 through August 15).

TAKE PRIDE[®]
IN AMERICA 

Ms. Tanya Rubenstein

2

Hawaiian hawks also nest in both exotic and native woody vegetation. To avoid impacts to Hawaiian hawks we recommend avoiding brush and tree clearing during their breeding season (March through September). If you must clear the property during the Hawaiian hawk breeding season, we recommend conducting biological surveys to determine if Hawaiian hawk nests are in the vicinity.

It is unclear from your letter whether or not the entire project area will be fenced and ungulates removed. We recommend the entire Puu Makaala Natural Area Reserve and the 6,000 acres of forest at Kulani be fenced with ungulate-proof fencing and all ungulates removed. Feral pigs are known to destroy native plant communities and to create conditions favorable for the spread of diseases that are harmful to Hawaiian forest birds.

Pigs have been described as the most pervasive and disruptive nonnative influence on the unique native forests of the Hawaiian Islands, and are widely recognized as one of the greatest current threats to forest ecosystems in Hawaii (Aplet et al. 1991, p. 56; Anderson and Stone 1993, p. 195). While rooting in the earth in search of invertebrates and plant material, pigs directly impact native plants by disturbing and destroying vegetative cover, and trampling plants and seedlings. It has been estimated that at a conservative rooting rate of 2 square-yards per minute, with only 4 hours of foraging a day, one pig could disturb over 1,600 square-yards of groundcover per week (Anderson et al. 2007, p. 2). They may also reduce, or eliminate, plant regeneration by damaging or eating seeds and seedlings. Pigs are a major vector for the establishment and spread of competing invasive non-native plant species, by dispersing plant seeds on their hooves and coats as well as through the spread of their feces (Diong 1982, pp. 169–170), and by fertilizing the disturbed soil with their feces (Matson 1990, p. 245; Siemann et al. 2009, p. 547). Pigs feed preferentially on the fruits of many non-native plants, such as *Passiflora tarminiana* (banana poka) and *Psidium cattleianum* (strawberry guava), spreading the seeds of these invasive species through their feces as they travel in search of food. Additionally, rooting pigs contribute to erosion by clearing vegetation and creating large areas of disturbed soil, especially on slopes (Smith 1985, pp. 190, 192, 196, 200, 204, 230–231; Stone 1985, pp. 254–255, 262–264; Medeiros et al. 1986, pp. 27–28; Scott et al. 1986, pp. 360–361; Tomich 1986, pp. 120–126; Cuddihy and Stone 1990, pp. 64–65; Aplet et al. 1991, p. 56; Loope et al. 1991, pp. 1–21; Gagne and Cuddihy 1999, p. 52).

In addition to destroying native vegetation, feral pigs create mosquito breeding sites. Mosquito-borne diseases such as avian malaria and pox present a significant threat to native Hawaiian forest birds. The compacted volcanic soils, wallows, and downed, hollowed-out tree ferns created by feral pig activity hold water and create breeding sites for mosquitoes, which transmit avian disease (Scott et al. 1986, pp. 365–368; Atkinson et al. 1995, p. S68). Native Hawaiian birds became exposed to mosquito-borne avian diseases when mosquitoes were introduced to the islands in 1827 with imported caged birds and domestic fowl (Yorinks and Atkinson 2000, p. 731 and references therein). Native Hawaiian forest birds are more susceptible to malaria than are non-native bird species (van Riper et al. 1986, pp. 327–328), and native birds infected with malaria also show altered behaviors that increase their vulnerability to predation (Yorinks and Atkinson 2000, pp. 731–738). Avian malaria appears to be highly pathogenic for the Hawaiian honeycreepers (akiapolaau, Hawaii akepa, Hawaii creeper and ou are classified as Hawaiian honeycreepers and occur in the vicinity of the proposed project; Yorinks and Atkinson, p. 737).

Ms. Tanya Rubenstein

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In a study of iiwi (*Vestiaria coccinea*), another Hawaiian honeycreeper, Atkinson et al. (1995, p. S65) described "extraordinarily high mortality" of birds infected with malaria.

We appreciate the opportunity to provide technical assistance in your environmental compliance process for this project. If you have any questions regarding this letter, please contact Dr. Jeff Zimpfer, Fish and Wildlife Biologist, Consultation and Habitat Conservation Planning Program (phone: 808-792-9431; email: jeff_zimpfer@fws.gov).

Sincerely,



for Loyal Mehrhoff
Field Supervisor

References

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Ms. Tanya Rubenstein

4

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<http://www.hear.org/books/hte1985/>.
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Ms. Tanya Rubenstein

5

Enclosure 1. Federally threatened and endangered plants and animals, and federally designated critical habitat occurring at Puu Makaala Natural Area Reserve and the adjacent 6,000 acres of forest at Kulani.

Scientific Name	Common Name	Status	Critical Habitat
<u>Mammal</u>			
<i>Lasiurus cinereus semotus</i>	Hawaiian hoary bat	Endangered	No
<u>Birds</u>			
<i>Branta sandvicensis</i>	Hawaiian goose	Endangered	No
<i>Buteo solitaries</i>	Hawaiian hawk	Endangered	No
<i>Hemignathus munroi</i>	akiapolaau	Endangered	No
<i>Loxops coccineus coccineus</i>	Hawaii akepa	Endangered	No
<i>Oreomystis mana</i>	Hawaii creeper	Endangered	No
<i>Psittirostra psittacea</i>	ou	Endangered	No
<i>Puffinus auricularis newelli</i>	Newell's shearwater	Threatened	No
<u>Plants</u>			
<i>Asplenium peruvianum</i> var. <i>insulare</i>	no common name	Endangered	No
<i>Clermontia lindseyana</i>	oha wai	Endangered	Yes
<i>Cyanea shipmanii</i>	haha	Endangered	Yes
<i>Cyanea stictophylla</i>	haha	Endangered	Yes
<i>Cyrtandra giffardii</i>	haiwale	Endangered	Yes
<i>Phyllostegia velutina</i>	no common name	Endangered	Yes
<i>Plantago hawaiiensis</i>	kuahiwi laukahi	Endangered	No
<i>Sicyos alba</i>	anunu	Endangered	Yes
Critical habitat only			
<i>Argyroxiphium kauense</i>	Kau silversword	Endangered	Yes
<i>Phyllostegia racemosa</i>	no common name	Endangered	Yes



KAMEHAMEHA SCHOOLS

March 2, 2011

Ms. Tanya Rubenstein
Natural Area Reserves Project Coordinator
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, HI 96813

Aloha Ms. Rubenstein,

The Kamehameha Schools Land Assets Division is pleased to support the proposed development of a **Pu'u Maka 'ala Natural Area Reserve Management Plan**.

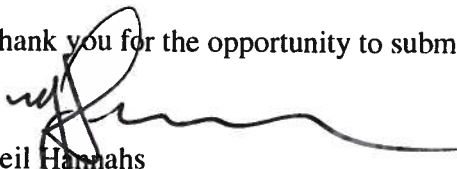
It is the mission of Kamehameha Schools ("KS") to create educational opportunities in perpetuity to improve the capability and well-being of people of Hawaiian ancestry. This well-being depends in large part on the existence of healthy native ecosystems such as those at Pu'u Maka'ala, and KS' neighboring properties in Keauhou, Ka'u.

KS has, since 1994, collaborated with area landowners and agencies to preserve the globally-rare natural resources in the 'Ola'a-Kilauea area, which include some of the very highest concentrations of native forest birds. These collaborative efforts have achieved dramatic and nationally-recognized results, reversing trends of habitat loss and species extinction.

KS expects that the proposed planning effort and its implementation will result in significant benefits to native ecosystems in and around Pu'u Maka'ala, and appreciates that the protection of these significant native ecosystems provides for the continuity of Hawaiian cultural traditions.

Joint stewardship of KS and DOFAW properties within the Pu'u Kipu, Kulani Cone and Wright Road management units has succeeded in managing ungulates, controlling weeds and restoring rare plants. KS supports the continued management of these areas for the health and abundance of natural resources.

Thank you for the opportunity to submit these comments.



Neil Hannahs
Director
Land Assets Division
Endowment Group
Kamehameha Schools



"Keola Lindsey "
<keolal@oha.org>
10/28/2010 01:05 PM

To <Tanya.Rubenstein@hawaii.gov>
cc
bcc
Subject Puu Makaala DEA

Aloha Tanya!- OHA is in receipt of your 10/11/10 letter seeking comments ahead of the DEA for the Puu Makaala NAR Management Plan. We would like a copy of the DEA for review and will provide comments at that time. Mahalo!

*Keola Lindsey
Office of Hawaiian Affairs
Compliance Monitoring Program
711 Kapiolani Boulevard
Honolulu, Hawaii 96813
keolal@oha.org (email)
(808) 594-0244 (office)*



United States Department of the Interior



NATIONAL PARK SERVICE
Hawai'i Volcanoes National Park
Post Office Box 52
Hawai'i National Park, Hawai'i, 96718

IN REPLY REFER TO:

L7621(HAVO)

November 15, 2010

Tanya Rubenstein
Natural Area Reserves Project Coordinator
Division of Forestry and Wildlife, DLNR
1151 Punchbowl St, Room 325
Honolulu, HI 96813

Dear Ms. Rubenstein,

We received your letter on October 11, 2010, requesting our input on your management plan for Pu'u Maka'ala NAR. The purpose of the plan is to protect, maintain and enhance the Reserve's unique natural, cultural, and geological resources. The proposed project includes fence construction, pig and invasive weed removal, planting of rare native plants, public access and the development of interpretive trails for the public.

Hawai'i Volcanoes National Park (HAVO) supports the overall goal of the management plan to protect, maintain and enhance the Reserve's unique natural, cultural and geological resources. Over the last two decades Hawai'i Volcanoes National Park has partnered with DLNR, Kūlani Correctional Facility and the other members of the Three Mountain Alliance Watershed Partnership to protect rare species and important habitats in the region. Perpetuation of native forest in Pu'u Maka'ala NAR is integral towards providing connectivity for species movement across the landscape and maintaining ecological integrity of the area.

Regarding your request for information on the history, land use, archeological sites, traditional uses and cultural associations in the project area, we recommend that the State refer to Kepa Maly's report for the Kamehameha lands "He Wahi Mo'olelo No keauhou A Me Na Wahi Pana Ma Laila." The information provides a good starting place to investigate activities on similar/adjacent lands to Pu'u Maka'ala NAR. Also, boundary testimonies and a search of the SHPD office (contact Teresa Donaham), State archives, UH Manoa library, Bishop Museum and old forestry records for any reports that were previously done for the area or adjacent lands may prove useful.

Regarding Kupuna referral, we suggest you reach out to the Kumu Hula from Hilo, Puna and Ka'u that may use the area for native plant collection, and la'au lapa'au people that may collect medicinal plants in the area. The Office of Hawaiian Relations list of Native Hawaiian organizations on the internet may be of use. Also this request for Kupuna referral could be sent to the Hawaii Community College, and UH Hilo Hawaiian Studies departments for input and participation in this process.

We appreciate the opportunity to provide preliminary comments for the preparation of your management plan and look forward to reviewing the draft document. If you have questions regarding this letter, please contact Dr. Rhonda Loh, Chief of Natural Resources Management (phone: 808-985-9323; email: rhonda_loh@nps.gov)

Sincerely,

A handwritten signature in blue ink, appearing to read "Cynthia L. Orlando". The signature is fluid and cursive, with the first name being the most prominent.

Cynthia L. Orlando
Superintendent

cc: Rhonda Loh



ronsan2224@aol.com
10/16/2010 11:40 PM

To Tanya.Rubenstein@hawaii.gov
cc kupunasam@gmail.com, jimalbertini@gmail.com,
ja@interpac.net, puanani625@gmail.com,
dr.kahumoku@hotmail.com, aloha_rocio@yahoo.com,
bcc

Subject Re: Pre-Consultation on Environmental Assessment (EA) for
the Pu'u Maka'ala Natural Area Reserve (NAR)
Management Plan

History: This message has been forwarded.

Dear Tanya Rubenstein, Natural Area Reserves Project Coordinator:

Thank you for your memo of October 11, 2010 inviting comments on
this project by November 15, 2010.

Ohana Ho`opakele is an organization very much interested in your
Environmental Assessment.

Concerning the issues you mentioned in the project area, namely:

1. History, land use and cultural sites e.g., historic or
archaeological sites, burials;
2. Traditional gathering practices in the project area--both past and
present;
3. Cultural associations through traditions, legends, traditional
use, or otherwise; and
4. Referrals of kupuna who might be willing to share their cultural
knowledge of the area.

I would like to comment on issues #1 and #4.

Concerning the land use of the proposed Natural Area Reserve
Management Plan, I believe that the area is related to both the Waiakea
Ahupuaa and the Olaa Ahupuaa. Both of these ahupuaa were designated
"Crown Lands" under the Mahele. Can you explain in your Environmental
Assessment how Crown Lands can be used for a Natural Area Reserve. I
understand that Crown Lands are reserved for Kamehameha III and his
family. In the event there are no heirs to the crown, the land would
be used solely for the Kingdom of Hawai'i.

Concerning kupuna who might be willing to share their cultural
knowledge of the area, I want to recommend Kupuna Calvin Kaleiwahea.
Kupuna Kaleiwahea owned Aloha Aiona Ranch which is a few miles away
from the Kulani forest. He lives at the Volcano and can be contacted
by telephone at home at 808-985-8653 or by cell at 808-896-9806. The
other family that I recommend you contact is the Hawelu family living
in Kurtistown. They are descendants of the birdcatchers in the Olaa
forest and owned the halfway house going to the volcano from Hilo.

I ask that you keep Ohana Ho`opakele informed by sending us a copy
of the Draft EA. You can send it to us at P.O. Box 5530, Hilo, HI
96720.

Thank you for this opportunity to comment on your Environmental
Assessment.

Sincerely,
Ronald S. Fujiyoshi,
Treasurer
Ohana Ho`opakele
cc: Ohana Ho`opakele officers
Advisor Dante Carpenter
Representative Faye Hanohano



Nanihawaii
<nanihawaii@aol.com>
11/15/2010 03:44 PM

To Tanya.Rubenstein@Hawaii.gov
cc
bcc
Subject Re: Pu'u Maka'ala NAR

Tanya Rubenstein
Natural Area Reserve Project Coordinator
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, Hi 96813

Dear Tanya Rubenstein;

Thank you for your graciousness, and this opportunity to comment.

As a life time resident of Hawaii, wilderness explorer, student of the natural sciences and previous member of the Sierra Club, I would like to make a few comments. I grew up hiking in the native forests, and learning about native species. I also had experiences with hunters, both in my family and with other locals and friends. I enjoyed an era when there was back country access via off road vehicles, and other similar sports. These are the cultural practices that I would like to bring to light.

The whole concept of fencing the forest is both something very new, and very offensive to so many of those who had at one time, enjoyed free access to public wilderness lands. The loss of access the public is experiencing does not inspire interest in the protection of native forests. The wilderness experience cannot be fully appreciated by adventurous out door explorers, when access is only allowed once or twice a year, and only with a ranger escort. It seems the NAR practices provide for only a very few select people to enjoy these wonderful places.

As lands are being converted to either NAR or DOFAW preserves, there is not only a disregard for the adventurous wilderness spirit, but also a disrespect for the cultural practice of hunting. Hunters provided their families with meat, and stocked their freezers. Hunting has been a tradition, staple, and recreation for families for a long time in the Islands. Now they are getting fenced out, and wildlife is being destroyed. This is both devastating and very sad for the hunting community.

The Big Island in particular has been famous for its out door opportunities and back country off road vehicle fun. The Mauna Kea Recreational User Group sought to preserve access up at Kulani for off road vehicle recreation, but were completely ignored.

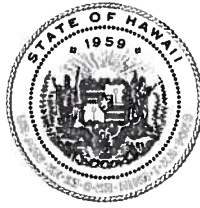
The Pu'u Maka'ala and Kulani lands were converted to NAR in the dark of night. Nothing was known when this land was being set up for conversion. By the time the public was able to learn about this take over, it was already "in the bag."

What can the public hope for besides a once a year guided tour of a wilderness museum? Maybe at the least a portion of the 6,600 acres of the Kulani forest could be turned into a high country public park with picnic areas and trails. Maybe old passages that were used by off road vehicles could be preserved and opened up for the public.

In a final comment I would like to add, there is growing concern over the use of herbicides in water shed areas. The excessive use of herbicides could prove with the test of time to be harmful. The use of bio-control for the sake of the native forest is also a controversial subject, as it effects the cultural practices involving non-native species of the last 100 years.

Thank you again, for allowing public comments.
Sincerely,

Nani KM Pogline
HCR1-Box 5209
Keaau, Hi 96749
808-982-8332




STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET, ROOM 325
HONOLULU, HAWAII 96813
TEL (808) 587-0166 FAX (808) 587-0160

September 23, 2011

To: Pua Aiu, Administrator
State Historic Preservation Division (SHPD)
Attn: Theresa Donham, Hawai'i Archaeologist

From: Paul Conry, Administrator
Division of Forestry and Wildlife 

Subject: Request for Determination, HRS §6E-8, Historic Preservation Review
Pu'u Maka'ala Natural Area Reserve Management Plan
Puna and South Hilo Districts, Hawai'i
TMK's 1-8-12:03, 1-9-01:1, 2-4-8:19, 2-4-8:21, 2-4-8:25 (portion),
and 2-4-008:09 (portion).

The Division of Forestry and Wildlife (DOFAW) is preparing a Draft Environmental Assessment for the Pu'u Maka'ala Natural Area Reserve (NAR) Management Plan and we would like to request SHPD concurrence with a determination of "no historic properties affected" for management actions proposed in the plan (HAR 13-275-5 (2)).

Project Summary

Pu'u Maka'ala NAR is situated on lands within the upper portions of Waiākea ahupua'a of the South Hilo District and the kalana (sub-district) of 'Ōla'a within the District of Puna. It was formally established in 1981 by Governor's Executive Order 3102 from lands withdrawn from the 'Ōla'a and Waiākea Forest Reserves. The original 12,106 acre (ac) (4,899 hectare (ha)) Reserve was created to protect native wet forest. In November 2010, an additional 6,600 acres (2,671 ha) of the former Kūlani Correctional Facility property was added to the NAR, bringing the total acreage of the NAR to 18,706 acres (7,570 ha) (Figure 1).

The primary threats to biodiversity and watershed integrity at Pu'u Maka'ala NAR are feral ungulates (wild, hoofed animals such as pigs, sheep, goats and cattle), especially feral pigs (*Sus scrofa*) and non-native, invasive weeds. The purpose of the actions proposed in the plan is to manage threats to the integrity, diversity and functioning of Pu'u Maka'ala NAR ecosystems so that the unique natural and cultural resources are protected, maintained, and enhanced.

Management programs have been developed to support this overall goal and include the following:

1. Ungulate Management (fencing, ungulate removal, fence maintenance)
2. Weed Management (weed control using herbicide, manual control)
3. Habitat Protection and Rare Species Restoration (planting rare plants, release of Alala [Hawaiian Crow], predator control)
4. Monitoring (monitoring response of native species/ecosystems to management)
5. Public Access, Outreach and Education (maintenance of trails, educational programs)
6. Fire Prevention and Response
7. Enforcement
8. Partnership Collaboration
9. Infrastructure (maintain existing trails/roads, maintain water infrastructure)

DOFAW does not yet have all the funding necessary to complete the proposed management programs, which will be implemented in phases, over the next fifteen years. However, if federal funding is used for the project, we will complete required Section 106 consultation.

Description of Proposed Management Actions and Area of Potential Effect

Fencing for ungulate management is the primary management action described in the draft plan. Initial field surveys have been conducted to identify approximate locations for the planned fence alignments (Figure 2). Final alignments will be based on terrain, feral ungulate movement patterns, sensitive resources, and feasibility. Final fence alignments will be sited to avoid impacts to botanical, faunal, visual, and, should any be identified, archaeological resources.

New fences will be aligned along existing four-wheel drive (4WD) roads where possible and follow local topography in order to minimize impacts to native ecosystems and reduce material transport and hand clearing costs. Prior to construction, the planned new fence alignment will be flagged and inspected by NAR staff for rare or endangered plant species and archaeological features. If necessary, fence alignment will be shifted to avoid individual rare plants or features. Fence construction in some areas will require clearing vegetation with hand and small power tools to create a fence corridor up to six foot (1.8 meter) wide. Fence materials will be transported to the site via trucks and helicopter. Fences will be constructed by driving posts into the ground no more than ten feet (3 meters) apart and attaching four foot (1.2 meter) high, high-tensile, bezinol-coated, steel woven, wire mesh (hogwire) to the outside of the posts. The hogwire will be tight to the ground and supplemented by anchor pins between fence posts.

Other proposed management actions for the NAR described in the plan will also be limited in scope and will not impact any known historical resources (e.g. weed control using herbicide and manual control, reforestation of pastures through tree planting, planting endangered plants using hand tools, predator control etc.)

No actions are proposed that will alter the Mauna Loa Boy's School structure. NAR staff may surround the structure with fencing and add signage to reduce the public safety hazard from the deteriorating structure. NAR staff will consult with SHPD prior to planning any actions related to the Boy's School structure.

Overall, the proposed action is expected to have a positive impact on native Hawaiian traditional and cultural practices. Protection of the forest and restoration of its native habitats can benefit practices such as traditional gathering by insuring that native plant populations are healthy. In addition, overall conservation of native habitats and species will aid in preserving the rich native Hawaiian history and spiritual connection to the forest, as places linked with oli and stories are preserved. Fencing will incorporate fence ladders and crossovers at appropriate locations so access by people is not blocked (only animal movement), and improvement and maintenance of access trails will be implemented. Therefore, proposed management actions will have long-term benefits for the perpetuation of native traditions and cultural practices.

Historical Resources

In 2004, Kumu Pono Associates prepared *He Mo'olelo 'Āina: A Cultural Study of the Pu'u Maka'ala Natural Area Reserve, District of Hilo and Puna, Island of Hawai'i*, a detailed study of historical and archival literature and limited oral history interviews and consultation with kama'aina and others with knowledge of the land. This document is an important reference for cultural resources management in the NAR. The complete study is available at <http://hawaii.gov/dlnr/dofaw/nars/reserves/big-island/puumakaala>.

This 2004 study did not note any records or references to specific archaeological sites in the proposed project area (which at the time did not include Kūlani). The study notes that “because of the remote nature of the 'Ōla'a and Waiākea forest lands which comprise the present-day Pu'u Maka'ala NAR, no government communications pertaining to historic trails or government road projects exist for the region. Boundary Commission testimonies describe trails through the forest lands, rising from the lowlands of Waiākea, 'Ōla'a, Keauhou and Humu'ula. Based on the native traditions and *kama'āina* testimonies, it is likely that “practitioner” trails existed throughout the forest region. Features such as “*kauhale manu*” (bird-catcher's shelters), “*kahua kalaiwaa*” (canoe-makers clearings), “*oiaina*” (trailside resting places and shelters), the “*ala hele*” (trails), and other features associated with traditional and customary accesses, would leave little evidence in the present-day, as the traditional features and uses generally had minimal impact on the natural landscape. Those things left behind, not cared for or maintained, were simply reabsorbed into the landscape.”

Kumo Pono Associates found “that the mountain landscape, its' native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property. Its protection, and the continued exercise of traditional and customary practices, in a traditional and customary manner, are mandated by native custom, and State and Federal Laws (as those establishing the 'Ōla'a and Waiākea Forest Reserves, the Pu'u Maka'ala NAR, and the Endangered Species Act).”

The State Historic Preservation Division has no records of historic properties or archaeological sites from Pu'u Maka'ala NAR. However, most of this dense forest area has not been surveyed for sites. Historic sites generally known from the area include the following:

- Mauna Loa Boy's School is a historic structure but it has not been maintained and is in currently in severe disrepair.

- Puu 'Ō'ō trail, a historic cattle crossing route from Keauhou to Humu'ula, is just above the Kūlani portion of the Reserve.

Summary Cultural/Archaeological and Historical Studies for the Project Area and Vicinity		
He Mo'olelo 'Āina: A cultural study of the Pu'u Maka'ala NAR, Districts of Hilo and Puna, island of Hawai'i.	Kumu Pono Associates Maly, K. and O. Maly. 2004.	Prepared by for Hawai'i Department of Land and Natural Resources, DOFAW. Available at: http://hawaii.gov/dlnr/dofaw/nars/reserves/big-island/puumakaala
Archeological inventory survey and limited cultural assessment for the proposed wastewater treatment facility at Kūlani Correctional Facility (TMK: 3-2-4-08:9)	Rechman, Robert B. 2001.	No sites found. archeological expectations for the general area are very limited due to location in the "rainforest zone" The summit of Pu'u Kūlani or Kūlani Cone marks the traditional land divisions of South Hilo, Puna and Kā'u and should be considered a cultural property due to references in chant and legend.
Riddle of the relic. How to get there from here: the story of Kūlani Road. The History of Kūlani Road Part II.	Warshauer, Kent. 2001. June 24 and July 1. Hilo Herald Tribune.	The Kūlani road was completed in 1945 by prison work crews from Waiākea prison camp. Kūlani was used since 1946 as a prison camp, and certain areas were used for logging, ranching and other activities. The road from the main facility to Mauna Loa Boys School, a home for delinquent boys, was completed in 1946.
Riddle of the relic. Boy's camp had short, notorious history.	Warshauer, Kent. 2001. April 24, 2001 Hilo Herald Tribune.	Construction of the Boy's School was completed in 1952 and the facility opened as Mauna Loa Forestry Camp, modeled after the Civilian Conservation Corps camps. Boy's School closed in 1953. Since closure the facility was used intermittently by Kūlani Correctional Facility and by the military.
Riddle of the relic. Army Road has interesting history.	Warshauer, Kent. 2002. September 8. Hilo Herald Tribune.	Army Rd area of the Reserve, which was used by the military from 1964 - 1970 for the testing of chemical and biological weapons.
Archeological and historical literature search and research design: lava flow control study, Hilo, Hawai'i.	McEldowney, H. 1979 Bishop Museum, Honolulu.	Project area is within rainforest zone and archeological expectations for the general area are very limited. Pre-contact period bird catchers may have used forest seasonally and established temporary residences. Such sites would have been constructed of perishable materials.

Impacts and Mitigation Measures

The probability of historic properties being present in areas proposed for management actions is very low and, should any be present, the probability of their being adversely affected is low because the various actions proposed in the plan entail only minimal ground disturbance.

Accordingly, we believe these projects will not affect any significant historic properties:

- Management actions (primarily fencing) are proposed for areas in remote, heavily vegetated upper elevation rain forest terrain with no known archeological or historic sites.
- Proposed management actions are limited in scope and involve minimal ground disturbance (e.g. hand-clearing of vegetation, construction of fences with no use of heavy machinery).
- Archeological studies in adjacent areas have not found any sites proposed for fencing and have determined there is a low likelihood of sites in this wet upper-elevation rain forest.
- Should any historic resources, including human skeletal remains, structural remains, or lava tube cave openings with midden deposits be identified during construction activities or other management actions, work in the immediate area will cease, and the State Historic Preservation Division will be contacted.
- Precise locations for proposed management actions such as fencing have not yet been finalized and are flexible. Should any historic resources be found in the field, projects can be relocated to avoid disturbance.
- Visual effects of the project will be minimal because most of the proposed fencing will be placed in areas distant from accessible viewpoints.
- The native Hawaiian ecosystems and species of the Reserve are an essential part of the overall cultural landscape. Protection and enhancement of the long-term survival of the natural resources in the Reserve through proposed management is the primary means to protect this valued cultural landscape.

Thank you for your assistance with this project. Please contact Tanya Rubenstein for additional information regarding this request. She can be reached at (808) 587-0027 or Tanya.Rubenstein@hawaii.gov.

Attachments: Figure 1. Location Map, Pu'u Maka'ala Natural Area Reserve
Figure 2. Proposed Fence Construction

Figure 1. Location Map, Pu'u Maka'ala Natural Area Reserve

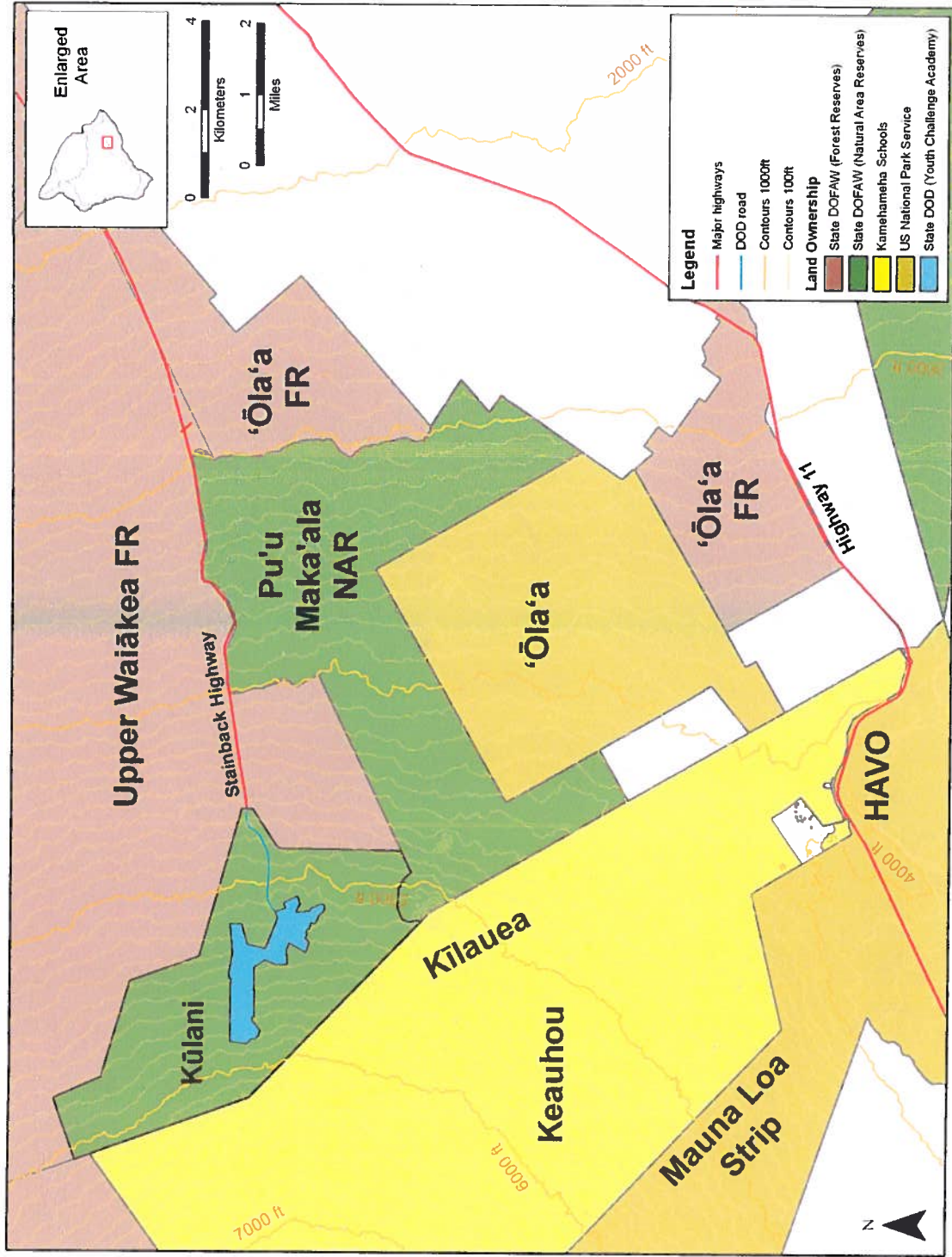
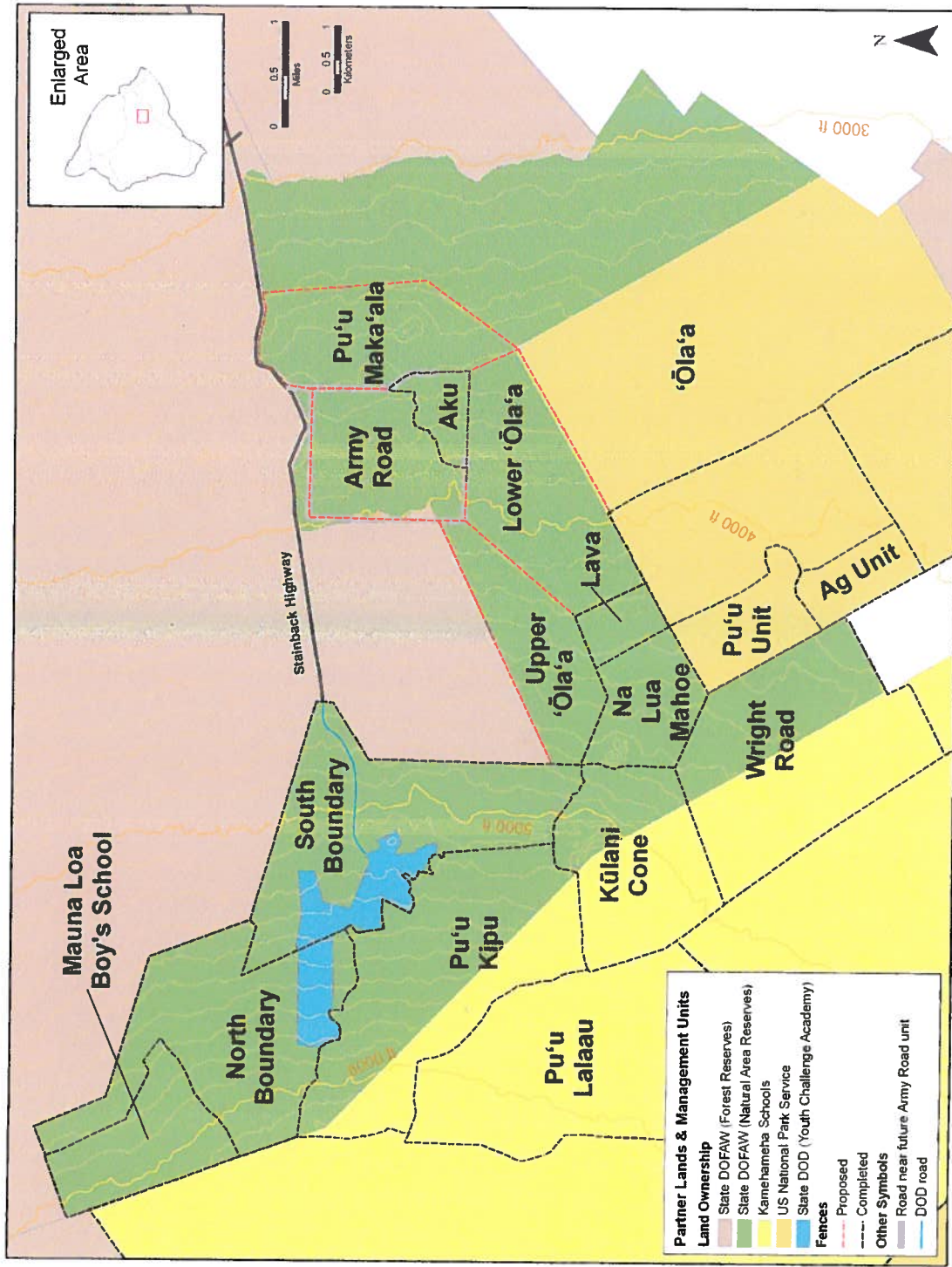
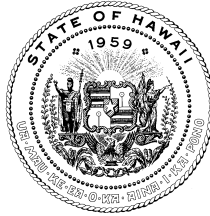


Figure 2. Pu'u Maka'ala NAR Existing Management Units and Proposed Fencing



NEIL ABERCROMBIE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

GUY H. KAULUKUKUI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

November 18, 2011

Log No. 2011.2466
Doc No. 1111TD21

MEMORANDUM

TO: Paul Conry, Administrator
Division of Forestry and Wildlife

FROM: Theresa K. Donham, Deputy State Historic Preservation Officer

A handwritten signature in black ink, appearing to read "Theresa K. Donham", is written over a horizontal line.

SUBJECT: **Chapter 6E-8 Historic Preservation Review – Draft Environmental Assessment Preparation Notice For the Pu‘u Maka‘ala Natural Area Reserve (NAR) Management Plan ‘Ōla‘a and Upper Waiākea Ahupua‘a, Puna and South Hilo Districts, Island of Hawai‘i**
TMK: (3) 1-8-012:003; 1-9-001:001; 2-4-008:009, 019, 021, and 025 (por.)

This is in response to your memo dated September 23, 2011 and received September 30, 2011 regarding the subject Management Plan that will apply to 18,706 acres of State land in the above TMK parcels. This Natural Area Reserve includes 12,106 acres designated as a NAR in 1981, and 6,600 acres of the former Kūlani Correctional Facility that was added to the NAR in November 2010. As indicated in your memo, the purpose of the management plan is to manage threats to the integrity and diversity of the NAR. Primary threats are feral ungulates (pigs, goats, etc.) and invasive weeds. Nine management programs are proposed: ungulate management (fencing, removal), weed management, habitat protection, monitoring, public access, fire prevention, enforcement, partnership collaboration and infrastructure. The proposed management plan was discussed in a meeting with Tanya Rubenstein and Lisa Hadway on August 29, 2011; and a site visit was conducted to the proposed fencing project area with Lisa Hadway on September 20, 2011.

Fencing

The ungulate fencing program will be the focus of the DEA; proposed fencing alignments are shown in a map attached to your memo. These include alignments along the boundaries of four management areas in TMK 1-8-012:003, which encompasses 6,871 acres. Portions of the Upper and Lower ‘Ōla‘a Units have been previously fenced; new fencing is proposed for the remainder of these boundaries. The Army Road and Pu‘u Maka‘ala Units will be fenced on all sides, except where they abut the Aku Unit, which has been previously fenced.

As indicated in your memo, fencing will be placed immediately adjacent to existing four-wheel drive roads where possible, and will be located to minimize impacts to native ecosystems. All planned fence lines will be flagged and inspected by NAR staff prior to installation, to ensure that rare plant species and historic properties are not impacted. The alignment will be moved to avoid these resources. Vegetation clearing will be with hand operated tools and will occur in a corridor approximately six feet wide to enable fence construction. Fencing will consist of four-foot high woven hogwire with metal t-posts and anchor pins to secure the fence along the ground surface. The proposed fencing has not been funded at this time; should federal funds be awarded, Section 106 consultation will occur. The area of potential effect for this work would be the 6-foot wide cleared fence corridor and any potential staging areas that may be needed to temporarily stage fencing material. After fence construction, a corridor immediately along the exterior side of the fence receives increased animal and human traffic, resulting in a narrow zone of relatively high impact to the ground surface.

Access and Infrastructure

Access will be provided by constructing fence ladders and crossovers, and by improving access trails. There is no mention of constructing new roads in your memo; and this was not proposed during the consultation meetings; the proposal is to maintain existing roads and existing water infrastructure.

Identification of Historic Properties

A summary of cultural, archaeological and historic studies relevant to the project area is attached to your memo. As indicated in this list, there have been few intensive inventory surveys in or around this project area. Literature reviews and cultural assessments indicate that due to the high elevation, traditional use was generally specialized and of short duration, resulting in few physical remains of structures that would survive for centuries in the forest environment. The review notes the presence of twentieth century facilities that are now over 50 years in age. These include the Kūlani Correctional Facility, first construction in 1946 and expanded in following years; and the Mauna Loa Boy's School, opened in 1952 and closed in 1953. The school facility was used periodically by the correctional facility and for military training activities. The Mauna Loa Boys School is within the NAR project area and is currently being used to store fencing materials; this use does not cause or constitute any adverse effects to the structure, which is in poor condition. The campus of the Kūlani Correctional Facility is not within the NAR.

The Pu'u 'Ō'ō Trail is located in the general vicinity, outside and to the west of the proposed fencing areas. This was an important inter-district trail that connected the Volcano area with Humu'ula and Keanakolu; it was used during the historic ranching era and probably follows an ancient trail corridor. In a prior review of the Kūlani Correctional Facility Master Plan, our office requested that development activities avoid the western portions of Parcel 2-4-008:009, due to an increased likelihood that sites associated with the trail would be present (Don Hibbard memo to Gordon Matsuoka, September 29, 1992; *Log 6396, Doc 9209hm04*). The fence lines proposed here do not extend into the western portion of Parcel 2-4-008:009 and will not affect this trail.

Other historic properties in the vicinity include Pu'u Kūlani, where the boundaries of Ka'ū, South Hilo and Puna Districts meet. This pu'u is a traditional cultural property and is located along the boundary between Parcels 2-4-008: 009 and 025, within the Kūlani Cone Management Unit. No new fencing is proposed for this unit.

Project Impacts and Mitigation

Our office has previously reviewed and commented on a management plan/DEA for the 'Ōla'a-Kilauea Management Area that includes portions of TMK 2-4-008:009 and 025; and on a DEA for a fencing project in the Kilauea Forest/Kūlani Correctional Facility area that includes portions of TMK 1-9-001:001. In both reviews, we indicated that due to the low occurrence rate of archaeological resources in this region, and given the flexibility of fencing projects to avoid any discoveries, we indicated that the projects would have no effect on historic sites (Don Hibbard letters to Tanya Rubenstein, April 8, 1997 and December 22, 1998, *Log 19233, Doc 9704PM01; Log 22678, Doc. 9812PM09*).

We have received no new information about this area to cause substantial revisions in our prior determinations. The expected low impacts of the project are summarized in your memo and include provisions for relocation of fence lines in order to avoid historic properties. We request that your mitigation measures regarding avoidance be more specific and include the following: If possible evidence of past human activity is observed during initial fence line assessment, construction, or subsequent monitoring, NAR staff will contact the SHPD Hilo office and report the find. Such finds might include lava tubes, rock alignments, mounds or architectural features, excavations or areas of broken pahoehoe, indications of trails, concentrations of artifacts, or any non-natural rock formation. SHPD staff will assist in determining the age, function and significance of the find and in determining appropriate mitigation. If the find is determined to have, or potentially have traditional cultural value, consultation with Native Hawaiian Organizations and knowledgeable individuals will also occur during planning of mitigation/protection measures. With the above measures in place, we concur that no historic properties will be affected by the fencing project. We also request that the above measures be applicable to the other proposed and ongoing management activities, such as fire prevention, habitat protection, monitoring and reforestation.

Please contact me at 933-7653 or Theresa.K.Donham@hawaii.gov if you have any questions or comments.