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LAND
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May 8, 2012

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

OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET, SUITE 702
HONOLULU, HAWAII 96813
MAY 10 11 25 AM '12

Dear Mr. Hooser,

Subject: Draft Environmental Assessment for the Ka'ū Forest Reserve Management Plan
(Ka'ū District, 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 May 23, 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,

Paul J. Conry, Administrator
Division of Forestry and Wildlife

OEQC Publication Form The Environmental Notice

Name of Project: Ka'ū Forest Reserve Management Plan
Applicable Law: Chapter 343, HRS
Type of Document: Draft EA
Island: Hawai'i
District: Ka'ū
TMK: (3rd) 9-7- 001:001, 009, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022; 9-6-006:009, 010, 015, 018; and 9-5-015:003 (por.)
Permits Required: Board of Land and Natural Resources approval; HRS Chapter 6e, Historic Sites approvals.

**Name of Proposing/
Approving Agency:** Department of Land and Natural Resources, Division of Forestry and Wildlife
Address 1151 Punchbowl Street, Room 131
City, State, Zip Honolulu HI 96813
Contact and Phone Tanya Rubenstein 808-587-0027

Consultant Geometrician Associates
Address PO Box 396
City, State, Zip Hilo HI 96721
Contact and Phone Ron Terry 808-969-7090

Project Summary: The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW), is preparing a management plan for the 61,641-acre Ka'ū Forest Reserve. The Plan responds to a need to maintain and restore key watershed, preserve a unique ecosystem with critically endangered plants and animals, perpetuate natural resources vital to Hawaiian culture and practices, find a suitable site to reintroduce 'Alalā or Hawaiian Crow into the wild, and provide for continued and expanded public use. Common to all three alternatives under consideration is construction of 12,000 acres of new fenced management units in the upper elevation central portions of the Reserve in which ungulates will be removed and the native forest protected. Field surveys would be conducted to identify locations for the planned fence alignments, and final fence alignments would be sited to avoid any impacts to botanical, faunal, and archaeological resources. Fences would include walkovers and gates to ensure public access into management units. Other actions include weed monitoring and control, trail and access improvements for hunters and hikers, outplanting of rare plant species, cooperation with water source users, and actions to foster reintroduction and survival of the 'Alalā. Impacts to pig hunting, which is considered by many to be a cultural practice, would occur but be less than significant because of the proposed locations of management areas. DOFAW seeks to balance providing public hunting opportunities in the Reserve with the protection of native ecosystems and watersheds, and the Plan includes actions to substantially facilitate public hunting in the Reserve.

Dear Participant:

Attached for your review is a Draft Environmental Assessment (DEA) prepared pursuant to the EIS law (Hawai'i Revised Statutes, Chapter 343) and the EIS rules (Administrative Rules, Title 11, Chapter 200).

Project Name: **Ka'ū Forest Reserve Management Plan**

Location: Island: **Hawai'i** District: **Ka'ū**
Tax Map Key Number: **(3rd) 9-7- 001:001, 009, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022; 9-6-006:009, 010, 015, 018; and 9-5-015:003 (por.)**

Comments must be received or postmarked by: **June 22, 2012**

Please send original comments to the:

Consultant: **Geometrician Associates**
Address: **PO Box 396**
Hilo HI 96721
Contact: **Ron Terry** Phone: **808-969-7090**

Copies of the comments should be sent to:

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Agency: **Department of Land and Natural Resources, Division of Forestry and Wildlife**
Address: **1151 Punchbowl Street, Room 131**
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Contact: **Tanya Rubenstein** Phone: **808-587-0027**

If you no longer need the EA, please recycle it. Thank you for your participation in the Environmental Assessment process.

Dear Participant:

This notice is to inform you that that a Draft Environmental Assessment (DEA) prepared pursuant to the EIS law (Hawai'i Revised Statutes, Chapter 343) and the EIS rules (Administrative Rules, Title 11, Chapter 200) is available for review. **As of May 23, 2012, the EA is available for download at: <http://hawaii.gov/health/environmental/oegc/index.html>**

Hardcopies of the EA have been sent to the Naalehu, Pahala and Hilo Public Libraries. Limited numbers of hardcopies are also available for private distribution (call 808-969-7090 to request).

Project Name: **Ka'ū Forest Reserve Management Plan**

Location: Island: **Hawai'i** District: **Ka'ū**
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DRAFT ENVIRONMENTAL ASSESSMENT

Ka‘ū Forest Reserve Management Plan

May 2012

Prepared for:

**State of Hawai‘i
Department of Land and Natural Resources
1151 Punchbowl Street, Room 131
Honolulu, Hawai‘i 96813**

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DRAFT ENVIRONMENTAL ASSESSMENT

Ka‘ū Forest Reserve Management Plan

TMKs (3rd) 9-7- 001:001, 009, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022; 9-6-006:009, 010, 015, 018; and 9-5-015:003 (por.)

PROPOSING/APPROVING AGENCY:

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1151 Punchbowl Street, Room 131
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CLASS OF ACTION:

Use of State Lands and State Funds

This document is prepared pursuant to:
The Hawai‘i Environmental Policy Act,
Chapter 343, Hawai‘i Revised Statutes (HRS), and
Title 11, Chapter 200, Hawai‘i Department of Health Administrative Rules (HAR).

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TABLE OF CONTENTS

SUMMARY	ii
PART 1: PROJECT DESCRIPTION, PURPOSE AND NEED AND E.A. PROCESS.....	1
1.1 Project Background and Location.....	1
1.2 Purpose and Need	6
1.3 Project Description	8
1.4 Environmental Assessment Process.....	13
1.5 Public Involvement and Agency Coordination	14
PART 2: ALTERNATIVES	15
2.1 No Action Alternative.....	15
2.2 Action Alternatives	15
2.3 Alternatives Evaluated and Dismissed from Further Consideration.....	21
PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION	22
3.1 Biological Resources	22
3.1.1 Vegetation and Flora	22
3.1.2 Fauna.....	30
3.1.3 Wildfire, Pests and Disease	37
3.2 Geology, Climate, Soil Erosion and Watersheds.....	39
3.3 Agriculture and Economy	45
3.4 Cultural Resources.....	50
3.5 Socioeconomic Conditions, Recreation and Public Health	66
3.6 Scenic Resources	73
3.7 Consistency with Government Plans and Policies.....	74
3.7.1 Hawai‘i State Plan	74
3.7.2 Hawai‘i State Forest Reserve Laws, Regulations and Policies.....	77
3.7.3 Hawaii’s Comprehensive Wildlife Conservation Strategy	78
3.7.4 Hawai‘i County General Plan and Ka‘ū Community Development Plan	80
3.7.5 Federal and State Endangered Species Laws and Plans	83
3.8 Cumulative and Secondary Impacts.....	85
3.9 Summary of Mitigation Measures	87
PART 4: DETERMINATION	89
PART 5: FINDINGS AND REASONS.....	89
REFERENCES	92

LIST OF TABLES

TABLE 3-1	Endangered, Threatened or Rare Plants in or Near Ka‘ū Forest Reserve	26
TABLE 3-2	Native Birds in Ka‘ū Forest Reserve	31
TABLE 3-3	Estimated Population Status of Endangered Forest Birds in Ka‘ū Forest Reserve.....	32
TABLE 3-4	Watersheds of the Ka‘ū Forest Reserve.....	40
TABLE 3-5	List of Organizations and Individuals Contacted for Interviews	51
TABLE 3-6	Selected Socioeconomic Characteristics, Ka‘ū District.....	67
TABLE 3-7	U.S. Fish and Wildlife Service Recovery Plans/Critical Habitat Designations.....	85
TABLE 3-8	Summary of Mitigation Measures	87

LIST OF FIGURES

FIGURE 1-1	Map of Ka‘ū Forest Reserve	2
FIGURE 1-2	Composite Satellite Image of Ka‘ū Forest Reserve	3
FIGURE 1-3	Photographs of Ka‘ū Forest Reserve	4
FIGURE 2-1a	Alternative A.....	18
FIGURE 2-1b	Alternative B.....	19
FIGURE 2-1c	Alternative C.....	20
FIGURE 3-1	Vegetation Communities of Ka‘ū Forest Res	24
FIGURE 3-2	Critical Habitat in Ka‘ū Forest Reserve.....	28
FIGURE 3-3	Ka‘ū Forest Reserve Water Resources	42
FIGURE 3-4	Traditional Ecological Zones Identified by Handy and Pukui (1998).....	53

LIST OF APPENDICES

APPENDIX 1	Ka‘ū Forest Reserve Management Plan
APPENDIX 2	Cultural Impact Assessment
APPENDIX 3	Public Involvement

SUMMARY OF THE PROPOSED ACTION, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW), is preparing a management plan for the 61,641-acre Ka‘ū Forest Reserve. The Plan responds to a need to maintain and restore key watershed, preserve a unique ecosystem with critically endangered plants and animals, perpetuate natural resources vital to Hawaiian culture and practices, find a suitable site to reintroduce ‘Alalā or Hawaiian Crow into the wild, and provide for continued and expanded public use. Common to all three alternatives under consideration is construction of 12,000 acres of new fenced management units in the upper elevation central portions of the Reserve in which ungulates will be removed and the native forest protected.

Field surveys would be conducted to identify locations for the planned fence alignments, and final fence alignments would be sited to avoid any impacts to botanical, faunal, and archaeological resources. Fences would include walkovers and gates to ensure public access into management units. Other actions include weed monitoring and control, trail and access improvements for hunters and hikers, outplanting of rare plant species, cooperation with water source users, and actions to foster reintroduction and survival of the ‘Alalā. Impacts to pig hunting, which is considered by many to be a cultural practice, would occur but be less than significant because of the proposed locations of management areas. DOFAW seeks to balance providing public hunting opportunities in the Reserve with the protection of native ecosystems and watersheds, and the Plan includes actions to substantially facilitate public hunting in the Reserve.

Implementation of the Plan will require approval by the Board of Land and Natural Resources, Chapter 6e, HRS, approvals related to historic sites, and review by the Office of Conservation and Coastal Lands and appropriate approvals for any cooperative actions implemented on adjacent private lands.

PART 1: PROJECT DESCRIPTION, PURPOSE AND NEED AND ENVIRONMENTAL ASSESSMENT PROCESS

1.1 Project Background and Location

The Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is preparing the Ka‘ū Forest Reserve Management Plan (“the Plan”). It will be one of a series of site-specific plans that will present brief histories, descriptions of cultural and natural resources, and proposed management actions for various Forest Reserves in Hawai‘i. The Plan is meant to be implemented over a 15-year time frame.

The current draft of the Plan is contained in full in Appendix 1. The Plan will be amended after consideration of public comments, and a final Plan will be published in the Final EA. The basic goals and objectives of the Plan will then be set, but management actions are meant to be updated through the dynamic process of incorporating community input and research results into resource protection and enhancement, which is called adaptive management. Ongoing refinement of the Plan will involve findings from ecosystem management and traditional ecological knowledge to improve the outcomes of management.

The Plan contains in-depth information that is summarized in this EA to the extent required to evaluate impacts and provide the background for proposed mitigation. Readers interested in addition details may consult Appendix 1.

Project Location

The Ka‘ū Forest Reserve (“the Reserve”) is located in the Ka‘ū District on the southeastern side of the island of Hawai‘i (Figure 1-1). It extends in elevation from about 2,000 to 7,000 feet above sea level. The nearest towns are Pāhala, Nā‘ālehu and Wai‘ōhinu. The properties involved are identified by Tax Map Keys: (3rd.) 9-7-001:001, 009, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022; 9-6-006:009, 010, 015, 018; and 9-5-015:003 (por.). The Reserve is roughly a parallelogram in shape, but it excludes several private parcels belonging to The Nature Conservancy (TNC) (9-7-001:004 and 007) and Kamehameha Schools (KS) (9-7-001:005, 006, and 012) that nearly divide it in several locations. Figure 1-2 is a satellite image that illustrates vegetation types in and adjacent to the Reserve. A variety of landscapes is present within the Reserve (Figure 1-3).

DOFAW has management responsibility for the 61,641-acre Ka‘ū Forest Reserve as part of the state Forest Reserve System, which was created by the Territorial Government of Hawai‘i through Act 44 on April 25, 1903. The more than 630,000 acres of land in the Forest Reserve System are managed under the guidance of the Hawai‘i State Constitution, Hawai‘i Revised Statutes (Chapter 183) and associated Hawai‘i Administrative Rules (Chapter 104). Through these directives, DOFAW focuses its resources to protect, manage, restore, and monitor the natural resources of the Forest Reserve System. The Ka‘ū Forest Reserve was established by Governor’s Proclamation on August 2, 1906 to protect the forest on the lower slopes of Mauna Loa, with particular regard for water supply of the agricultural lands of Ka‘ū.

Figure 1-1 Map of Ka'ū Forest Reserve

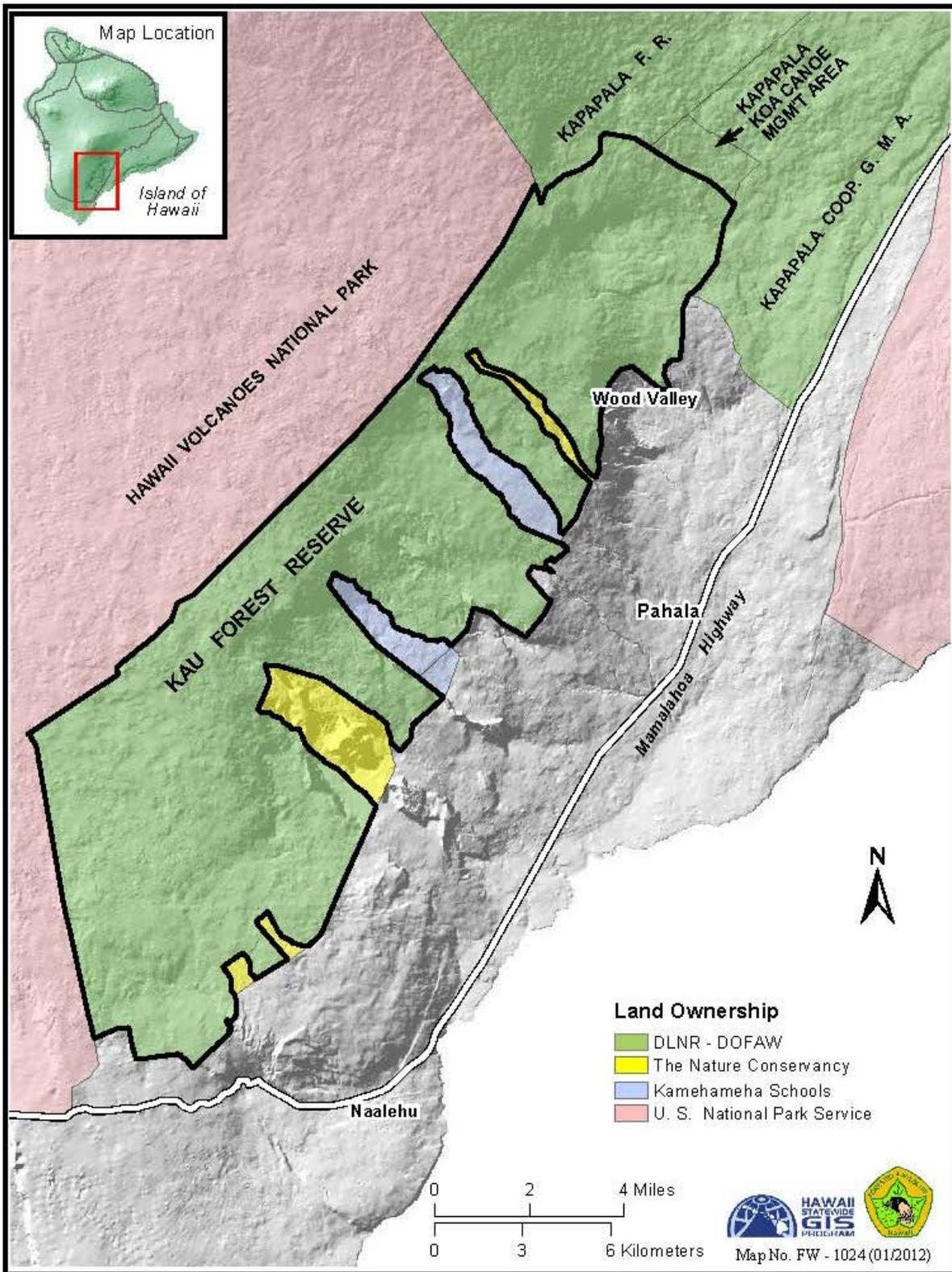


Figure 1-2 Composite Satellite Image of Ka'ū Forest Reserve



Figure 1-3



Aerial View of Reserve (© Rob Shallenberger) ▲

▼ Typical Walkover for Fenced Management Units (courtesy The Nature Conservancy)



The Reserve is adjacent to federal, private and other State lands managed for natural and cultural resource protection, ranching and farming. Adjacent major landowners include the U.S. National Park Service (NPS), Kamehameha Schools (KS), and The Nature Conservancy of Hawaii (TNC) (see Figure 1-1). The Reserve is also bordered by multiple private land owners and State-leased lands, including ranchers, farmers, and residents.

Existing Management and Research Activities

DOFAW has long conducted feral cattle control to protect the watershed and native ecosystems in the Reserve. Hundreds of feral cattle have been removed since the 1980s, particularly from the northern and central portions of the Reserve. Currently, there are low numbers of feral cattle in the Reserve, and staff from DOFAW continue to remove the remaining cattle. Adjoining ranchers have primary responsibility for maintaining and constructing fences to prevent cattle from entering the Reserve. DOFAW staff also maintain roads used for public access to the Ka'ū Forest Reserve in order to promote public use. Several small fenced areas have been constructed for protection and/or outplanting of rare plant species.

Many of DOFAW's efforts are cooperative with other agencies. In terms of threatened and endangered species management, seven forest bird surveys have been conducted between 1976 and 2008 by DOFAW and other cooperating agencies and organizations. 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. A summary of survey results is available at: <http://pubs.usgs.gov/of/2007/1076/of2007-1076.pdf> (Gorresen et al 2007).

Invasive species control and resource protection have also been priority activities in the Reserve. Limited portions of the Reserve have been surveyed for weeds. Surveys have been conducted along the lower boundary and on Hawai'i forest bird survey transects. DOFAW and Big Island Invasive Species Committee (BIISC) staff have surveyed and controlled populations of priority weeds in Ka'ū Forest Reserve including cats claw, bocconia, palm grass, ginger, strawberry guava and night blooming jasmine.

DOFAW and several adjacent landowners are members of the Three Mountain Alliance (TMA), a voluntary public-private watershed partnership with the goal of cooperative management of Hawai'i's natural and cultural resources. The overall management goal of the TMA is to sustain the multiple ecosystem benefits provided by the three mountains of Kīlauea, Mauna Loa, and Hualālai, by responsibly managing watershed areas, native habitat and species, historical, cultural, and socio-economic resources for all who benefit from the continued health of the three mountains.

TMA lands include the 116,000-acre Kahuku section of Hawai'i Volcanoes National Park, which was formerly used as a ranch and was then sold by Damon Estate to the Park in 2003 (see Figure 1-1). NPS is currently developing a General Management Plan (GMP) for the Park, which will provide a framework to use in making decisions about how to protect resources, what levels and types of uses are appropriate, what facilities should be developed, and how people should access the park. Other ongoing resource management actions at Kahuku include replacing the boundary fence

with Ka‘ū Forest Reserve, removing feral ungulates, reforestation of pasture and non-native invasive plant control. NPS management of Kahuku provides new opportunities for cooperative management with adjacent DOFAW lands in Ka‘ū, including public access to the Reserve through Kahuku, recreational opportunities, fire protection, invasive species control, management of threatened and endangered species, interpretation, education and outreach.

TNC, another TMA member, purchased the 3,511-acre Ka‘ū Preserve in 2002 to protect biologically rich and intact native forest found there. TNC’s Ka‘ū Preserve consists of four separate sections that are adjacent to the Ka‘ū Forest Reserve (see Figure 1-1). The TNC Ka‘ū Preserve is included in the state’s Natural Area Partnerships Program, which provides State-matching funds on a two-to-one basis with private funds for the management of natural resources on private lands permanently dedicated to conservation. TNC has constructed a fence around a 1,200-acre portion of the preserve at Kaiholena and removed feral ungulates from within the fenced unit. Other management activities include non-native invasive plant control and education and outreach. TNC has also worked to enhance public hunting in the Ka‘ū Forest Reserve by coordinating access through the TNC preserve, maintaining roads and providing fence step-overs.

In 2010, TNC contracted with Resource Mapping Hawai‘i to collect high resolution aerial imagery with a fixed wing aircraft in TNC’s Ka‘ū Preserve and also along the lower edge of Forest Reserve, where the forest meets the pasture. These aerial images will help identify patches of priority weeds in the forest so they can be controlled.

TMA member Kamehameha Schools’ extensive land holdings include two parcels of approximately 2,883 acres in the Conservation District (see Figure 1-1). KS seeks to *mālama i ka ‘aina*: practice ethical, prudent and culturally appropriate stewardship of lands and resources (KS 2000-2015 Strategic Plan). KS intends to integrate Hawaiian cultural values and knowledge into resource stewardship practices, incorporate *ahupua‘a* management principles, and promote a broad understanding of stewardship efforts and, as appropriate, cultural resource management programs.

1.2 Purpose and Need

DOFAW has identified the following key needs related to the Reserve:

- *Need to maintain and restore key watershed.* The Ka‘ū Forest Reserve is a critical watershed for the people of Ka‘ū. Water sources in the Reserve are used for domestic supplies as well as agriculture, and maintaining this water supply is important for the future viability of agriculture in Ka‘ū. The native forest replenishes springs and other groundwater, and reduces flooding and erosion. The water resources of Ka‘ū are threatened by invasive species of animals and plants, which degrade the native forest. Ungulates such as cattle, pigs, and mouflon sheep as well as invasive plants damage the native vegetation and soil, and lead to reduced quantity and quality of water.
- *Need to preserve a unique ecosystem with critically endangered plants and animals.* The Ka‘ū Forest Reserve is important for preserving Hawai‘i’s unique native forest ecosystems and its species. These include a wide variety of rare or endangered plants and animals.

Endangered birds for which the continuing health of the Reserve may be a critical factor include the ‘Akiapōlā‘au (*Hemignathus munroi*), Hawai‘i Creeper (*Oreomystis mana*) and Hawai‘i ‘Akepa (*Loxops coccineus*). In addition, the Reserve provides important habitat for other rare organisms including *loulou* or Hawaiian palm (*Pritchardia lanigera*), ‘Io or Hawaiian Hawk (*Buteo solitarius*), the ‘Ope‘ape‘a, or the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), and Pinao or Hawaiian Damselfly (*Megalagrion xanthomelas*). The Reserve also contains designated critical habitat for a species of endangered Picture Wing Fly (*Drosophila heteroneura*). Survival and recovery of these rare native plants and animals depend upon preservation of habitat by reducing impacts from threats such as ungulates, disease-bearing mosquitoes and other invasive insects, non-native predators, introduced diseases and invasive plants.

- *Need to perpetuate natural resources vital to Hawaiian culture and practices.* The Reserve contains resources that are vital for maintaining Hawaiian culture and practices. Hawaiians considered native plants and animals as family and have a strong spiritual connection to the mountain landscape and the forest itself. Gathering plants such as ferns, *maile* (*Alyxia oliviformis*), flowers, fruits, and other *lei*-making materials cannot be perpetuated into the future unless the forest ecosystem remains relatively pristine.
- *Need for suitable site to reintroduce ‘Alalā or Hawaiian Crow into the wild.* Up until the 1970s the Reserve supported the ‘Alalā (*Corvus hawaiiensis*). The ‘Alalā is listed as endangered and the species is extinct in the wild. The entire population of less than 100 birds is housed in two captive breeding facilities, making the ‘Alalā one of the rarest birds in existence. The ‘Alalā was restricted to the forests in the western and southern portions of the island, associated with ‘ōhi‘a and ‘ōhi‘a-koa forests with an understory of native fruit-bearing trees and shrubs. This understory is essential to the survival of the ‘Alalā in the wild, providing food as well as cover from natural predators such as ‘Io. The ‘Alalā Recovery Team has identified the Reserve as one of the high priority sites to restore this rare bird.
- *Need to provide for continued and expanded public use,* especially for residents of the Ka‘ū District. The Reserve is an important area for public use that includes hunting, recreational opportunities, cultural uses, personal gathering, and educational programs and activities. There is currently limited public access to much of this large area, and existing access needs to be maintained as well as improved by working with adjacent landowners to provide additional access, particularly across State-leased and private land below the Reserve.

Based upon the identified management needs in the area, the general purposes of the Ka‘ū Forest Reserve Management Plan are to:

- Develop management actions for general and specific areas that protect and restore the watershed and native species as vital natural and cultural resources. These actions include fencing and ungulate removal from the most critical area(s), predator control, invasive plant removal and control, and native plant restoration.
- Reintroduce the ‘Alalā to the Ka‘ū Forest Reserve.
- Enhance public access to Ka‘ū Forest Reserve through development and maintenance of public access roads, and other infrastructure (trails, cabins and/or campsites, etc.).

- Conform with the purpose of the Forest Reserve System and the Ka‘ū Forest Reserve, in particular as stated in Hawai‘i Revised Statutes (Chapter 183) and associated Hawai‘i Administrative Rules (Chapter 104), to protect, manage, restore, and monitor the resources of Forest Reserves for the public benefit, particularly water resources.

1.3 Project Description

A series of management objectives and actions that respond to the purpose and need described above comprise the “action” elements of the Plan. Most of these actions could have either beneficial or adverse effects and thus require examination in this EA. The actions listed below have been summarized and adapted from Section III of the Plan, which may be consulted for background and further details.

As with management that already occurs as part of the Three Mountain Alliance, some of the management actions listed below may be implemented cooperatively with adjacent private landowners on private parcels belonging to The Nature Conservancy (9-7-001:004 and 007) and Kamehameha Schools (KS) (9-7-001:005, 006, and 012), if the landowners decide to participate and they obtain appropriate necessary approvals related to the location in the Conservation District.

1. *Watershed Values and Native Ecosystems*

Management Objective: Protect and manage forested watersheds to produce fresh water for public use, reduce land-based pollutants (e.g. soil erosion, animal waste), improve coastal water quality and maintain native ecosystems.

Actions:

1. Prevent damage to watershed and native ecosystems by removing all feral cattle from within the Reserve and controlling livestock trespass by maintaining existing boundary fencing.
2. Protect watershed and native ecosystems from feral ungulate damage by construction of 12,000 acres of new fenced management units in the upper elevation parts of the Reserve.
3. Remove feral ungulates from within fenced management units using a variety of approved methods including special public hunts, trapping, and staff control.
4. Inspect, maintain and replace fences.
5. Monitor fenced management units for ungulate presence following complete removal, and control the ingress of ungulates, if necessary.
6. Protect and maintain biological diversity of the Reserve’s ecosystems.
7. Monitor watershed function.
8. Participate in collaborative initiatives such as the Three Mountain Alliance Watershed Partnership with other public and private forest landowners.
9. Protect important forested lands through addition to the Forest Reserve System.

Three possible fencing unit alternatives of about 12,000 acres each are being considered, which differ in the location of fencing. These alternatives are described and mapped in Section 2 of the

EA, and Section 3 provides an analysis of impacts, on an alternative-by-alternative basis where relevant.

Whatever the alternative selected, DOFAW would subdivide the total fenced area into units of 2,000 to 4,000 acres that would be fenced over time, as funding becomes available. The final configuration and number of fenced unit(s) would consider factors such as water resources, quality of native ecosystems and habitat for native species, level of damage from ungulates, public use of area, cooperation with adjacent landowners, terrain, logistics, accessibility, and feasibility for effective feral ungulate removal. Field surveys would be conducted to identify locations for the planned fence alignments, and final fence alignments would be sited to avoid any impacts to botanical, faunal, and archaeological resources. Fences are not meant to restrict public access into management units, and walkovers and gates would be installed in order for people to access fenced areas. Fencing costs are estimated at approximately \$150,000 per mile (labor, materials and helicopter), and would be completed based upon the availability of funding for labor and materials. DOFAW staff and/or contractors will need to implement construction of fenced units in phases.

As fence construction in a unit is completed, DOFAW staff would use various approved methods to remove ungulates from within the fenced units (Hawai'i State DOFAW 2007). Public hunting will be encouraged during the first phase of ungulate removal, but additional control methods including drives, trapping, staff control with dogs, snaring, and other approved methods may be needed to remove all the ungulates.

Regular fence inspection and maintenance would be needed once fence construction was complete. Fences would also need to be replaced as they deteriorate and costs for fence replacement would need to be taken into account in future management plans.

2. *Invasive Species Control*

Management Objective: Protect intact native forest by removing high priority non-native, invasive weeds and other invasive species.

Actions:

1. Monitor and map the distribution of high priority weeds and develop a control strategy.
2. Identify highest priority areas for intensive weed control.
3. Control weeds along invasion corridors (e.g., roads, trails, fences) and within fenced management units using approved methods.
4. Maintain procedures to prevent introduction of new weeds.
5. Monitor weeds to determine whether weed control measures are effective and to detect changes in long term 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. DOFAW staff will monitor weed control areas to evaluate the effectiveness of control efforts. Ka'ū Forest Reserve is also targeted for additional weed mapping using new technologies (high resolution aerial imagery). Analysis of the aerial imagery will assist DOFAW staff in locating priority weeds for control purposes.

Weed control priorities include suppression and containment of priority weeds (night blooming jasmine, *kahili* ginger, bocconia, clidemia, and strawberry guava) along the lower Reserve boundaries to prevent and reduce the spread of these weeds into more intact native forest areas in the higher elevations. Regular surveys along the lower boundary and along forest bird survey transects should be continued to detect new incipient weeds and increased spread of priority weeds into the upper Reserve. DOFAW will develop cooperative weed control projects with adjacent private landowners and lessees to benefit ranching, forestry and agriculture as well as suppress priority weeds in critical native forest buffer areas.

Other weed control priorities include the following: reduce the spread of bocconia from Wood Valley into the Reserve; develop a containment strategy for night-blooming jasmine (e.g., keep Waihaka gulch population farthest to the east from spreading further east); eliminate *kahili* ginger from Mauna Kea Springs Hunter Trail vicinity west of Waihaka gulch; and control glory bush on Mountain House Road.

Priority areas for weed management will also include 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.

Weed control goals include early detection and preventing the establishment of incipient, habitat modifying weeds that are not currently present (e.g., miconia) or are still localized. For priority weeds already present, 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, DOFAW 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 people working in and visiting the area. DOFAW staff and volunteers will follow protocols for cleaning of boots, equipment and vehicles.

A combination of control techniques including staff control using manual, mechanical and approved herbicides will be used to remove weeds. The technique used will be 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. Due to widespread and heavy infestations of certain weeds and limited resources, DOFAW will use approved biocontrol agents within the Reserve, when available, and if shown to be effective.

3. *Threatened and Endangered Species Management*

Management Objective: Protect occurrences of threatened and endangered species and restore populations of these species in appropriate habitat to assist with the overall recovery of these species.

a) General Actions:

1. Fencing and feral ungulate removal (discussed above in section on Watershed Values - Actions #1-4).
2. Weed management and preventing the introduction of new habitat-modifying species are discussed above (Invasive Species Control - Actions #1-5).

Implementation of the actions described above will benefit many threatened and endangered plants and animals but is not enough to recover certain threatened and endangered species. These species may have wild populations that are so low that the species cannot survive and recover without additional management. They may require additional management actions to maintain the presence of wild populations or re-establish new populations. Additional specific actions for forest birds, ‘Alalā and rare plants are discussed below.

b) Threatened and Endangered Forest Bird Actions

1. Predator control.
2. Continue long-term forest bird monitoring program in cooperation with the Hawai‘i Forest Bird Interagency Database Project to assess changes in the population and distribution.

c) ‘Alalā Actions

1. Fencing and ungulate control – a minimum area of approximately 2,500 acres is required for initial releases.
2. Remove predators from the release area (all feral cats and 80 percent of other non-native predators (mongoose, rats).
3. Restore native food plants through planting, as needed.
4. Construct release cages, most likely placed on scaffolding to minimize predator access, in natural forest openings with some clearing likely necessary. A remote cabin or weatherport will be built for staff to maintain the constant presence at the release site for an undetermined length of time to care for, feed, monitor and track released birds.
5. Determine ‘Io density and the relationship between ‘Io density and the availability of rodents and game birds and vegetation density.

d) Threatened and Endangered and Rare Plant Actions

Actions:

- Survey, map and monitor existing populations and individual rare plants and collect propagation material.
- Propagate and re-introduce certain species of rare and endangered plants in appropriate protected habitat through outplanting, in coordination with other agencies and organizations working on rare plant recovery.
- Monitor growth and survival of reintroduced plants.
- Protect rare plants in areas outside fenced management units through the construction of small fenced exclosures
- Conduct other management, as required (control of damaging weeds, insects, slugs, plant disease and/or mammalian predators).

DOFAW staff will work cooperatively on rare plant recovery with other organizations and agencies including the Hawai‘i State Plant Extinction Prevention Program (PEPP) and the Volcano Rare Plant Facility (VRPF) of the University of Hawai‘i. PEPP is focused on preventing the extinction of taxa with fewer than 50 individuals in the wild. The VRPF and/or other state permitted facilities will propagate all rare plants used in the DOFAW program.

4. *Public Activity*

Management Objective: Provide for continued public use of the Reserve, including hunting, recreational opportunities, cultural uses, personal gathering, educational programs and activities.

Actions:

1. Maintain existing public access roads.
2. Develop new access routes to increase access in cooperation with neighboring uses, particularly on existing roads or other alignments just within the Reserve boundary, and across private and State-leased lands below the Reserve.
3. Continue to facilitate public hunting in the Reserve.
4. Develop low-impact activities and minimal improvements, including picnic and camping areas, trails and public cabins/shelters, which are consistent with the remote, wilderness nature of the Reserve. DOFAW seeks community input and recommendations on the potential development and locations for additional recreational amenities.
5. Hire outreach staff and work with partners to provide community outreach and education (e.g. volunteer service trips, student internships, school programs, etc.) to build public understanding and support for Ka‘ū Forest Reserve’s unique native resources.

5. *Resource Protection*

Management Objective: Reduce the threats of fire, insects, and disease to the Reserve.

1. Install a remote automatic weather station to monitor fire weather in the Reserve and/or adjacent areas (specific location to be determined).
2. Respond to fires, as needed.
3. Monitor forest for insects and disease.

6. *Game Animal Management*

Management Objective: Continue to provide public hunting opportunities in the Reserve.

Actions:

1. Maintain existing public access roads for use by hunters.
2. Develop new access routes to increase hunter access, particularly across private and state-leased lands below the Reserve.
3. Provide opportunities for public hunters to assist with the removal of feral pig and sheep in fenced, management units prior to staff control.

7. *Commercial Activity*

Management Objective: Develop means to make the Reserve economically self-supporting, in whole or in part, as has been done with other forest reserves across the State.

Actions:

1. Determine environmentally compatible means for generation of revenue to support proposed management activities.

1.4 Environmental Assessment Process

Basis for Environmental Assessment

This Environmental Assessment (EA) was prepared in accordance with Chapter 343 of the Hawai‘i Revised Statutes (HRS) by the Division of Forestry and Wildlife of the Hawai‘i Department of Land and Natural Resources, the proposing and approving agency. Chapter 343, HRS, along with its implementing regulations, Title 11, Chapter 200, of the Hawai‘i Administrative Rules (HAR), is the basis for the environmental impact assessment process in the State of Hawai‘i. An EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to thirteen specific criteria. Part 4 of this document states the finding (anticipated in the Draft EA) that no significant impacts are expected to occur, and Part 5 lists each criterion and presents the findings by the

approving agency. If approving agency finds after considering comments to the Draft EA that no significant impacts would be expected to occur, then it issues a Finding of No Significant Impact (FONSI), and the action will be permitted to occur. If the agency concludes that significant impacts are expected to occur as a result of the proposed action, then it determines that an Environmental Impact Statement (EIS) must be prepared for the action to proceed.

Implementation of the Plan will require approval by the Board of Land and Natural Resources, Chapter 6e, HRS, approvals related to historic sites, and review by the Office of Conservation and Coastal Lands and appropriate approvals for any cooperative actions implemented on adjacent private lands.

1.5 Public Involvement and Agency Coordination

Public outreach has been conducted through formal early consultation letters, a series of several dozen informal meetings, and phone/ communications with parties who have inquired about the project. DOFAW, its partners at The Nature Conservancy and its consultants contacted the following agencies, organizations and individuals by mail, email or phone. Those with whom the team conducted presentations, attended meetings, or had interviews are indicated by an asterisk:

Individuals and Organizations:

Discovery Harbor Community Association
Ka 'Ohana o Honu'apo
Ka'ū Preservation
Ka'ū Agricultural Water Co-op Steering Committee*
Ka'ū Chamber of Commerce*
Landowners Edward Olson Trust*, Monica Mallick, EWM*, C. Manfredi, Kamehameha Schools*
Ocean View Community Association/ Community Development Corporation /*
Ocean View Ranchos Community Association
O Ka'ū Kakou
Ranchers Lani Petrie, Wally Andrade, Alfred and Michelle Galimba, and Kyle Soares*
Sierra Club, Moku Loa Group
Three Mountain Alliance*

County Agencies and Officials:

Civil Defense Agency
County Councilmember Brittany Smart*
Department of Parks and Recreation
Department of Public Works
Department of Water Supply (Kurt Inaba, Engineering Division Chief)*
Fire Department
Planning Department (Ron Whitmore, Planner, Ka'ū Community Development Plan)*
Police Department

State Agencies and Officials:

Department of Agriculture
Department of Health, Environmental Planning Office
Department of Transportation
Office of Hawaiian Affairs
Representative Bob Herkes and Senator Gil Kahele*
State Historic Preservation Division

Federal Agencies and Officials:

Hawai'i Volcanoes (HAVO) National Park*
U.S. Fish and Wildlife Service*
U.S. Geological Survey, Biological Resources Division*

The consultation has included six all-day field trips with several dozen hunters and general community members in order to share information about the project area and its resources and the proposed actions.

Copies of written communications received in response to early consultation efforts are included in Appendix 3a. The Final EA will include copies of all written comments received in response to the Draft EA during the 30-day comment period as well as the responses of DOFAW to each letter.

PART 2: ALTERNATIVES

2.1 No Action Alternative

Under the No Action Alternative, the suite of actions described in the Ka'ū Forest Management Plan would not be undertaken. General management would continue under the status quo, although a variety of new, minor actions that do not require compliance with Chapter 343, HRS, might also be undertaken on a piecemeal basis. This EA considers the No Action Alternative as the baseline by which to compare environmental effects from the project.

2.2 Action Alternatives

Three possible fencing area alternatives being considered, each comprising roughly 12,000 acres, which differ only in the location of the fenced management areas. The alternatives are general and are still in draft form, pending agency and public comment and completion of environmental analysis. Whatever the alternative selected, DOFAW would subdivide the total fenced area into units of 2,000 to 4,000 acres. These be fenced over time, as funding, which is estimated at about \$10,350,000 total for each alternative, becomes available.

In general, however, it should be noted that the areas are located in the upper elevation (above 4,000 to 4,500 feet) portions of the Reserve. This area exhibits the highest quality habitat and watershed, particularly habitat for the three endangered forest bird species, and it is also a priority area for restoration for release of the ‘Alalā. Furthermore, monitoring data from forest bird transects shows this area is the portion of the Reserve that has the most feral ungulate damage. Although there is currently an intact canopy of tall native trees, in many areas much of the ground and understory layers of ferns, small plants and young tree seedlings have been damaged by feral ungulates, leaving the ground bare and exposed. Without management, the native forest will continue to decline because young trees will not be able to grow and become established to replace the older canopy trees as they die. Fencing and feral ungulate removal will benefit native ecosystems by limiting the browsing and trampling of native plants. Other benefits include reduction of soil erosion/exposed soil and subsequent invasion of non-native plants.

The following is a list of action alternatives that currently appear appropriate to consider as part of the EA process (see Figures 2-1a-c for maps):

Alternative A: Implementation of all management actions, with fencing of about 12,000 acres of the southwestern portion of the Reserve above 4,000 to 4,500 feet in elevation (Figure 2-1a). This area includes important watershed for Wai‘ōhinu and Nā‘ālehu. It is somewhat weedier than other areas and contains fewer rare, threatened or endangered plant species and less dense concentrations of endangered forest birds. However, it was highly ranked by the ‘Alalā Recovery Team as a release site due to abundant food plants, broad elevational gradient and accessibility for release, monitoring and care of the crow. Two sides of the proposed fenced unit are already built and it is accessible by road, reducing the cost of initial fencing. Pig hunters report frequent use and residents cite it as a site for *maile* gathering because of access from Lorenzo Road, Kiolakaa Road and Ha‘ao Springs Road. Depending on the outcome of National Park planning studies, it may be adjacent to areas considered for higher levels of public uses at the Kahuku Unit of Hawai‘i Volcanoes National Park. This alternative offers potential links to the TNC property at Kaiholena and associated partnership opportunities.

Alternative B: Implementation of all management actions, with fencing of about 12,000 acres of the central portion of the Reserve above about 4,500 to 5,000 feet in elevation (Figure 2-1b). This area includes important watershed for Pahāla. This area has rare, threatened and endangered plant and animal species and only limited weeds. It was highly ranked by the ‘Alalā Recovery Team as a release site because of good forest canopy but has less abundant preferred food plants. It is less accessible for release, monitoring and care of the ‘Alalā, although its remoteness may be beneficial to release owing to less human disturbance and edge effect. Ākepa and Hawai‘i Creepers (both of which are endangered forest birds), as well as ‘I‘iwi, are relatively abundant. One side of the proposed fence has been built, and it is accessible by road. No public accesses are present nearby. The remoteness of this area, coupled with the rugged terrain and dense vegetation of surrounding areas, makes recreational use of the area difficult, although hunters report that they

sometimes access it through hunting trails from *makai*. This alternative offers potential links to two TNC properties and two KS properties, and associated partnership opportunities.

Alternative C: Implementation of all management actions, with fencing of about 12,000 acres of the northeastern portion of the Reserve above 4,500 to 5,000 feet in elevation (Figure 2-1c). This area includes important watershed for Wood Valley. Although ranked highly by the ‘Alalā Recovery Team as a release site, it has less abundant preferred food and the more open canopy, partially due to past disturbance by feral cattle, may not be ideal for the release of the crow. The area has rare, threatened and endangered plant species and contains more *koa* than other portions of the Reserve, due to the drier climate. ‘Akiapōlā’au are most abundant here, and Ākepa and Hawai‘i Creepers and are also present. Due perhaps to drier habitat, fewer mosquitoes and thus less avian disease, ‘I‘iwi are found at lower elevations in this northeastern portion of the Reserve. The National Park is planning additional boundary fencing on one side. This area is accessible to the general public from public roads on the Kapāpala side, and community members report it is frequently hunted and visited for *maile* gathering. This alternative offers potential links to a TNC property and a KS property, and associated partnership opportunities.

At this point, DLNR has identified Alternative B as the preferred alternative, because it offers the following:

- Rare, threatened and endangered plant and animal species and only limited weeds
- A diversity of forest types including wet and mesic ‘ōhi‘a, and wet and mesic *koa* forests
- A highly suitable location for introduction of the ‘Alalā, with good forest canopy (if somewhat less abundant preferred food plants), and accessibility for release, monitoring and care of the ‘Alalā, but also sufficient remoteness to help minimize human disturbance and edge effect
- Relatively abundant Ākepa, Hawai‘i Creepers and ‘I‘iwi as well as ‘Akiapōlā’au
- Fencing already built on one side
- Relatively little reported use by hunters
- Potential partnership opportunities with two TNC properties and two KS properties, the most of any alternative

Section 3 analyzes impacts on an alternative-by-alternative basis. Based on the input received and further analysis they will be refined, and the Final EA will present the selected alternative for implementation.

Figure 2-1a Alternative A

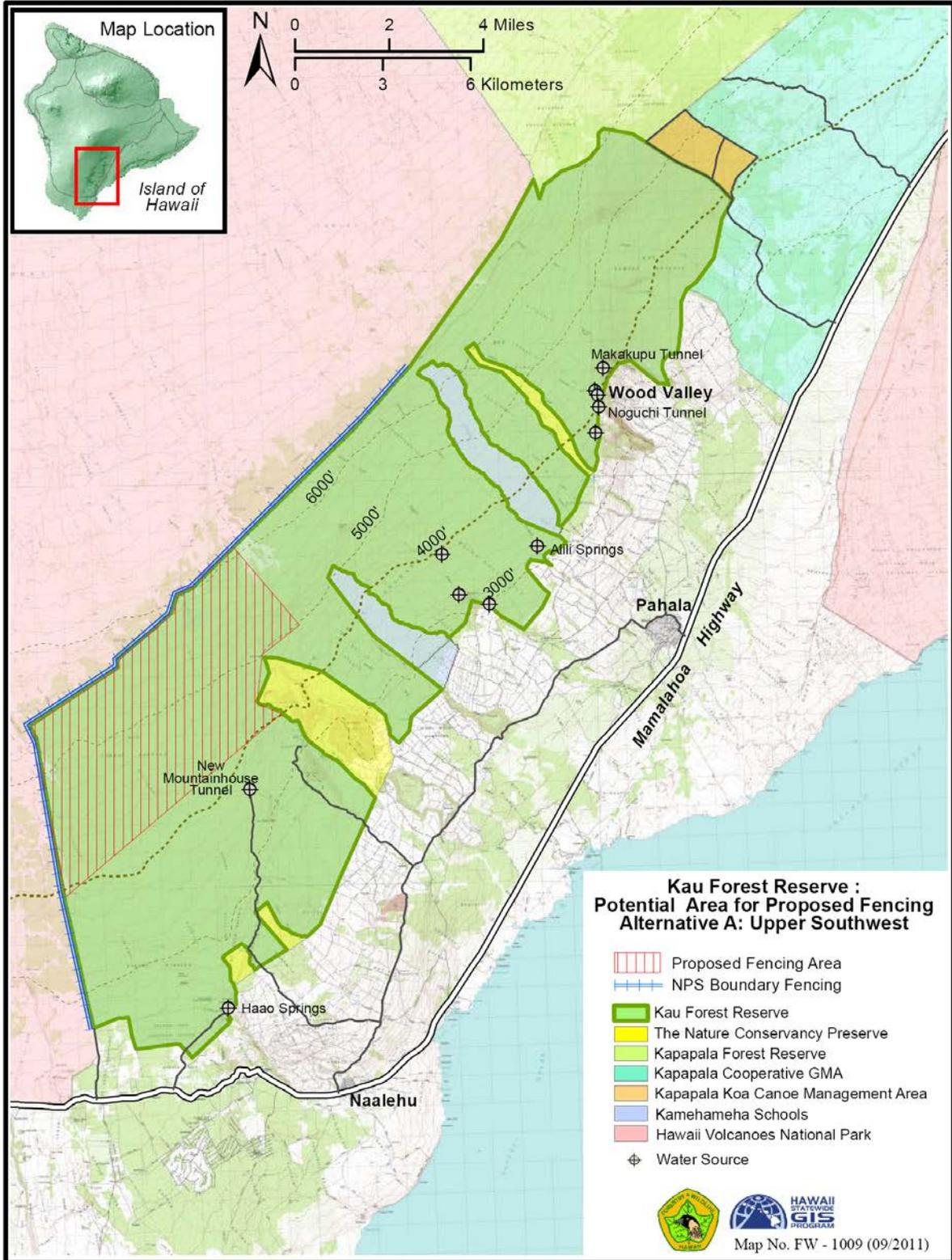


Figure 2-1b Alternative B

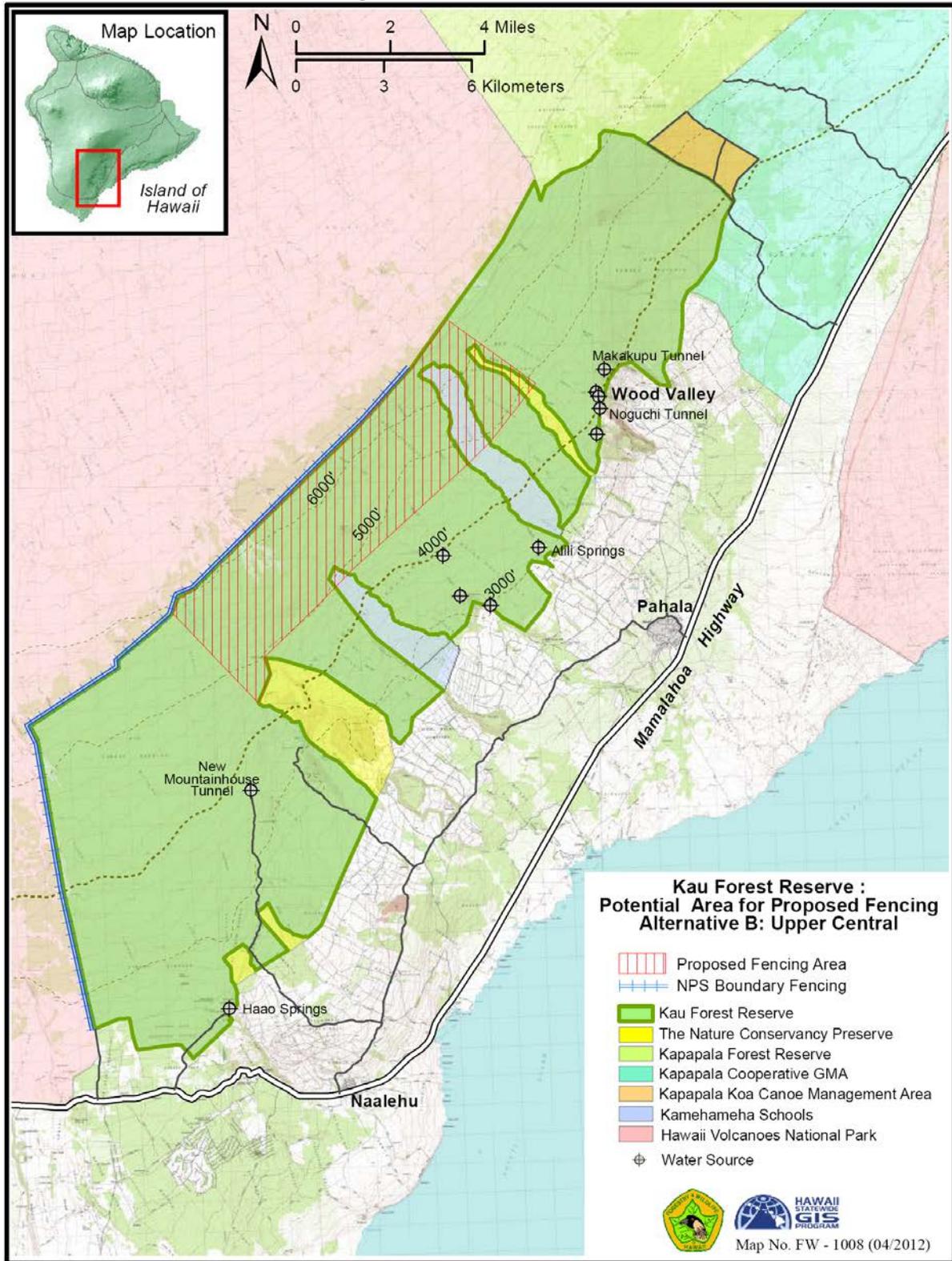
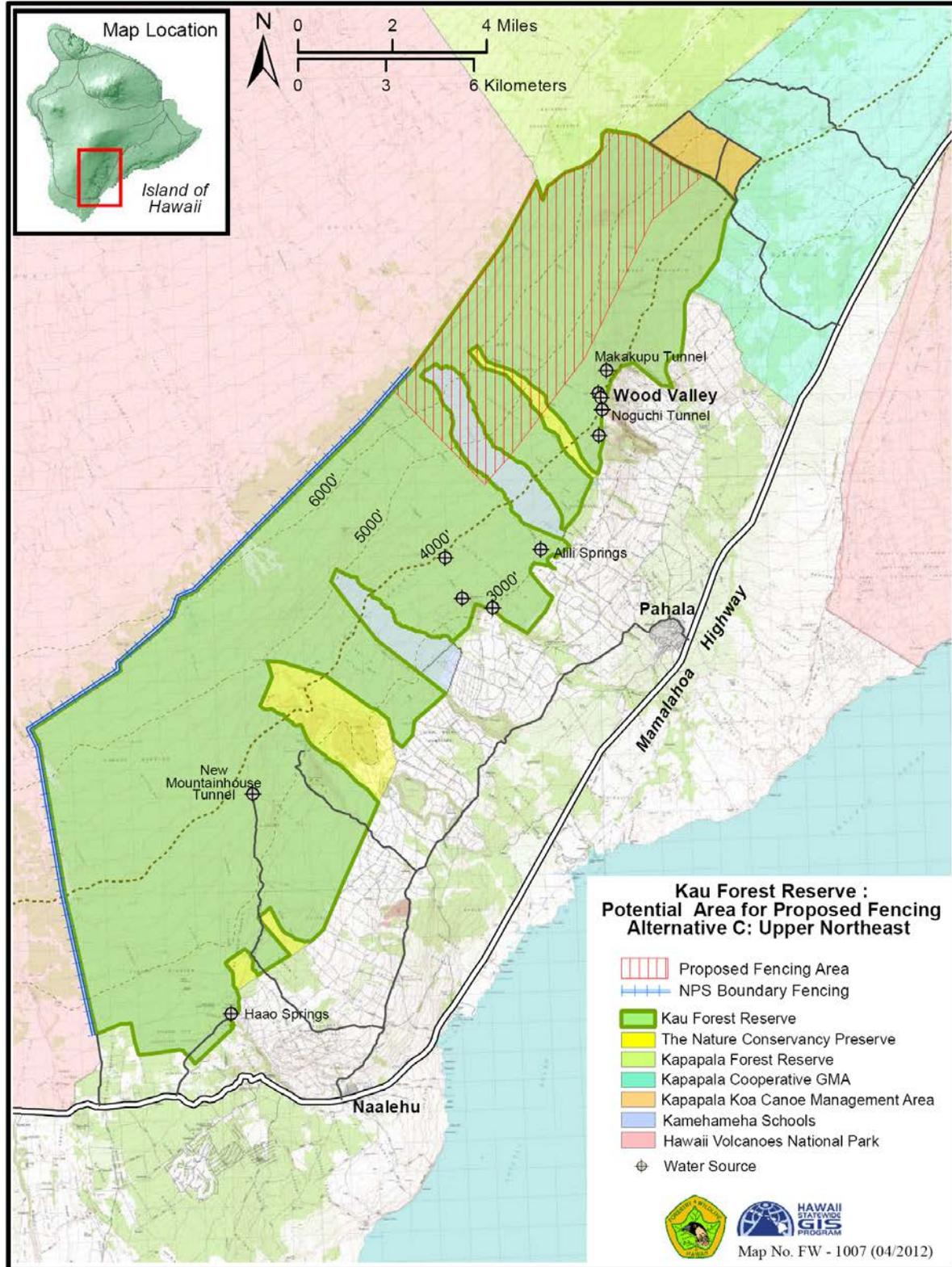


Figure 2-1c Alternative C



2.3 Alternatives Evaluated and Dismissed from Further Consideration

An alternative that was suggested by several parties during early consultation was fencing and removing ungulates from all of the Ka‘ū Forest Reserve. It is recognized that there are rare plants, birds and important native ecosystems that require preservation throughout the Reserve. Maintaining and/or restoring areas of low elevation may be vital to preserving the long-term health of forest bird populations, which visit different parts of the Reserve at different times to follow flowering or other resources. Furthermore, protecting only high elevations may not fully protect the vital watersheds that provide domestic and agricultural water in the wells, tunnels and springs below. However, fencing all or most of the Reserve was dismissed from consideration from the current version of the Plan because the cost, at an estimated \$20 million for fencing alone, would be exceedingly high, beyond what DOFAW expects to have available in the next 15 years. Moreover, removing ungulates from the entire Reserve is opposed by community members because it would adversely affect hunting opportunities. As discussed in Section 3.1.5 below, hunting in Ka‘ū is an important component of subsistence and cultural practice. Discussions with Ka‘ū community members indicated general opposition to fencing the entire Reserve. Without a certain level of community support for the general management of the Reserve, the Plan is unlikely to succeed.

Another alternative that would have combined Alternatives A, B and C (called Alternative D, and described and included in initial consultation with the community and agencies) and fenced the entire area of the Reserve above about 4,000 to 4,500 feet in elevation (depending on location) was also considered. This alternative would have tripled the protected area for biological and watershed purposes and would have included all proposed Ka‘ū release sites for the ‘Alalā, and it would have left the lower half of the Reserve still available for hunting. However, there were severe concerns that the costs would be far greater than the amount DOFAW believes will be available for the project over the next 15 years. Furthermore, early consultation has indicated widespread community concerns over hunting impacts if the entire upper half of the Reserve were fenced within 15 years.

Finally, several variations on Alternatives A, B and C were suggested that would have reconfigured the 12,000 acres to involve include a *mauka-makai* swath that extended to the *makai* boundary of the Reserve. For several reasons, including that the *makai* areas of the Reserve are most heavily hunted, and that lower elevation areas are not as much a priority for protection of endangered forest bird habitat, this alternative was not carried forward. It should be noted, however, that there is potential for a fully fenced and managed *mauka-makai* swath by combining Alternatives A and B with existing or potential management actions on the Kaiholena TNC preserve, which is already fenced halfway up from the elevation of the *makai* boundary of the Reserve.

Many management actions in the Plan, including weed control, outplanting, small fenced enclosures and biological data collection, will occur outside of fenced management areas. Reintroduced ‘Alalā may range outside the fenced areas, and management actions to support these birds would then also extend beyond such areas. In the future, additional lower-elevation portions of the Reserve could undergo fencing and ungulate removal, subject to the availability of funds and community consultation. It is hoped that additional hunting opportunities outside the Reserve can eventually be

developed on State or private lands, which could reduce use of the Reserve for hunting and increase community support for and involvement in ecosystem and watershed preservation and restoration.

Although the Plan includes only 12,000 acres of fenced management areas, In DLNR's long term initiative to protect watersheds, *The Rain Follows The Forest - Hahai no ka ua i ka ululā'au. A Plan to Replenish Hawaii's Source of Water* (DLNR 2011), the Ka'ū Forest Reserve is identified as a priority watershed. DLNR's goal is to protect and restore all priority watershed around the State. According to that plan, fencing core areas within priority watersheds will be incremental, taking many decades. Thus it can be expected that at some point additional fenced management will be proposed by DLNR. Any such proposals would include compliance with Chapter 343, HRS, and preparation of an Environmental Assessment or Environmental Impact Statement, if required.

PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

Introduction

3.1 Biological Resources

The discussion of biological resources below is divided for convenience into a Vegetation and Flora section and a Fauna section, although it is recognized that these resources are part of an integrated ecosystem whole. A section on the special topic of Wildfire, Pests and Disease follows.

Included in these sections are discussions of threatened and endangered species. Federal and State of Hawai'i endangered species laws require government agencies to ensure that their actions are not likely to jeopardize the continued existence of federal or State listed threatened endangered species (16 U.S.C. §1536(a)(2) and (4); Chapter 195D, HRS). The U.S. Endangered Species Act defines Critical Habitat as areas that may or may not be occupied by a threatened or endangered species, but are essential to the conservation of the species. These areas may require special management considerations or protection (16 U.S.C. §1532 (5)). Federal and State agencies also have an interest in protecting rare species, including Candidate and Species of Concern, which do not yet have legal protection under the Endangered Species Act. Candidate organisms are taxa for which substantial information on biological vulnerability and threat support proposals to list them as threatened or endangered. Species of Concern are taxa for which available information meets the criteria for concern and the possibility to recommend as candidate.

Biological resources are treated in greater detail in the Plan; readers interested in additional information are referred to Appendix 1.

3.1.1 Vegetation and Flora

Existing Environment

The vegetation of the Reserve currently consists almost entirely of native forest ecosystems. According to DOFAW's Draft Management Guidelines, most of the Reserve falls into highest quality native ecosystem vegetation classification, with minimal disturbance and low levels (less than 10 percent) of non-native plants (Hawai'i State DOFAW 2001).

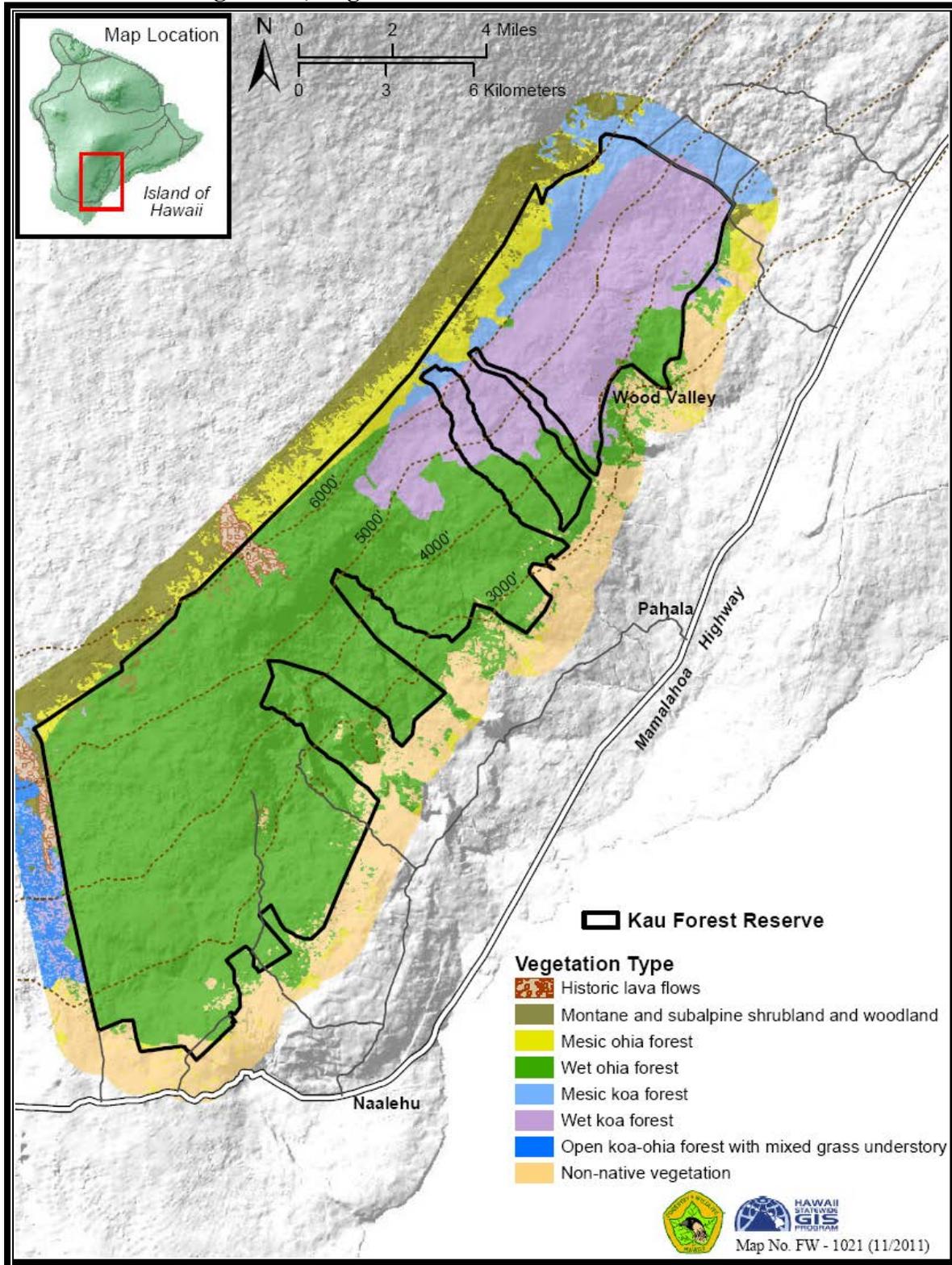
Although much of the native forest upper canopy (which consists of large trees) is intact, feral ungulates and non-native weeds have seriously degraded large portions of the Reserve, threatening the long-term survival of high quality native forest. Upper elevation portions of the Reserve exhibit widespread disturbance from feral ungulates that has left a ground layer with exposed soil and leaf litter instead of native ferns, small plants and tree seedlings. These openings in the forest floor enhance erosion as soil washes away during storms. Large upper canopy trees may not be replaced when they die, due to lack of regeneration of younger generations of native trees in the middle and lower forest layers. Lower portions of the Reserve have severe weed infestations that are spreading into the middle and upper areas of the Reserve due to openings in the forest created by feral ungulates. The long-term survival of the forest is threatened by the gradual disappearance of the native trees and plants and conversion to non-native weedy species. Management is needed to address these threats, slow the decline of this unique forest ecosystem and restore areas that have been severely impacted.

There are five major native-dominated communities in the Ka'ū Forest Reserve (Figure 3-1) (UH 2005; Jacobi 1989; Price unpub. data). The wet forest types typically receive over 75 inches in average annual precipitation while the mesic forest types receive 50 to 75 inches. These vegetation communities are described in detail below:

Wet 'Ōhi'a Forest is one of the most widespread wet forest types in the Hawaiian islands and covers a large portion of the southwest portion of the Reserve in both lowland and montane areas. This forest type is generally dominated by 'ōhi'a, with a dense hāpu'u (*Cibotium* spp.) tree fern layer. Some areas, particularly steep slopes contain more open/stunted 'ōhi'a forest with an uluhe (*Dicranopteris linearis*) understory. An 'ōhi'a-dominated forest belt with more open canopy and shrub layer of kanawao (*Broussaisia arguta*) occurs from 5,315- 5,724 feet in elevation (Jacobi and Price 2007). This community contains many rare and endangered plants, birds and invertebrates.

Wet Koa Forest occurs in the center of the Reserve and extends to the northeast. 'Ōhi'a and koa (*Acacia koa*) form the canopy with subcanopy layers rich in endemic trees, shrubs, sedges, and ferns such as 'ōlapa (*Cheirodendron trigynum*), kāwa'u (*Ilex anomala*), kōlea (*Myrsine lessertiana*), pilo (*Coprosma* spp.), manono (*Hedyotis terminalis*), and ālani (*Melicope* spp.). Native ferns, shrubs, and sedges such as 'uki (*Carex alligata*) are found beneath the hāpu'u tree fern layer. This forest type has older substrates than elsewhere in the area and supports many native forest birds and invertebrates (TNC 2006b, Jacobi and Price 2007).

Figure 3-1, Vegetation Communities of Ka'ū Forest Reserve



Mesic Koa Forest is found at the highest elevation in the northeast and into the Kapāpala Forest Reserve. This forest type has a good representation of ‘ōhi‘a and koa forming the canopy layer, with native trees forming the subcanopy layer. *Hāpu‘u* tree ferns typical of wet forests are scarce or lacking. In addition, plants more characteristic of drier areas, such as *manena* (*Melicope hawaiiensis*), ‘*aiea* (*Nothocestrum breviflorum*), and *pūkiawe* (*Styphyelia tameiameia*), may be present. Where it has not been greatly disturbed, the ground cover is dominated by native ferns, often including large *laukahi* (*Dryopteris wallichiana*). The groundcover in portions of this forest is dominated by non-native grasses, primarily meadow ricegrass (*Paspalum scrobiculatum*), which is not a habitat modifying weed in this area. Many rare plants, including members of *Clermontia*, *Cyanea*, *Phyllostegia*, and *Stenogyne* occur here (TNC 2006b). This community provides important habitat for forest birds as well as specialized plants and animals such as ‘Alalā (TMA 2007).

Mesic ‘Ōhi‘a Forest occurs near the upper Reserve boundary. This community is a transitional vegetation type between wet and mesic montane habitats and drier subalpine shrublands (Hawai‘i Natural Heritage Program 1995). This forest type is dominated by an ‘ōhi‘a canopy with native trees and shrubs in the subcanopy. As with mesic *koa* forests described above, there is a lack of large tree ferns and a ground cover of native ferns.

Montane and Subalpine Shrubland and Woodland occurs at the upper boundary of the Reserve and into Kahuku at the drier upper elevations. This forest type is generally more open canopy, with scattered, shorter stature native trees and shrubs. Native grasses such as *Deschampsia nubigena* are found in the understory. This area also contains younger lava flows with less well-developed forests.

Open Koa-‘Ōhi‘a Forest with a Mixed Grass Understory is present adjacent to the Reserve, at Kahuku. Long-term use of these lands as pasture has resulted in open forest and with a non-native grass understory.

Non-Native Vegetation occurs just outside of the Reserve. The agricultural land along the lower boundary of the Reserve, adjacent to the forest, was cleared for sugar cane production and is now mainly used for pasture. Serious infestations of habitat-modifying invasive weeds including strawberry guava (*Psidium cattleianum*), Koster’s curse (*Clidemia hirta*) and night-blooming jasmine (*Cestrum nocturnum*) occur on the lower forest edge and some lower Reserve sections.

In addition to the communities described above, there are riparian ecosystems with assemblages of vegetation and rare species that reflect moister conditions and steep gulch faces.

The Ka‘ū Forest Reserve and surrounding areas support 153 endemic plant species and provide habitat for at least 32 known species of rare plants (for the purposes of this EA, a rare plant refers to listed Threatened or Endangered species as well as Candidate Species and Species of Concern) (Table 3-1). Fourteen of these rare plants are listed as endangered by the U.S. Fish and Wildlife Service. In addition, the Reserve contains officially designated Critical Habitat for three species of

Hawaiian plants: *Phyllostegia velutina*, *Cyanea stictophylla*, and *Melicope zahlbruckneri* (U.S. Fish and Wildlife 2003) (Figure 3-2).

Impacts and Mitigation Measures: Action Alternatives

As discussed in detail in Section 1, a number of aspects of the Plan could affect vegetation and flora, both adversely and beneficially. Elements of the plan that have at least some potential for some adverse effects, even if they are overall beneficial, are the following:

- Removal of feral cattle from within the Reserve and controlling livestock trespass through maintenance of existing boundary fencing.
- Construction of about 12,000 acres of new fenced management units in the upper elevation central portions of the Reserve and removal of feral ungulates from within them.
- Regular surveys and weed mapping.
- Suppression and containment of priority weeds in low-elevation areas of the Reserve to prevent or reduce the spread of these weeds into more intact native forest areas.
- Weed control in ungulate-free fenced units to promote recovery of native vegetation.
- Cooperative weed control projects to benefit ranching, forestry and agriculture.
- A focus on weed control in disturbed weed corridors such as roads, trails, and fence lines.
- Combination of control techniques including staff control using manual, mechanical and approved herbicides will be used to remove weeds, based on target species, area sensitivity, and effectiveness.
- Use of approved weed biocontrol agents within the Reserve if available and effective.

DOFAW's experience working with rare plants around the State indicates that any adverse effects from most of the above will be limited due to adequate prior monitoring for rare plants, proper training of crews, and diligence during operations. The particular combination of control techniques to remove weeds, including manual, mechanical and herbicides, will be 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. All herbicide use will follow labeling requirements. 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 the Plan as appropriate. DOFAW staff and partners will utilize approved biocontrol agents within the Reserve, when available. In particular, the strawberry guava biocontrol agent, *Tectococcus ovata*, may be applied and the results monitored for success. Release of biocontrol agents will be done in accordance with federal and State requirements to insure no negative impacts to native species will occur.

The overall effect will be highly beneficial for improving the quality of the vegetation and protecting rare plants. Three endangered species recovery plans, the *U.S. Fish and Wildlife Recovery Plan for the Big Island Plant Cluster* (USFWS 1996), the *U.S. Fish and Wildlife Big Island II: Addendum to the Recovery Plan for the Big Island Plant Cluster* (USFWS 1998a); and the *U.S. Fish and Wildlife Final Designation and Nondesignation of Critical Habitat for 46 Plant Species from the Island of Hawai'i, HI* (USFWS 2003), discuss management actions for the benefit and recovery of highly endangered plants found in the Reserve: *Cyanea stictophylla*, *Melicope*

**Table 3-1
Threatened, Endangered or Rare Plants Found in or Near Ka‘ū Forest Reserve**

Species	Common Name	Federal Status*	Critical Habitat
<i>Argyroxiphum kauense</i>	Mauna Loa silversword	LE	
<i>Asplenium peruvianum</i> var <i>insulare</i>		LE	
<i>Asplenium schizophyllum</i>		-	
<i>Clermontia lindseyana</i>	‘oha wai	LE	
<i>Cyanea platyphylla</i>	‘āku‘āku	LE	
<i>Cyanea shipmanii</i>	hāhā	LE	
<i>Cyanea stictophylla</i>	hāhā	LE	X
<i>Cyanea tritomantha</i>		C	
<i>Cyrtandra menziesii</i>		SOC	
<i>Eurya sandwicensis</i>		SOC	
<i>Fragaria chiloensis</i>	‘ōhelo papa	SOC	
<i>Lobelia hypoleuca</i>		-	
<i>Marattia douglasii</i>	pala, kapua‘ilio	-	
<i>Melicope zahlbruckneri</i>		LE	X
<i>Neraudia ovata</i>		LE	
<i>Nothoctrum breviflorum</i>		LE	
<i>Phyllostegia ambigua</i>		SOC	
<i>Phyllostegia floribunda</i>		C	
<i>Phyllostegia velutina</i>		LE	X
<i>Phyllostegia vestita</i>		SOC	
<i>Pittosporum hawaiiense</i>		SOC	
<i>Plantago hawaiiensis</i>		LE	
<i>Pritchardia lanigera</i>	loulu	SOC	
<i>Ranunculus hawaiiensis</i>	makou	C	
<i>Rubus macraei</i>		SOC	
<i>Sanicula sandwicensis</i>		SOC	
<i>Silene hawaiiensis</i>		LE	
<i>Sisyrinchium acre</i>	mau‘u lā‘ili	SOC	
<i>Stenogyne angustifolia</i>		LE	
<i>Strongylodon ruber</i>	nuku ‘i‘iwi	SOC	
<i>Trematolobelia wimmeri</i>	koli‘i	SOC	
<i>Vicia menziesii</i>		LE	

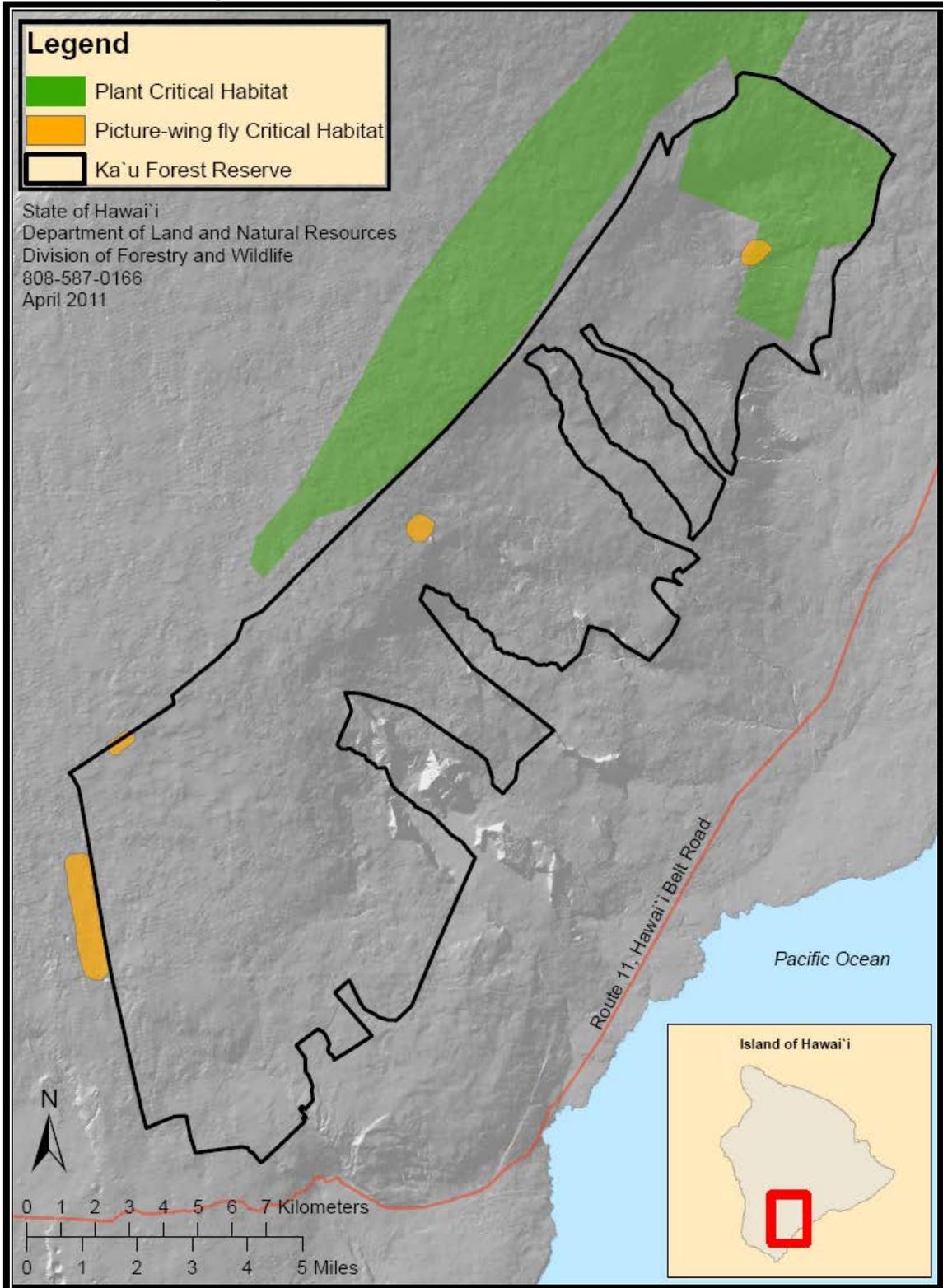
* Key to Federal Status:

Listed Endangered (LE) = Taxa listed as endangered.

Candidate (C) = Taxa for which substantial information on biological vulnerability and threat(s) support proposals to list them as threatened or endangered.

Species of Concern (SOC) = Taxa for which available information meets the criteria for concern and the possibility to recommend as candidate.

Figure 3-2, Critical Habitat in Ka'ū Forest Reserve



zahlbruckneri, and *Phyllostegia velutina*. The *U.S. Fish and Wildlife Recovery Plan for Four Species of Hawaiian Ferns* (USFWS 1998c) provides recommendations for management of the Reserve's *Asplenium peruvianum* var *insulare*.

Some actions contained with the Plan involve public use and do not necessarily entail benefits to rare plants. In particular is the following:

- Construction and use of trails, shelters and other facilities for the general public and managers/researchers.

Before establishing trails, access roads, campgrounds, shelters, and other facilities, DOFAW will survey areas for sensitive resources, including rare plants, and determine whether there is a potential for the facilities to engender direct impacts (e.g., cutting, trampling or vandalizing) or indirect impacts (fire, pest introduction). Facilities will be built and trails routed generally in non-sensitive areas or in ways that protect rare plants. It is important, however, to allow the public to enjoy and appreciate Hawai'i's rare plant heritage, and therefore the facility locations must strike a balance.

Specific elements of the Plan that are aimed at directly benefitting native plants, and thereby mitigating for potential for adverse effects, include:

- Surveys, mapping, monitoring, and propagation material collection of rare plants.
- Propagation, reintroduction and monitoring of rare and endangered plants in appropriate protected habitat, in coordination with other agencies and organizations working on rare plant recovery.
- Protection of rare plants in areas outside fenced management units through the construction of small fenced enclosures.

As discussed in detail in the Plan, DOFAW has worked with and will continue to work with a variety of partners to propagate and reintroduce many species of rare plants in accordance with guidelines recommended by the Hawai'i Rare Plant Restoration Group (<http://www.hear.org/hrprg/>).

Comparison of Impacts by Alternative

As depicted in Figures 2-1a-c, implementation of Alternative A would provide fenced management units within approximately 12,000 acres in the upper southwestern portion of the Reserve, representing about a sixth of the Reserve's area. In terms of flora and vegetation, this would protect mainly wet 'ōhi'a forest, along with rare species including *Cyanea stictophylla* and *Phyllostegia ambigua*. Implementation of Alternative B would provide fenced management units within approximately 12,000 acres in the upper central portion of the Reserve. This would protect both wet and mesic 'ōhi'a forest and wet and mesic *koa* forest, and rare species including *Cyanea shipmanii*. Alternative C would provide fenced management units within approximately 12,000 acres in the upper northeastern portion of the Reserve. This area contains both wet and mesic *koa* forest along

with some mesic ‘ōhi‘a forest, and habitat for rare species including *Cyanea tritomantha* and *Phyllostegia velutina*.

It is difficult to compare the three alternatives as far as rare plant diversity because certain rare plant species are very particular to a specific habitat type, and each alternative would protect different species of rare plants. There are also other rare plants that either occur, or could potentially occur (if reintroduced through outplanting) in any of these three alternatives A-C (e.g. *Clermontia lindseyana* and *Phyllostegia floribunda*). In general, Alternatives B and C contain or potentially contain a greater diversity of rare plants due to greater overall habitat diversity. These alternatives include mesic habitats with koa forest as well as ‘ōhi‘a forest.

Impacts and Mitigation Measures: No Action Alternative

Under the No Action Alternative, there would be a trend towards continued spread of invasive species, degrading vegetation and declining numbers of rare plants throughout the Reserve. Although DOFAW would continue to undertake efforts to protect and promote populations of rare plant species on a piecemeal basis, as funding allowed, it is likely that there would be a severe net loss of these species and their habitat. As discussed in sections below, this would lead to harmful consequences for not only rare plants, but also habitat for animals, the health of the watershed, and cultural resources of a biological nature.

3.1.2 Fauna

Existing Environment

The Reserve contains a rich variety of wildlife resources including endemic species of birds and invertebrates, as well as the ‘Ōpe‘ape‘a, or the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). Non-native species include birds, mammals and invertebrates. Faunal habitat varies with the vegetation types described in Section 3.1.1, above. In addition, intermittent streams provide habitat for aquatic insects and other stream-associated organisms. Lava tubes and caves are associated with pāhoehoe lava flows and most likely contain subterranean invertebrate communities, especially in forested portions of the area (Hawai‘i Natural Heritage Program 1995).

The *Hawaii’s Comprehensive Wildlife Conservation Strategy* (Mitchell et al 2005) identifies the Reserve as a priority area for management for the long-term conservation of native wildlife on the island of Hawai‘i. The area is a priority because it is one of the most diverse and intact forests on the island with high densities of both common and rare forest birds and great potential habitat for restoration of some endangered forest bird populations. Lower portions of the Reserve harbor a diverse native insect fauna. As part of a broader landscape that includes Kapāpala Forest Reserve and Hawai‘i Volcanoes National Park, the Reserve provides a range of elevations and rainfall that would allow wildlife populations to move in response to changing climate or weather conditions (Mitchell et al 2005). The Ka‘ū Forest Reserve has also been identified as an important bird area by the National Audubon Society (National Audubon Society 2011).

The following is a discussion of the faunal resources by group:

Native Wildlife

Birds

The Reserve is very important for the survival and recovery of Hawaiian forest birds because it contains large tracts of upper elevation native forest. The Reserve provides habitat for eight native forest birds, including five of the six birds that are endemic to Hawai'i Island, four of which are federally endangered. An additional five endemic or indigenous species likely use small areas of the Reserve (Table 3-2). In addition to supporting a diverse avifauna, the area provides habitat for the second largest concentration of native birds on Hawai'i Island and some of the highest densities in the State (Gorresen et al 2007).

Table 3-2. Native Birds with Habitat in Ka'ū Forest Reserve

Species	Scientific Name	Island Distribution	Federal Status*	State Status*
Nēnē or Hawaiian Goose	<i>Branta sandvicensis</i>	H, K, M, Mo	LE	LE
'Ua'u or Hawaiian Petrel	<i>Pterodroma sandwichensis</i>	H, L, K, M	T	LE
'Akē'akē or Band-rumped Storm Petrel	<i>Oceanodroma castro</i>	H, K	C	LE
Kōlea or Pacific Golden Plover	<i>Pluvialis fulva</i>	Throughout Hawai'i	MBTA	Indigenous
'Io or Hawaiian Hawk	<i>Buteo solitarius</i>	H	LE	LE
Pueo or Hawaiian Short-eared Owl	<i>Asio flammeus sandwichensis</i>	Throughout Hawai'i	MBTA	Endemic
'Alalā or Hawaiian Crow	<i>Corvus hawaiiensis</i>	Captivity	LE	LE
Hawai'i 'Elepaio	<i>Chasiempis sandwichensis</i>	H	none	Endemic
'Ōma'ō	<i>Myadestes obscurus</i>	H	MBTA	Endemic
Hawai'i 'Amakihi	<i>Hemignathus virens</i>	H, M, Mo	MBTA	Endemic
'Akiapōlā'au	<i>Hemignathus munroi</i>	H	LE	LE
Hawai'i Creeper	<i>Oreomystis mana</i>	H	LE	LE
Hawai'i 'Ākepa	<i>Loxops coccineus</i>	H	LE	LE
'I'iwi	<i>Vestiaria coccinea</i>	H, K, O, M, Mo	MBTA**	Endemic
'Apapane	<i>Himatione sanguinea</i>	Throughout Hawai'i	MBTA	Endemic

* Key to Federal Status:

Listed Endangered (LE) = Taxa listed as endangered.

Threatened (T) - Taxa listed as threatened

Candidate (C) = Taxa for which substantial information on biological vulnerability and threat(s) support proposals to list them as threatened or endangered.

Migratory Bird Treaty Act (MBTA) = It is illegal to harass or kill birds listed under the MBTA

** USFWS is reviewing the status of this species and will decide within a year whether it should be listed.

Populations of native Hawaiian forest birds in the Reserve and across the State have declined due to habitat loss and the ecological impacts of introduced species. Of the 46 historically known forest bird species in Hawai'i, only 24 species still survive, and of these, 13 species are listed as endangered. Ten species of endemic Hawaiian birds have likely gone extinct over the past 25 years – an average of one extinction every two years (Pratt et al. 2009).

The Reserve provides habitat for six honeycreepers (Subfamily Drepanidinae) endemic to the Hawaiian Islands. These include three federally listed endangered species: ‘Akiapōlā‘au (*Hemignathus munroi*), Hawai‘i Creeper (*Oreomystis mana*), and Hawai‘i ‘Ākepa (*Loxops coccineus*). The non-endangered honeycreepers found in the area include Hawai‘i ‘Amakihi (*Hemignathus virens*), ‘I‘iwi (*Vestiaria coccinea*) and ‘Apapane (*Himatione sanguinea*). Other native birds reported from the project area include the federally endangered ‘Io or Hawaiian Hawk (*Buteo solitarius*), the Hawai‘i ‘Elepaio (*Chasiempis sandwichensis*), and the ‘Ōma‘o or Hawaiian thrush (*Myadestes obscurus*).

Native forest birds are primarily found above 4,000 feet in elevation, where colder temperatures minimize mosquito abundance, which limits avian malaria, a non-native disease carried by mosquitoes. The distributions of ‘Akiapōlā‘au, Hawai‘i Creeper, and Hawai‘i ‘Ākepa within the Reserve are even more narrowly restricted to a narrow band of forest and adjacent woodland above 5,000 feet (see Figures 8-10 in the Appendix 1 for maps). These species have been extirpated from habitat below this elevation at least since 1976 due to the prevalence of mosquito-borne avian malaria (Scott et al 1986). Lower elevations are not generally habitat for endangered forest birds on Hawai‘i Island due to the presence of mosquitoes but may be important for native forest birds that have developed resistance to avian malaria (Pratt et al 2009).

The Reserve supports substantial proportions of the total populations of several endangered birds (Table 3-3). The Akiapōlā‘au, the rarest of the honeycreepers in the Reserve, forages preferentially on *koa*, but nests almost exclusively in ‘ōhi‘a. This species is concentrated in the northeastern portion of the Reserve, which supports a large percentage (approximately 56%) of the species’ total population (Tweed et al 2007). Hawai‘i Creeper and Hawai‘i ‘Ākepa densities are highest in mature ‘ōhi‘a and *koa*-‘ōhi‘a forests in the upper central portion of the Reserve and these two species have a larger distribution and population compared to the Akiapōlā‘au. Populations of these three species in the Reserve are separated from other populations on Hawai‘i Island. The ‘Io, ‘Ōma‘o, and the other three honeycreeper species are broadly distributed across the Reserve, although the ‘I‘iwi is restricted to mostly above 5,000 feet in elevation. The ‘I‘iwi occurs lower in elevation in the northeast, perhaps because drier conditions reduce mosquito abundance and hence avian disease.

Table 3-3

Estimated Population Status of Endangered Forest Birds in Ka‘ū Forest Reserve

Species	Total Population	Ka‘ū Population
‘Alalā	~95	0
‘Akiapōlā‘au	1,900	1,073 (616 - 1,869)
Hawai‘i Creeper	14,000	2,268 (1,159 - 4,438)
Hawai‘i ‘Ākepa	12,000	2,556 (1,340 - 4,876)

Source: Gorresen et al 2007

The endemic birds Nēnē or Hawaiian Goose (*Branta sandvicensis*) and ‘Ua‘u or Hawaiian Petrel (*Pterodroma sandwichensis*), as well as the indigenous ‘Akē‘akē or Band-Rumped Storm-Petrel (*Oceanodroma castro*), Kōlea or Pacific Golden Plover (*Pluvialis fulva*) and Pueo or Short-eared Owl (*Asio flammeus sandwichensis*), may use small portions of the Reserve; the importance of the Reserve to these species is low or unknown.

Finally, as recently as the 1970s, the Forest Reserve also supported the ‘Alalā or Hawaiian Crow (*Corvus hawaiiensis*). The ‘Alalā is listed as endangered and the species is extinct in the wild. The entire population, approximately 95 birds is housed in two captive breeding facilities, making the ‘Alalā one of the rarest birds in existence. Known from the island of Hawai‘i (and from fossils on the island of Maui), the ‘Alalā was restricted to the dry and mesic forests in the western and southern portions of the island. The species was associated with ‘ōhi‘a and ‘ōhi‘a-koa forests with an understory of native fruit-bearing trees and shrubs. This understory is essential to the survival the ‘Alalā in the wild, providing food as well as cover from natural predators such as ‘Io. The ‘Alalā also acted as an important seed disperser for native plants. Threats to wild ‘Alalā include predation by non-native mammals, non-native diseases (avian malaria and toxoplasmosis), habitat degradation, fragmentation, and loss, and direct human impacts.

Although they are insulated from these threats in captivity, their small population size makes them vulnerable to inbreeding problems, which has resulted in genetic-related egg and chick death as well as to demographic problems (e.g. uneven sex ratio). Recently, this problem has been minimized and production of young in captivity has dramatically increased during the last three years. In addition, unpredictable environmental events such as hurricanes, droughts, volcanic eruptions and vog will further complicate the restoration of this species to the wild. All of these threats will challenge the species for many years post-release.

The current captive population of ‘Alalā is at the point where restoration of a wild population can proceed. Three sites in the Reserve (southwest, central and northeast) were included in a rapid assessment of vegetation at six potential ‘Alalā release sites on the island of Hawai‘i to rank sites for suitability as reintroduction sites for this species (Jacobi and Price 2007). Out of the six sites examined, the southwest and central Ka‘ū study sites ranked first and second overall and the northeast site (which included Reserve as well as Kapāpala ranked fourth overall. The Reserve is a high priority site to restore this wide ranging species to the wild due to the large size and elevational range and diversity of wet and mesic forest types, as well as the fact that the area recently supported ‘Alalā. The restoration of a wild population of ‘Alalā will require minimizing threats, including predator control, and protecting significant areas of forest protected from ungulates. In addition to the restoring ‘Alalā, these efforts will benefit the watershed resources of the Reserve as well as native plants, invertebrates, and other birds. Restoring the ‘Alalā to the wild will require human assistance, including providing supplemental food, a semi-permanent infrastructure and a constant, long-term human presence. Planning for initial releases is underway, although the Reserve may not be the first release site.

Mammals

The ‘Ōpe‘ape‘a, or the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), is the only endemic terrestrial mammal in Hawai‘i (Hawai‘i Natural Heritage Program 1995). The ‘Ōpe‘ape‘a is listed as endangered under the U.S. Endangered Species Act. Recent surveys of TNC lands below the Reserve at Kaiholena and on NPS lands at Kahuku have noted the presence of the ‘Ōpe‘ape‘a, and it is presumed that the species also uses the Reserve, as they use similar forested areas at that elevation across the island.

Invertebrates

The Reserve contains 245 acres of designated critical habitat in two separate areas for one endangered species of Picture Wing Fly (*Drosophila heteroneura*) (USFWS 2008) (Figure 3-2). Habitat for this species is in wet, montane, 'ōhi'a and 'ōhi'a-koa forest, and larval stage host plants include 'ōlapa and *Clermontia* sp. (USFWS 2006b). The Hawaiian Picture-Wing Fly group consists of 106 known species, most of which are relatively large and have elaborate markings on their wings. The picture-wing *Drosophila*'s have been referred to as the "birds of paradise" of the insect world because of their relatively large size, colorful wing patterns, elaborate courtship displays and territorial defense behaviors. Each species is found only on a single island, and the larvae of each are dependent upon only a single or a few related species of native host plants. The *U.S. Fish and Wildlife Designation of Critical Habitat for 12 Species of Picture-Wing Flies from the Hawaiian Islands* (USFWS 2008) provides recommendations for habitat management for *Drosophila heteroneura* including areas within the Reserve.

Ka'ū Forest Reserve also contains habitat for three endemic species of Pinao or Hawaiian Damselfly: *Megalagrion blackburnii*, *Megalagrion caliph* and *Megalagrion xanthomelas*. *Megalagrion xanthomelas* is a candidate for listing as an endangered species and is known from Hīlea gulch (Parham *et al* 2008).

Non-Native Wildlife

Birds

A large variety of introduced birds inhabit the Ka'ū Forest Reserve. The most common species include the Japanese White-eye (*Zosterops japonicus*), Northern Cardinal (*Cardinalis cardinalis*), and Red-billed Leiothrix (*Leiothrix lutea*). The densities of these species appear stable and relatively low in the upper elevations. Japanese White-eye is the most abundant non-native species recorded in Ka'ū and occurs in forest and open habitat. Red-billed Leiothrix are widespread throughout the Reserve and most abundant at lower elevations (Gorresen *et al* 2007).

Other non-native species present in Ka'ū include the Japanese Bush-Warbler (*Cetia diaphone*), Hwamei (*Garrulax canoous*), Common Myna (*Acridotheres tristis*), House Finch (*Carpodacus mexicanus*), Erckel's Francolin (*Francolinus erckelii*), Kalij Pheasant (*Lophura leucomelanos*), Spotted Dove (*Streptopelia chinensis*), Barn Owl (*Tyto alba*), Yellow-fronted Canary (*Serinus mozambicus*), Saffron Finch (*Sicalis flaveola*), Japanese Quail (*Coturnix japonica*), Chukar (*Alectoris chukar*), Zebra Dove (*Geopelia striata*), Wild Turkey (*Meleagris gallopavo*), and (Eurasian) Sky Lark (*Alauda arvensis*).

Mammals

A variety of non-native mammals such as feral pigs (*Sus scrofa*), feral cattle (*Bos taurus*), mouflon sheep (*Ovis musimon*), feral sheep-mouflon hybrids (*Ovis aries-Ovis musimon*), rats (*Rattus* spp.), mice (*Mus musculus*), cats (*Felis catus*), and small Indian mongoose (*Herpestes auropunctatus*) are

present in the Reserve. Other ungulates including sheep (*Ovis aries*), feral goats (*Capra hircus*) and Axis deer (*Axis axis*) are not known from the Reserve, but may be present in adjoining areas.

Impacts and Mitigation Measures: Action Alternatives

Most of the actions proposed as part of the Plan will produce highly beneficial impacts to native species. In particular, the protection of fencing, ungulate removal, weed control and outplanting are critical to the long-term health and recovery of native ecosystems that provides habitat for threatened and endangered plants and animals. Such actions are recommended parts of U.S. Fish and Wildlife Service Recovery Plans (see sub-appendix D of Appendix 1 for list).

The native birds of Ka‘ū will benefit substantially. Removal of feral ungulates will allow native understory plants and trees to regenerate, providing additional areas for birds to forage for fruit and nectar resources, and perpetuating the forest. Removing pigs will reduce the number of mosquito breeding sites, which reduces the transmission of avian diseases and the spread of non-native plants. The former is critically important as rising temperatures associated with climate change broaden the elevational band over which mosquitoes and the avian malaria parasite will be able to survive, reducing the overall area of disease-free native forest bird habitat.

To mitigate impacts to endangered birds and Hawaiian hoary bats from fence construction, helicopter transport of construction materials and crew will be scheduled to avoid the breeding season for Hawaiian Hawks and other endangered birds. All activities will avoid clearing vegetation taller than 15 feet from June 1 to September 15 each year, which is the bat pupping season when mothers and their young are vulnerable to roost disturbance. In addition, DOFAW will avoid the use of barbed wire, which can entangle bat wings and injure or kill them.

A number of actions are specifically directed to benefit the ‘Alalā (although they would also benefit other native organisms). These include fencing and ungulate control over at least 2,500 acres, to accommodate initial release of ‘Alalā. Also critical is removal of predators from the release area (and, as feasible, other high-priority areas), including all feral cats and 80 percent of other non-native predators including mongooses and rats. The ‘Alalā release effort will involve both physical infrastructure such as release aviaries and intensive research on ‘Io density, habitat and behavior and its interaction with ‘Alalā. 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 may be needed. The release and monitoring team will need to maintain a constant presence at the release site for an undetermined length of time to care for, feed, monitor, and track released birds. 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.

Management actions of habitat over areas much larger than the initial release areas will benefit the ‘Alalā and increase chances of recovering a stable, reproducing population in the wild. Specific management actions to protect invertebrates are not proposed at this time. Little is known about

native invertebrates in Ka‘ū Forest Reserve so additional surveys are needed to inventory species and identify important habitat for rare species. Previously discussed management actions to benefit watershed and native ecosystems and other rare species will also benefit rare native invertebrates, as native invertebrates are generally dependent on native plants for food and as host plants.

It should be emphasized that recovery plans for a number of critically endangered Hawaiian birds depend to a large extent upon actions that would occur under the Plan in the Reserve. In particular, the *U.S. Fish and Wildlife Revised Recovery Plan for Hawaiian Forest Birds* (USFWS 2006) and the *Revised Recovery Plan for the ‘Alalā (Corvus hawaiiensis)* (USFWS 2009) rely on actions that would occur in the Reserve, one of the largest areas of relatively intact bird habitat in the State.

There are minor potential adverse impacts to native species associated with the Plan, particularly the actions related to increasing agency and public access. Rare species individuals and sensitive habitat can be damaged through carelessness, vandalism, fire or theft. An increased presence of hikers and hunters can also help spread weeds. However, public access can also benefit the native forest by generating public awareness and support, promoting citizen monitoring of ecological conditions, and fostering professional and volunteer conservation efforts.

Adverse effects can be mitigated by educating the public and other visitors on important resources to be aware of or avoid. The Plan provides that DOFAW staff and volunteers will follow protocols for cleaning of boots, equipment and vehicles. In addition, kiosks for education and action, such as those present at the Kahuku section of Hawai‘i Volcanoes National Park, should be provided at key public accesses to the Reserve.

Control of non-native animals could include the use of rodenticides and other toxic baits to control rats and mice, which could potentially poison non-target animals. The 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 only. The controls and practices will avoid impacts to endangered animal species as well as plants and water resources.

Comparison of Impacts by Alternative

As depicted in Figures 2-1a-c, implementation of Alternative A would provide fenced management units within approximately 12,000 acres in the upper southwestern portion of the Reserve, representing about a sixth of the Reserve’s area. Although it is somewhat weedier than other areas and contains fewer rare, threatened or endangered species, it was highly ranked by the ‘Alalā Recovery Team as a release site due to abundant food plants preferred by the endangered crow, and it is an accessible area for release, monitoring and care of the ‘Alalā. Two sides of the proposed fenced area are already built.

Alternative B involves fenced management units within approximately 12,000 acres in the upper central portion of the Reserve. It was highly ranked by the ‘Alalā Recovery Team as a release site because of good forest canopy but has less abundant preferred food plants. It is less accessible for

release, monitoring and care of the ‘Alalā, although its remoteness may be beneficial to release owing to less human disturbance and edge effect. One side of the proposed fence has been built, and it is accessible by road.

Alternative C involves fenced management units within approximately 12,000 acres in the upper northeastern portion of the Reserve. Although ranked highly by the ‘Alalā Recovery Team as a release site, it has less abundant preferred food and the more open canopy may not be ideal for the release of the crow. This area is accessible for release, monitoring and care of the ‘Alalā, but it has a greater level of human disturbance and “edge effect” because of Kapāpala Ranch and relatively high levels of hunting. It has the advantage of being the last area in Ka‘ū where the crows were sighted.

Aside from ‘Alalā considerations, each alternative would provide substantial benefits to native fauna populations, but there are differences, particularly for forest birds. Based on bird counts depicted in the Plan (see Figures 8-11 in Appendix 1), Ākepas and Hawai‘i Creepers are most common in the area that would have fenced management units in Alternative B, and to a lesser degree in Alternative C. Few are present in the area covered by Alternative A. ‘Akipōlā‘au are most abundant in the Alternative C area, followed by Alternative B. Few to none are present in the Alternative A area. Each alternative involves areas with ‘I‘iwi, but especially Alternatives B and C.

Impacts and Mitigation Measures: No Action Alternative

Under the No Action Alternative, native animal species are likely to continue their slow decline in the Reserve. Some areas may remain pristine and unaffected for several decades, but the effects of ungulates, weeds and predators, unremediated by any systematic effort to monitor and control them, will eventually severely degrade habitat.

3.1.3 Wildfire, Pests and Disease

Existing Environment

Fire in Ka‘ū is generally associated with the limited urban settlements, grazing areas, and wild grass and shrub lands, which are drier than the generally moist Reserve. Since 2002 DOFAW has noted fires in the former cane lands, in eucalyptus plantings, and in Kapāpala Ranch. However, wildfire poses a genuine threat to the Reserve, particularly during times of drought and in areas adjacent to human activity. Hawai‘i’s flora evolved with infrequent naturally-occurring fire, so most native species are not fire-adapted and are unable to recover quickly after wildfires. Wildfires leave the landscape bare and vulnerable to erosion and non-native weed invasions. Continued feral ungulate damage to native ecosystems can convert native forest to non-native grasses and shrubs, which provide more fuel for fires. Invertebrate pests and disease can weaken and defoliate vegetation, leaving it more vulnerable to fire. Weeds, 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 from catalytic converters and other hot surfaces of vehicles or heavy equipment, and illegal campfires. The main natural ignition sources are lightning and lava flows. DOFAW is the primary responder to fires within the Ka‘ū Forest Reserve. DOFAW is responsible for fire protection within DOFAW lands and also cooperates with the Hawai‘i Fire Department and federal fire control agencies in developing plans, programs and mutual aid agreements for assistance for prevention on other lands.

The Reserve has an undoubtedly large but mostly undocumented population of non-native invertebrates. Many 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. Other non-native parasitoids adversely impact native moth species, and ants are a significant mortality factor for native invertebrates. Slugs (*Milax gagates*, *Limax maximus* and *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 and humans.

Both Jackson’s chameleon (*Chamelaeleo jacksonii*) and Coqui frog (*Eleutherodactylus coqui*) have growing populations on the island, and these species can consume native invertebrates, such as insects, spiders, and small snails. They have been reported from various areas just *makai* of the Reserve and have presumably colonized within at least limited areas of the Reserve as well (pers. comm. Shalan Crysedale, TNC, to Ron Terry, March 2012).

Introduced diseases and pathogens threaten native animals and plants. Given the lack of biosecurity in Hawai‘i, future introduction of new diseases and pathogens is highly likely. Avian pox and avian malaria are mosquito-transmitted diseases that currently kill or weaken many 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 many native forest bird species, infection with these diseases is almost always fatal (USGS 2005; USGS 2006c).

Introduced plant diseases such as ‘ōhi‘a rust (*Puccinia psidii*) and *koa* wilt (caused by the fungus *Fusarium* sp.) have the potential to impact the major components of the forest throughout the Reserve. ‘Ōhi‘a rust affects not only ‘ōhi‘a but also other members of the Myrtaceae plant family (HEAR 2010). In severe infections, growing tips wither and die back. *Koa* wilt is a serious, often fatal disease of this native tree, which can rapidly lose its foliage and die within a few months (UH-CTAR 2010).

Impacts and Mitigation Measures: Action Alternatives

The Plan includes specific management objectives meant to counteract the adverse effects of wildfire, pests and disease. These include installing a remote automatic weather station to monitor

fire weather, and continuing to respond to fires, as needed. Management actions to protect watershed values and native ecosystems will maintain the overall health of the forest, which will make the forest more resistant to threats from fire, insects and disease, and there will be increased early warning monitoring for insects and disease.

Comparison of Impacts by Alternative

Implementation of any of the three alternatives would provide substantial benefits in terms of reducing the effects of wildfire, pests and disease.

Impacts and Mitigation Measures: No Action Alternative

Under the No Action Alternative, little would be done to counteract the adverse effects of wildfire, pests and disease. This inaction would lead towards degradation of watershed function, recreational value, and native species habitat.

3.2 Geology, Climate, Soil Erosion and Watersheds

Existing Environment: Geology, Soils and Climate

[NOTE: Appendix 1 contains extensive data and maps on geologic substrate, soils and climate that will not be repeated here. The information most relevant for assessing impacts of the Plan pertains to the watershed function of the Reserve, along with geologic hazards for human use.]

The geology of the Ka‘ū District is derived from volcanic eruptions from Kīlauea and Mauna Loa volcanoes. The age and type of volcanic material influences the development of soils, stream channels, aquifers, and forest types. The oldest exposed rocks found in the area originated from the Ninole Volcanic Series and can be seen in steep slopes such as Pu‘u Enuhe (Stearns and MacDonald 1946). The Kahuku lava flows are highly permeable and consist of pāhoehoe and ‘a‘ā flows with some interbedded ash. The Kahuku lava flows lie on top of the Ninole Volcanic Series and underneath the Pāhala Ash. Pāhala Ash consists of pumice fragments carried by the wind from lava fountains during eruptions of Kīlauea, Mauna Loa, and Mauna Kea as well as dust from Ka‘ū Desert. The Ka‘ū Volcanic Series covers the majority of the district and includes pāhoehoe and ‘a‘ā basalts of more recent eruptions.

Mauna Loa is still active and has erupted 33 times between 1843 and 1984 (Lockwood and Lipman 1987). Forty percent of Mauna Loa’s surface is covered by lava flows less than 1,000 years old, and flows in 1950 reached the upper elevation of Ka‘ū Forest Reserve. Portions of the Reserve could potentially be covered by lava from future volcanic eruptions. The Reserve is located within Volcanic Hazard Zones 3 and 6 for Mauna Loa (USGS). During the past 750 years, lava flows have covered about 15 to 20 percent of Zone 3 on Mauna Loa. The portion of the Reserve above Nā‘ālehu is classified as Zone 6, as it is currently protected from lava flows by the local topography.

Kīlauea Volcano is also currently active. The Ka‘ū District is in the path of volcanic emissions from Kīlauea, particularly from the second active vent at Halema‘uma‘u. Trade winds blow the volcanic fumes to the southwest, towards Ka‘ū, and at times volcanic emissions (which contain sulfur dioxide and other pollutants) have built up to levels that are hazardous to human health and damaging to agriculture. Volcanic emissions may also adversely affect the health of some native plant and animal species (USGS 1997; UH 2008).

The Reserve experiences frequent seismic activity, which occasionally lead to landslides and tsunamis. Seismic activity in the region is related to the movement of magma within Kīlauea and Mauna Loa or due to movement along numerous fault lines. In 1868, an earthquake caused a large destructive landslide that buried a village in Wood Valley and caused a large tsunami that swept away numerous settlements along the Ka‘ū coast (Stearns and MacDonald 1946).

Soils in Ka‘ū have developed from volcanic rocks, cinders, and ash. Soil age and composition, along with climate, is a major influence on plant community composition and hydrology. Pāhoehoe, ‘a‘ā, cinders, and weathered ash provide differing contributions of minerals and drainage characteristics (Mitchell et al 2005). Accumulations of organic matter in the soil and ground litter are the most important factor in soil development on these relatively young substrates. In areas with greater rainfall, deposits of Pāhala Ash developed into soils that are important for agriculture in lower elevations and for watershed functions in higher elevations (University of Hawai‘i 1965).

The average temperature for the Ka‘ū Forest Reserve decreases with elevation and ranges from 55° to 75° Fahrenheit. Rainfall in the Hawaiian Islands depends greatly on topography and the mountains affect the pattern of annual rainfall (Giambelluca et al 1986). Average annual rainfall in the area ranges from 60 to 120 inches (Juvik and Juvik 1998) and is highest in the central part of the Reserve. Mauna Loa affects the climate in the area, as winds are driven around and upward creating three rainfall regimes: tradewind-dominated (Pāhala to Nā‘ālehu), rain shadow (southwest of Kīlauea summit), and high elevation. The frequent rainfall between Pāhala and Nā‘ālehu is thought to be caused by a combination of trade winds and a thermally-driven sea breeze/land breeze cycle (Scholl et al 1995).

The region experiences flooding from storm runoff and steep slopes. Flash flooding occurs often along the Mamalahoa Highway when intermittent streams in the area exceed culvert and bridge capacity. Flooding causes major disruption to Ka‘ū communities as it can not only damage but also geographically isolate them, warranting emergency government response, as in November 2000.

The Ka‘ū Forest Reserve was originally established in 1906 specifically to protect the water supply of the district, and it continues to provide important watershed services for the community. The Hawai‘i Stream Atlas recognizes eight watershed basins within the Ka‘ū District (Table 3-4, Figure 3-3).

Table 3-4. Watersheds of the Ka‘ū Forest Reserve

Watershed Basin Name	Streams
Hi‘onamoa Gulch	Hi‘onamoa, Mo‘a‘ula, Uwēwale, Ka‘ala‘ala, Pā‘au‘au, Waiakaloa, Kauhuhuula, Peleli‘ili‘i, Waihaka, Keāiwa, Pi‘ikea, Waloala, Makakupu, Punalu‘u
Ninole Gulch	Ninole
Hīlea Gulch	Hīlea
Honuapo	Honuapo
Kaunāmano	Kaunāmano
Nā‘ālehu	Alapai Gulch
Wa‘ōhinu	Kaluapuhi, Wa‘ōhinu
Kawela	Kaalualu

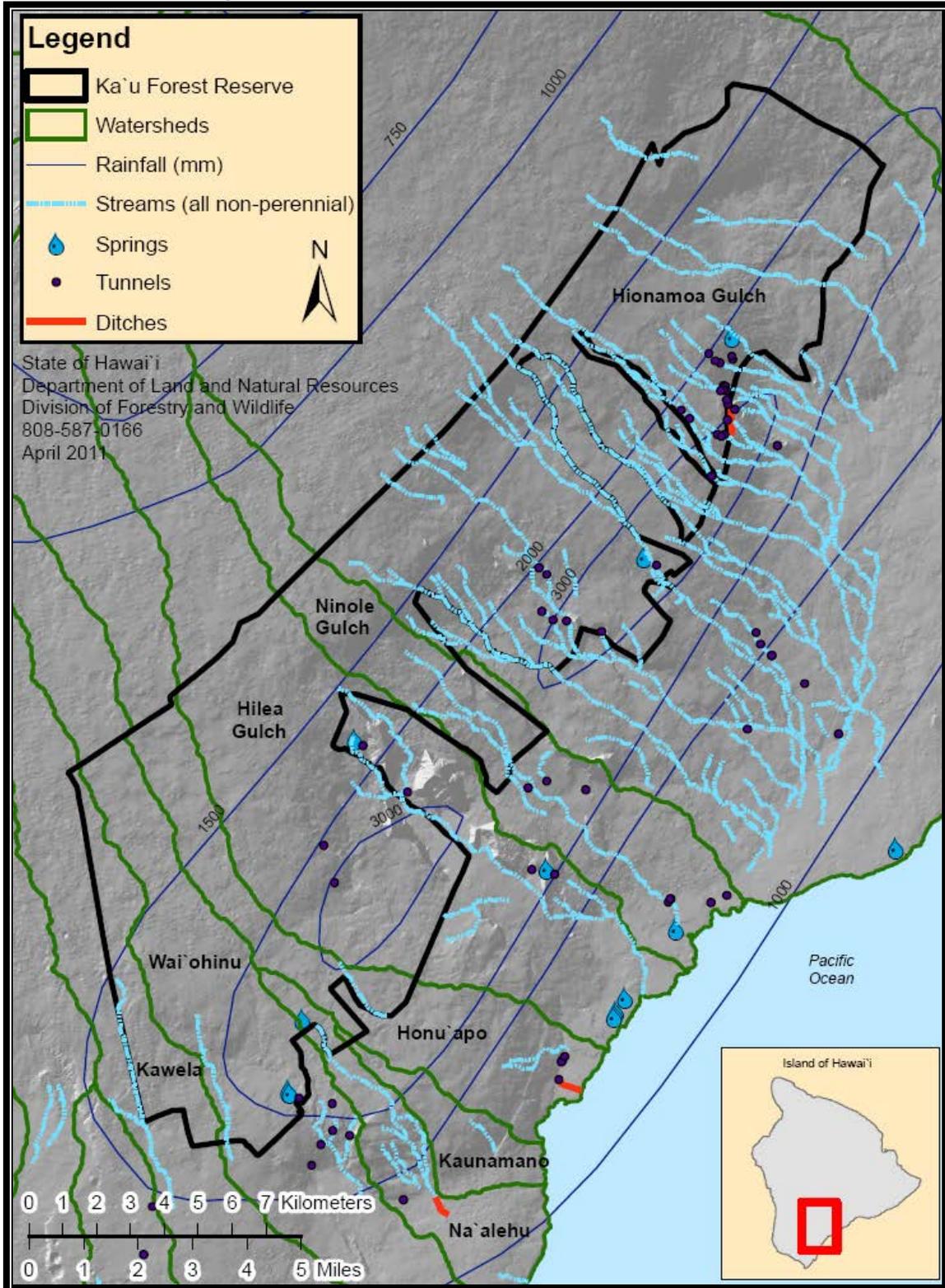
In the wet uplands, the relatively impermeable Pāhala Ash creates pockets of high elevation groundwater. This perched water creates high level springs and aquifers that have been tapped by tunnels. All these sources have little storage capability and are highly responsive to fluctuations in rainfall, with greatly reduced output during the dry season. Nevertheless, they supply the great majority of current water use in Ka‘ū.

For the Ninole volcanic series, the basalt member is highly permeable and carries fresh water at sea level and perched water above the ash layer. The Hilina volcanic series is highly permeable but carries only brackish water along the coast. The water absorbed into the lava sinks rapidly to the basal water table where it either floats on salt water or is perched on impermeable ash beds and becomes groundwater. Some basal water seeps out at springs at or near sea level along the coast (Stearns and MacDonald 1946). Despite the large amount of rain in the upland forests of Ka‘ū, the water is absorbed quickly into the highly permeable lava flows and there are no perennial streams (Davis and Yamanaga 1966). Surface water reaches the sea only after periods of heavy rainfall and flooding.

The abundant rainfall and excellent absorption characteristics of the Reserve lead to high sustainable yields in the aquifers of Ka‘ū. The Southeast Mauna Loa Aquifer Sector Area includes the ‘Ōla‘a [80501], Kapāpala [80502], Nā‘ālehu [80503] and Ka Lae [80504] Aquifer System Areas. The Reserve serves as the watershed for mainly the Nā‘ālehu Sector, with some contribution to Ka Lae at the south end and Kapāpala at the north. The sustainable yield of the Nā‘ālehu Aquifer System Area is 117 million gallons per day, with Ka Lae at 31 mgd and Kapāpala at 19 mgd (Hawai‘i County DWS 2010). Contrary to the perception of Ka‘ū as a very dry region, the watershed characteristics of the Reserve lead to a very high sustainable yield per unit area for the Nā‘ālehu Aquifer System as compared to all other aquifers in South Kona, North Kona, and South Kohala.

Water from the Reserve has been particularly important for Ka‘ū domestic water supply as well as agriculture, the lifeblood of the local economy. This topic is discussed in Section 3.1.4.

Figure 3-3, Ka'ū Forest Reserve Water Resources



The Relationship Between Healthy Native Forests and Watersheds

Forests in Hawai‘i are important zones of water input that can be adversely affected by factors promoting soil compaction, erosion, or pollution. In general, ecologists and water managers find that maintaining the native forest maximizes groundwater recharge and water quality.

Hydrologic studies in Hawaiian forests show that the complex, layered structure of the native forests reduces the impact of rain on surface soils and minimize the loss of surface soils. In intact forests, the impact of raindrops is buffered by leaves of upper canopy trees such as *‘ōhi‘a* and *koa*, and then again by leaves of subcanopy trees such as *mehame*, *kopiko*, *hāpu‘u* and *kolea*, and again by epiphytes, ground ferns, mosses and layers of decomposing branches and leaves. Native Hawaiians recognized the importance of forests in water production and water quality, as reflected in the Hawaiian proverb, “*Hāhāi no ka ula i ka ulu la‘au*” (The rain follows after the forests). Early foresters also recognized the importance of Hawaiian forests as watershed. Ralph Hosmer, the first Territorial Forester stated “In Hawai‘i, the most valuable product of the forest is water, rather than wood.”

Protecting watersheds insure the sustainability of groundwater, which is vital for human use. Forests collect and filter water into the groundwater and streams. A healthy forest without soil disturbance limits aquatic pollutants (e.g. siltation, suspended solids, turbidity, nutrients, organic enrichment, toxins and pathogens) due to erosion and runoff. Forests may also reduce the impacts of flooding and erosion by slowing down water as it flows down the mountain. Fog condensing on trees is an important source of moisture and can increase measurable precipitation by 20 percent (Juvik and Pereira 1973; Juvik and Nullet 1995).

Watershed services include providing a fresh water supply and habitat for native plants and animals, allowing better flood control, mitigating climate change impacts, and fostering economic, social, recreational and educational opportunities for the human communities in the area. Watershed economic value can be measured in dollars. A University of Hawai‘i study estimated the economic value of watershed services provided by the Ko‘olau Mountains on O‘ahu to be between \$7.44 billion to \$14 billion (Roumasset et al 1997).

Although one normally thinks of deforestation as the agent of watershed degradation in native forests, a change in species composition can also affect hydrology. Monoculture forests of alien species do not provide optimum watershed characteristics (Giambelluca et al 2007). Forests of eucalyptus on Maui, loblolly pine at Koke‘e on Kaua‘i, miconia on the Big Island, and strawberry guava statewide exhibit similar structural characteristics: a dense uniform canopy with very little understory. Recent measurements in two tropical montane cloud forests in Hawai‘i indicate that invasion by strawberry guava may reduce ground water recharge because of very high evapotranspiration rates (Giambelluca et al 2008). Compared with forests dominated by *‘ōhi‘a*, a site heavily invaded by strawberry guava exhibited 27 percent higher evapotranspiration as a function of available energy than the native dominated site, with the difference rising to 53 percent during dry-canopy periods. Much of the difference may be due to the dense stand structure and high foliage biomass of stands of strawberry guava, suggesting that for many decades to come these

forests will be diverting water that would otherwise recharge aquifers into evapotranspiration and possible loss from streams and groundwater. The ongoing replacement of native forests with non-native ones across island watersheds will result in further reductions of water to island aquifers.

Impacts and Mitigation Measures: Action Alternatives

The Plan includes specific management objectives meant to preserve and enhance the watershed values of the Reserve. Of critical importance are feral cattle removal, additional boundary fencing, and the combination of fencing and feral ungulate removal from fenced management units, because the improvement of habitat for native species also maximizes the watershed value of the area. Although there is currently an intact canopy of tall native trees, in many areas much of the ground and understory layers of ferns, small plants and young tree seedlings have been damaged by feral ungulates, leaving the ground bare and exposed. Fencing and feral ungulate removal will reduce soil erosion/exposed soil, increase absorption and the yield from springs and tunnels, and reduce flooding potential. All actions with potential to disturb substantial areas of soil (construction of trails, access roads, structures, etc.) will include Best Management Practices to prevent erosion or sedimentation and will conform to Chapter 27 of the Hawai'i County Code.

In terms of geologic hazards, there will be increased human use of the Reserve as a result of both more active management and the increased public use that would result from better access and more and better facilities. Lava flows from Mauna Loa, extreme eruptions or heightened volcanic gas production from Kīlauea, and earthquakes could all pose dangers to users and workers. Although it would not be practicable to monitor all entry and use of the Forest Reserve, DOFAW management may include check-in stations and hiker registration. Warning signs may be installed at trailheads to advise potential users about geologic hazards and flooding, as well as risks from feral animals, steep slopes, disorientation, dehydration and hypothermia, and other conditions.

Comparison of Impacts by Alternative

As depicted in Figures 2-1a-c, implementation of Alternative A would provide fenced management units within approximately 12,000 acres in the upper southwestern portion of the Reserve, representing about a sixth of the Reserve's area. Alternative B involves fenced management units within approximately 12,000 acres in the upper central portion of the Reserve; Alternative C involves fenced management units within approximately 12,000 acres in the upper northeastern portion of the Reserve; Each Alternative involves areas with considerable active or potential use of water from springs and tunnels, and each alternative would provide substantial benefits to watershed values in areas with active uses, as discussed in more detail in the next section..

Impacts and Mitigation Measures: No Action Alternative

Under the No Action Alternative, the watershed values of various areas in the Reserve would continue to degrade because of direct actions by feral ungulates such as understory browsing and soil compaction, as well as indirect impacts related to gradual change from native to non-native forest.

3.3 Agriculture and Economy

Economic generators in the Ka‘ū District are very limited. Commercial centers are located in Pāhala, Nā‘ālehu, Wai‘ōhinu, and Ocean View. Development in the area includes residential, small retail commercial centers, and family-owned or commercial farms. Major government facilities include schools, a police facility and a hospital. The U.S. Census Bureau estimated the median household income in 2009 at \$41,352, and almost 22 percent of households are below the poverty level. The primary economic drivers in Ka‘ū are currently macadamia nut farms, schools, medical services, cattle ranching, and construction. Tourism is a growth industry in Ka‘ū because of its proximity to Hawai‘i Volcanoes National Park.

Existing Environment: The Importance of Water

The Forest Reserve system originated in the 19th century when the kingdom began to notice the severe impact that introduced animals had on native forests and their economically important water production. In 1876 King David Kalākaua signed into law an Act for the Protection and Preservation of Woods and Forests, aimed at government-owned forest lands and water resources that were threatened by animals (Maly and Maly 2004c). Protection was critical for the sugar plantations that relied on the forest watersheds to continually supply water for their plantation operations.

In 1906, The Board of Commissioners of Agriculture and Forestry, on the basis of a report by Ralph S. Hosmer, Superintendent of Forestry, recommended to the Governor that a Forest Reserve be established in Ka‘ū. Lands proposed for this Reserve had been under a lease to Hawaiian Agricultural Company and Hutchinson Sugar Plantation Company and many of the leases were about to expire. The leases required protection of the forest, including fencing out cattle, and these companies installed 52 miles of fencing around and within the forest and developed a water supply with tunnels and ditches. He noted the vital watershed role of the Ka‘ū forest, stating “perhaps nowhere in the Territory is there a finer example of the fern jungle, with its dense mass of tree and other high-growing species.” Hosmer’s report stressed both the direct benefits to the plantation as well as indirect economic benefits to the territory through taxation and agricultural activities (Hawaiian Forester and Agriculturist 1906).

Agriculture has long been the region’s main economic base. Sugarcane production dominated the economy between 1868 and 1996, when the last mill closed in Pāhala. Despite the demise of plantation sugar, agriculture remains the anchor of Ka‘ū’s economy. About two-thirds of land in Ka‘ū is classified within the State Land Use Agricultural District, some of it Prime Agricultural Land. The Land Use Pattern Allocation Guide Map of the County of Hawai‘i General Plan identifies almost 50,000 acres of Important Agricultural Land, and 110,000 of Extensive Agriculture. This can be compared to almost 275,000 acres in Conservation and less than in all 2,500 acres in all categories of Urban. The majority of active agricultural land is used for grazing, but there are also hundreds of acres of orchard crops, primarily in the strip from Nā‘ālehu to Wood Valley. They vary with the decade but have included macadamia nuts, citrus, avocados, bananas, coffee, and persimmons. The macadamia nut industry includes the prominent Mac Farms of Hawaii,

and the local coffee has earned top prizes in cupping competitions. Cattle ranching is also significant, with large tracts of land utilized by several large, historic ranches, including the Kahuku Ranch and Kapāpala Ranch, as well as smaller operations. Studies by the Hawai‘i County Department of Water Supply (Hawai‘i County DWS 1992, 2010) estimated agricultural water use at 3.74 mgd in 1992 and 3.58 mgd in 2010, with only 0.12 mgd from metered water drawn from the DWS water system through accounts classified as “Agricultural”. Catchment, wells, springs and tunnels account for the remainder of the water used.

Although no farming or ranching occurs within the Reserve, the watershed functions and sugar plantation-era infrastructure of the Reserve are vital to many current agricultural operations and are the key to future agricultural expansion. From the early 1920s to the late 1930s the two sugarcane companies in the district, Hawaiian Agricultural Company in Pāhala and Hutchinson Sugar Company in the Nā‘ālehu area, developed about 40 tunnels to recover perched groundwater for sugarcane irrigation and transport to mills via flumes (County of Hawai‘i 2005) (see Figure 3-3 for locations of major tunnels and springs). The tunnels took advantage of groundwater that instead of sinking straight down flows atop the edges of buried ash layers, which are relatively impermeable and retard percolation. Water is especially plentiful in long-buried lava-filled gullies in the ash layer. The tunnels were laboriously dug by plantation laborers to follow the contact surface of lava flows and ash layers, where water would drip or gush into hard packed tunnels, sometimes equipped with wooden or metal flumes to reduce water loss. The tunnels are typically about four feet high and three feet wide, and they were constructed to wind throughout the mountain to follow the highest yield parts of the ash-lava contact surface. Some were very extensive – New Mountain House tunnel is 7,048 feet long.

By 1950, the tunnel and flume transport system had fallen into disrepair (County of Hawai‘i 2005). Sugarcane company leases for the water expired in 1973, and many tunnels were abandoned. Even so, the *Ka‘ū River Basin Study* (USNRCS 1994) estimated the yield of all tunnel sources in 1994 at 7 to 8 mgd. Noguchi No. 2 tunnel averaged 0.238 mgd and New Mountain House tunnel yielded 1.286 mgd. A shaft (which requires pumping rather than using gravity feed) at the Pāhala Mill was being pumped at the rate of 4.5 mgd.

The current flow from all the tunnels and springs is not known. A 2000 study of the Noguchi Tunnels by the U.S. Army Corps of Engineers estimated the yield of the tunnels between 0.2 and 0.6 mgd, depending on rainfall. Some of the water from the Noguchi Tunnels is used for a potable system that also supports agriculture in Wood Valley. The rest of the water flows to the Keāiwa Reservoir, which supplies the Keāiwa Agricultural Park and is currently being reconstructed. Other tunnels and springs in the Reserve with active agricultural users include Makakupu (Kapāpala Ranch) and Moaula (Mac Farms). According to the Hawai‘i County Water Use and Development Plan (Hawai‘i County DWS 2010), a significant amount of water is currently used for agricultural purposes, but current flow data is not readily available.

In 1994, the USDA, Soil Conservation Service (now the Natural Resources Conservation Service) prepared the *Ka‘ū River Basin Study* (USDA-NRCS 1994). The purpose of this study was to provide an evaluation of the soil and water related problems and concerns in Ka‘ū. Farmers and

ranchers who participated in scoping for the project cited flooding, agricultural water supply, wind erosion, rural water supply and sheet and rill erosion as high priority concerns. These concerns remain true today. The State Agricultural Development Corporation (ADC) is actively working with the Ka‘ū Agricultural Water System Co-op on getting a long-term agreement from DLNR to manage and improve many springs, tunnels and water infrastructure for agricultural uses. In addition to water sources and transmission facilities, storage facilities are vital. In sugar’s heyday, there were at least ten dugout type or above-ground reservoirs with a total capacity of 20.2 million gallons (USNRCS 1994). In the modern era of strict standards for water storage, Ka‘ū’s poor soil conditions, frequent seismic activity, and steep slopes have made large storage facilities difficult and expensive. The only major reservoir remaining is Keāiwa, which deterioration over the years had reduced to a capacity of only 2 million gallons, but which is now being repaired in conformance with modern standards to a 13.9 million gallon capacity.

Agriculture is not the only economic beneficiary of the Reserve’s watersheds. The Hawai‘i County Department of Water Supply (DWS) has long made use of tunnels and springs. Although now a backup system for the Pāhala well, Alili Tunnel in Pāhala once provided 0.3 mgd to the Pāhala System. After the closure of the sugar plantation, the DWS also assumed management of the Wai‘ōhinu-Nā‘ālehu Water System serving the communities of Wai‘ōhinu, Nā‘ālehu and South Point. This system depends primarily on the New Mountain House Tunnel Spring and Ha‘ao Spring. The average usage is on the order of 0.350 mgd.

No economic analysis has ever been done to determine the value of watershed services provided by the Ka‘ū Forest Reserve. However, most of the agriculture in Ka‘ū, including coffee, macadamia nuts, and ranching, depends on a steady supply of water from the springs and tunnels in the Reserve. Aside from their intrinsic value, it is important to protect the Reserve’s native ecosystems because these forested watersheds impact the water supply of Ka‘ū. In addition, forests can often reduce the impacts and costs of flooding and erosion by slowing down water as it flows down the mountain.

Existing Environment: Other Economic Factors

The Reserve has some economic use aside from the value of water. The Reserve supplies wild pig meat that many families in Ka‘ū rely on for subsistence, as discussed in the next section. Although there are no records of commercial use of forest wood or gathering of plant material, residents and perhaps some outsiders engage in not only personal but also commercial *maile* picking in the Reserve, particularly in the Lorenzo Road and Kapāpala areas. With few marked or easily useable accesses and no commonly available visitor information, the Reserve is not currently an attraction to tourists.

Impacts and Mitigation Measures: Action Alternatives

DOFAW is committed to work with the Agricultural Development Corporation to enable this agency and water users to conduct environmentally sound repair, maintenance and use of the water sources. Each alternative would provide substantial benefits to watershed values.

The Plan includes the objective to develop means to make the Reserve partially economically self-supporting, as has been done with other Forest Reserves across the State. According to laws governing the Forest Reserves, at HRS §183.5 (5), the department shall:

“Devise and carry into operation, ways and means by which forests and forest reserves can, with due regard to the main objectives of title 12, be made self-supporting on whole or in part.”

However, commercial activity is not a priority management activity for the Forest Reserve. DOFAW will only develop commercial activities in the Reserve in consultation with the local community and resource agencies that are compatible with the highest priorities – protection of watershed values and native ecosystems – and do not interfere with public activity. Such activities may include:

- Ecotourism activities that are small in scale such as guided hiking, hunting and bird-watching tours, which would require a commercial use permit from the BLNR or authorized representative and would be charged a fee.
- Small-scale timber harvest or forest product collection (both native and non-native species).

In addition, there would be modest but locally important economic benefits of more management actions in the reserve. This would include hiring of fencing crews or contractors, purchase of fencing materials from local suppliers, and potential permanent ecotourism and natural resource management jobs. These would likely include jobs and internships for Ka‘ū youths.

Comparison of Impacts by Alternative

As discussed previously, each alternative would provide substantial watershed benefit, and each involves areas with considerable active or potential use of water from springs and tunnels. While no detailed hydrological analysis has ever been conducted that would determine the precise surface watershed supplying each spring and tunnel, it can be presumed that the areas directly *mauka* of each source are part of its watershed. Alternative A involves fenced management units that maximally protect watershed areas for Ha‘ao Springs and Mountain House (both in active use), as well as Plantation Spring and several smaller tunnels and springs located in the Reserve and below. Alternative B involves watershed for Moaula, Cloud Rest, Alili and Fukuda Tunnels, and many other tunnels and springs. Alternative C includes the actively used Noguchi, Mudflow and Makakupu Tunnels, as well as Double Arch, Weda and other formerly used and potentially recoverable sources.

Impacts and Mitigation Measures: No Action Alternative

Under the No Action Alternative, the economic value of the watershed to agricultural and water supply interests would be diminished. Although non-native forests can also supply items of value in forestry and gathering, the perpetuation of native forests provides products of potentially higher

value, while maximally conserving watershed and habitat services. Ecotourism and similar activities that attract visitors and add to the economic base in Ka‘ū could still occur with proper permits, but they would most likely suffer from degraded habitat, as birders and hikers tend to value and visit native rather than non-native habitats and species.

3.4 Cultural Resources

Keala Pono Archaeological Consulting prepared a comprehensive Cultural Impact Assessment (CIA) for the project, which is attached as Appendix 2 and summarized below. The CIA provides invaluable information on the cultural context of all *ahupua'a* present within or near the Reserve, which is essentially most of Ka'ū, along with historical information concerning Ka'ū. Because not all such information is directly germane to impacts of the proposed action, it is not included in the summary, but the CIA report as a whole provides a valuable context for future interpretation activities. As social and cultural impacts are deeply intertwined, there has been no attempt to separate them below, but the reader is referred to Section 3.5 for a systematic discussion of hunting.

Methods

The CIA methods were guided by the *Hawai'i Environmental Council's Guidelines for Assessing Cultural Impacts*¹ and consisted of archival research as well as community consultation with knowledgeable parties recognized as having a cultural, historical, genealogical, or managerial connection to the project area in Ka'ū. Sources included historic maps and photos, accounts from early visitors, Hawaiian language newspaper articles, *mele*, *oli*, *'ōlelo no 'eau*, collections of *mo'olelo*, and archaeological reports obtained from individuals and institutions across the State of Hawai'i and ethnographic surveys consisting of oral history interviews. Table 3-5 is a list of organizations and individuals interviewed. Personnel included Kelley Uyeoka, MA, lead ethnographer, Li'ula Mahi, BA, ethnographer, U'ilani Macabio, BA, ethnographer, and Aoloa Santos, ethnographer.

Interview questions were derived from themes deemed important to attain a comprehensive understanding of the past, present, and future knowledge of the project area and impacts. The main themes that guided the consultation efforts included:

- *Mo'okū'auhau* – genealogy and family history
- *'Ohana* and individual ties to the land
- *Mo'olelo* and traditional accounts – including place names, *mele*, *oli*, *hula*
- Cultural practices – in the past and in the present
- Natural resources – gathering of plants, water resources
- Cultural and historic sites – in the immediate site and the surrounding areas
- Historical information – historical events, people
- Knowledge sources
- Impacts and mitigation recommendations
- Preservation and management concerns and recommendations

Additional information on interviews is contained in Appendix 2.

¹

http://oeqc.doh.hawaii.gov/Shared%20Documents/Environmental_Assessment_PrepKit/Cultural_Impact_Assessments/Guidelines-Assessing-Cultural-Impacts.pdf

Table 3-5. List of Organizations and Individuals Contacted for Interviews

Name of Contact	Position/Affiliation	Result of Contact	Contact Date
Pele Hanoa	<i>Kupuna, kama 'āina</i>	Interview	September 26, 2011
Janette Howard	<i>Kupuna, kama 'āina</i>	Chose not to participate	September 26, 2011
John Replogle & Shalan Crysdale	The Nature Conservancy (Nā'ālehu)	Interview and site visit to the reserve	September 26, 2011 & October 7, 2011
Kalani Decoito	<i>Kama 'āina, hunter</i>	Interview	October 6, 2011
Larry Galban	<i>Kama 'āina, hunter</i>	Interview	October 6, 2011
Susan Pua	<i>Kupuna, kama 'āina</i>	Interview	October 17, 2011
Earnest Peewee Breithaupt	<i>Kupuna, kama 'āina</i>	Interview	October 17, 2011
Mabel Kaipo	<i>Kupuna, kama 'āina</i>	Interview	October 19, 2011
Kilohana Domingo	Master <i>lau hala</i> weaver	Interview	October 21, 2011
Keola Awong, Helen Wong-Smith, Laura Schuster, Lora Gale	Hawai'i Volcanoes National Park	Interview	October 25, 2011
Thomas Kaniho	<i>Kupuna, rancher</i>	Interview	October 28, 2011
Kama Dancil	Kamehameha Schools Land Manager	Interview	November 16, 2011
Iwi Joaquin	Kamehameha Schools 'Āina Ulu Partner	Interview & visit to Keauhou Bird Conservatory	November 16, 2011
Clyde Namu'o	Office of Hawaiian Affairs	Letter	October 26, 2011
Theresa Donham	State Historic Preservation Division	Referral to archaeological studies at Hilo SHPD office	October 26, 2011

Traditional Land Use

The Native Hawaiian relationship with the 'āina is spiritually guided by reverence and deep-seated respect. This connection is depicted in the *Kumulipo*, a highly detailed genealogical creation chant, where *kānaka* descend from Papahānaumoku, Earth Mother, and Wākea, Sky Father. Therefore, to

disrespect the land is to disregard one's *'ohana*, and sustaining a *pono* connection to the *'āina*, or that which feeds, is essential to the balance of all life and to the wellbeing of our society.

Hawaiians generally did not inhabit the mountainous upland areas of the Hawaiian Islands. These areas were cold, wet and not as hospitable as lower elevations. The mountain regions did, however, supply important raw materials and were visited to obtain these resources. Trees growing in the mountains were cut for wood used to make canoes, bowls, tools, weapons, musical instruments and god images; birds were caught for their feathers, which were used in capes, helmets, *kahili* and *lei*; and ferns, foliage and fiber plants were gathered for decoration, fish traps, feather helmets, god images, musical instruments, twined baskets and other such things (Krauss 1993).

The extent to which people in Ka'ū visited the area of the present day Ka'ū Forest Reserve, and the circumstances surrounding these visits, are not known and can only be inferred. However, the area is rich in natural resources, and it was undoubtedly a place where Hawaiians came for resources and as a thoroughfare into the *mauka* portions of the island. Handy and Pukui (1998) described and conceptually mapped the different elevation zones in Ka'ū and the resources found within them from the perspective of an expert native inhabitant, Mary Kawena Pukui. The traditional ecological zones include:

Piko - (13,000 ft.) Moku Aweoweo Crater, Summit

Kua lono - (11,000–10,000 ft.)

Ma'u kele or **Wao kele** - (8,000–7,000 ft.)

Wao akua - (6,000–5,000 ft.)

Wao nahele or **Wao lā'au** - (5,000–4,000 ft.)

Wao 'ama'u or **Wao kānaka** - (3,000 ft.)

Wao 'ilima - (2,000 ft.)

Kula uka - (1,000 ft.)

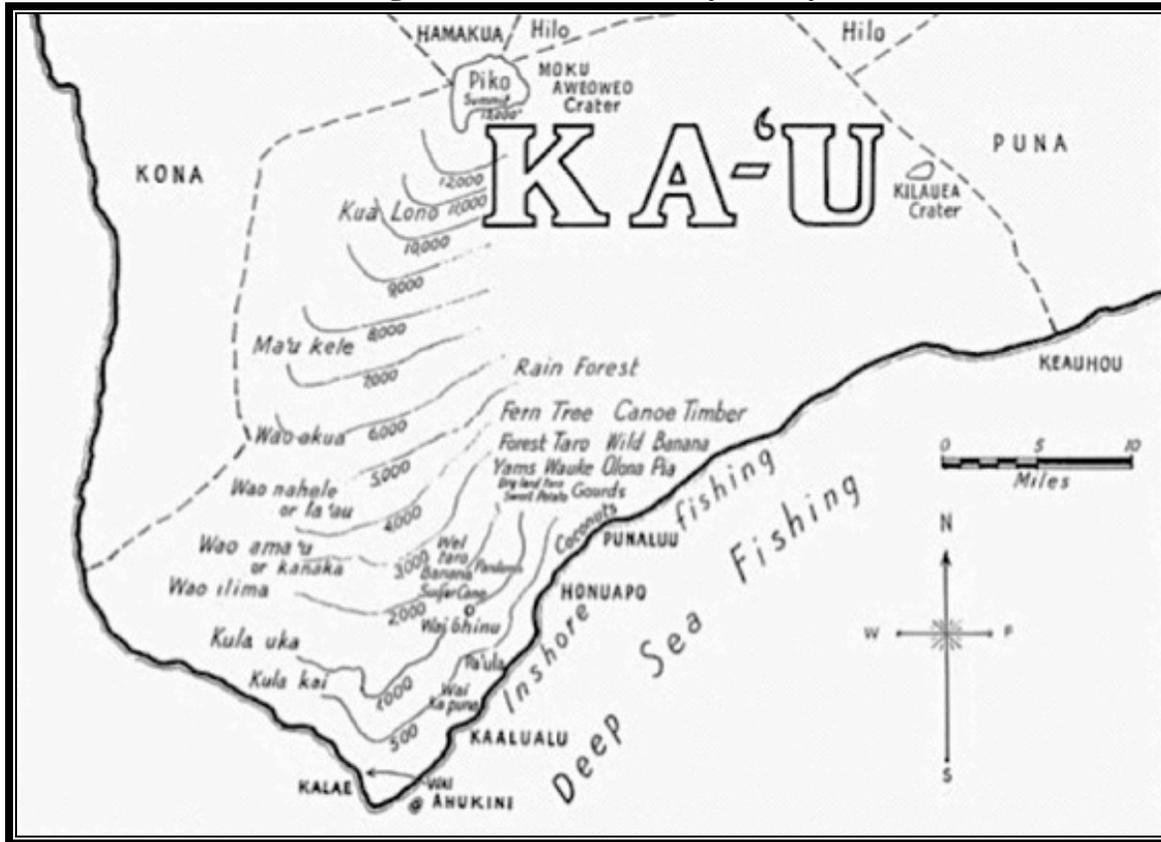
Kula kai - (1,000–500 ft.)

The wealth of resources that Ka'ū possessed from *mauka* to *makai* was what intrigued the first settlers to this area. In the words of Handy and Pukui:

...the land was both a challenge and a promise. They settled; they spread "like a gourd vine" over the plain. They cleared their plots and planted all that they had carefully transported from the old homeland (1998:222–223).

Hawaiians were prolific in naming the natural world around them and the mountains were no exception. Samuel Kamakau gave a general description of the names applied to different mountain regions from a Hawaiian perspective in an article in the Hawaiian newspaper *Ke Au Okoa* in 1869, translated below:

Figure 3-4
Traditional Ecological Zones Identified by Handy and Pukui (1998)



Heights in the center or toward the side of 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 forest 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*), 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.

Two other sources that describe the various mountain regions are found in *The Polynesian Family System in Ka'ū* (Handy and Pukui 1998) and *Native Planters* (Handy and Pukui 1991). Particular locations in Ka'ū are mentioned, and the more general descriptions can also be easily applied to the zones found within the uplands of Ka'ū. The descriptions provide insight into the traditional, pre-Western, Hawaiian worldview and land practices associated with this perspective. Particularly relevant to the Reserve is the definition of the *wao* (or upland jungle), which contained many native plant species important to their culture:

Wao means the wild—a place distant and not often penetrated by man. The wao la'au is the inland forested region, often a veritable jungle, which surmounts the upland kula slopes on every major island of the chain, reaching up to very high elevations... The Hawaiians recognized and named many divisions or aspects of the wao: first, the wao kanaka, the reaches most accessible, and most valuable, to man (kanaka); and above that, denser and at higher elevations, the wao akua, forest of the gods, remote, awesome, seldom penetrated, source of supernatural influences, both evil and beneficent. The wao kele, or wao ma'u kele, was the rainforest. Here grew giant trees and tree ferns ('ama'u) under almost perpetual cloud and rain.

The wao kanaka and the wao la'au provided man with the hard wood of the koa for spears, utensils, and logs for boat hulls; pandanus leaves (lau hala) for thatch and mats; bark of the mamaki tree for making tapa cloth; candlenuts (kukui) for oil and light; wild yams and roots for famine time; sandalwood, prized when shaved or ground as a sweet scent for bedding and stored garments. These and innumerable other materials were sought and found and worked by man in and from the wao...

Many plants in the rainforest had unique values. The strong, straight trunks of rainforest *koa* were used for canoes, and 'ōhi'a was an important timber. The sticky, milky sap (*kepau*) of several plants including 'oha was employed as birdlime for catching birds. The large black seeds of a'e or soapberry were prized for making necklaces. *Olopuia* was useful for the o'o or digging stick and adze handles, and *kolea* wood for kapa anvils. *Maile*, a twining shrub, is still treasured as a wreathed lei for ceremonial decoration. In ancient times it was used particularly on the hula altar, as associated with the goddess Laka. 'Alani contains a fragrant oil. The 'ie'ie or climbing pandanus had strong, durable roots that were woven into tight carrying baskets and into meshed funnels for shrimp traps. They also could be made into binding twine for house rafters and canoe outriggers. 'Iliahi or sandalwood has a fragrant heartwood that was powdered for perfuming bark cloth bed coverings. Ōhelo and 'akala berries were eaten, and many types of sedges, palms and other species provided thatch.

The rainforest abounded in ferns, from tiny delicate ground cover to majestic tree ferns. Some ferns such as *pala'ā* had stems that yielded a red dye, and others had juices used for medicine. *Palapalai* was sacred to Laka and essential for the hula altar, and *palapala'a* was sacred to Hi'iaka, whose magical skirt was made from it. The young leaves of *ho'i'o* were edible and a common famine food. The leathery fronds of the 'ama'u fern served for thatching upland shelters, for house decoration, and mulch for forest taro, and they had starchy piths that could be eaten as famine food, similar to

the *hapu'u pulu*. The soft down of this latter tree fern (*pulu*) was packed into body cavities in embalming.

One of the primary practices that brought Hawaiians into the upper portions of the forest, the location of today's Ka'ū Forest Reserve, was bird catching. This was done primarily for feathers, and also for the eggs and meat of some species. A number of bird catching techniques have been fascinatingly documented in Hawaiian language newspapers of the 19th century and are discussed in detail in Appendix 2. Interestingly, an ethic of conservation was observed, as bird catchers did not take all the birds or eggs they could, but left some alive, and plucked feathers from live birds that could regrow them.

It is noteworthy that the domestic pigs raised by Hawaiians did not often enter the forest and were not apparently hunted (Maly and Maly 2004; Burrows et al 2007). The eminent Hawaiian ethnographer Kepā Maly conducted an extensive review of over 60,000 Hawaiian land documents ranging from 1846 to 1910 looking for references to *pua'a*, and “nearly every reference was in the context of them being near-home and as being cared for (raised), not hunted” (Maly and Maly 2004:200). Maly also reviewed writings from native authors such as Malo, 'Ī'ī, and Kamakau and discovered that the term “hunting” was rarely ever used in historical records, and that “hunting” referred to traditional collection of native birds for food or their feathers (2004). Burrows et al (2007) stated that the only reference to hunting of mammals in the archival resources and traditional knowledge sources they reviewed was to hunting rats with bows and arrows. In the early 1800s hunting was a more common practice for Native Hawaiians, but they were primarily hunting bullocks, goats and other introduced grazers. Additionally, these hunting practices were mainly carried out at the request of landlords and ranchers.

Not only gathering but also agriculture had a place in the upper forests. Through generations of trial and error the people learned to adapt and develop many unique techniques tailored to their environment. Depending on the altitude, different food sources were grown to accommodate the varying environmental factors:

Moisture increases and evaporation decreases with altitude here, so beyond the *kula kai* (the lowest habitable zone) were the dwellings “of the upland slopes” (*ko kula uka*), less accessible to the sea, but interestingly favorable for gardening. In addition to sweet potato, dry land taro of the variety called Paua was planted, and sugar cane flourished. (This is the zone of the sugar plantations today.) Beyond this the open slopes (*kula*) become fern lands, then gradually merge with the lower forest (*wao*). In this zone where fern, bushes and small tree prosper other varieties of upland taro requiring more water were cultivated, under mulch to keep in the moisture. This continued right back into the lower forest. Here were the wild bananas, wild yam, (*Dioscorea*), arrowroot (*pia*); and tree fern (*Cibotium*), whose starchy core was eaten, extending down into this zone from the rainforest. (Handy and Pukui 1998:20–21).

According to Pukui, the wild mountain bananas from the cold uplands were ripened in Ka'ū, in pits just deep enough to take one banana and allow a few inches for covering with earth. The pit was

lined with banana leaves, then the leaves were laid over the bunches, and earth was thrown on top (Handy et al 1991:161–165).

Just as it is today, the watershed function of the forest was recognized by earlier Hawaiians. Springs inside what is now the Ka‘ū Forest Reserve served agriculture not only inside but also below the forest. Particularly important and valued were the springs above Wai‘ōhinu known as the Puna-wai-o-Hā‘ao. They consist of five separate springs, three of which are close together at the head of the stream that flows to Wai‘ōhinu, Wai-a-ka-‘ilio, Hā‘ao, and Wai-a-kahoali‘i (or Wai-a-Kamohoalii). The fourth and fifth springs were called Mau‘oli‘oli, located to the east of the three springs, and Kapuna also located east of the other springs, which empties into a small gulch. These springs represented wealth for the *ali‘i* and the community of which it provided for. The springs provided water to Wai‘ōhinu for wetland taro plantations, drinking, cooking, and irrigation of gardens (Handy et al 1991:589).

The names of the springs provide insight to the area and its importance to traditional Hawaiian culture and beliefs. Generally, Hā‘ao was the name for all the springs but specifically for the main spring. Its name comes from a reptile goddess, which is mostly identified with a spring, pool, or pond. Wai-a-ka-‘ilio (Water belonging to the dog) was named because of a dog’s quest to sate his thirst by scratching into the ground and discovering the spring. The dog, though not mentioned by name in any *mo‘olelo*, is believed to be a *kupua* (form of a god) of Kūmauna (Handy et al 1991:591). The spring Wai-a-Kahoali‘i (also known as Wai-a-Kamohoali‘i) was named after the goddess Pele’s older brother. Kamohoali‘i would take the form of a shark, which was, along with the *mo‘o*, associated with pools in ancient times. Linguistically, other ways of saying this name is Wai-a-ka-mo‘o-hali‘i, which means the spreading of the water below the spring.

Vital to accessing the forests and connecting them to other regions were trails. In traditional times, trails served to connect various settlements throughout the *ahupua‘a* and districts of Hawai‘i Island. One of the most important was the ‘Ainapō Trail in the Kapāpala area, which ended up in early and continuing use by foreigners as well. Much of it is currently a 4WD road to access hunting and gathering areas as well as the summit of Mauna Loa. Connected to the ‘Ainapō Trail is the Kahuku Trail. Located primarily above the Reserve in the Kahuku section of Hawai‘i Volcanoes National Park, portions of the trail are within the Reserve. Old maps also show a trail from Mountain House to Kahuku as well as numerous trails from the bottom of the Reserve boundary leading to tunnels systems within the Reserve.

Cultural Background

To fully understand Hawaiian epistemology or the native worldview, one must take a step back into the mindset of the *kūpuna*. This mindset is one that has evolved and developed over centuries of being intimately in tune with the natural environment from the heavens above to the depths below. Insight into how *nā po‘e kahiko* saw the Hawaiian landscape is provided through the *mo‘olelo*, *‘ōlelo no‘eau*, *oli*, *mele* and place names that are still extant. Every place, feature, resource, and atmospheric element in the Hawaiian universe was either utilized or recognized by *nā po‘e kahiko*, and described and recorded in the place names, *mele*, and *oli* they composed. By carefully and

systematically weaving them all together, the traditions and history serve as clues of the past. The reader is referred to Appendix 2 for a holistic discussion of these rich sources as they relate to Ka‘ū.

References to the area now contained within the Reserve often allude to an aura of mystery befitting its location in the *wao*. For example, a *mo‘olelo* concerning Wai‘ōhinu contains references to the Ha‘ao Springs area of the Reserve:

A cruel *kupua*, or nature spirit, came from Kahiki and dwelt just below the Ha‘ao springs. He married a Ka‘u woman, who bore him a son named Kupa. They inflicted all sorts of suffering on men who went to the spring; they killed many and hid the bodies among the tall weeds around the spring. A cloudburst brought down in the stream the grease (*hinu*) from these corpses and so the stream was called Wai-o-hinu. By a ruse the ogre and his son were caught in a net, and were burnt in an *imu* (Handy et al 1972:586).

The story of Kūmauna illustrates the powerful forces at work in the upland forests of Ka‘ū:

Ku-mauna (Ku of the mountain) is one of the forest gods banished by Pele for refusing to destroy Lohiau at her bidding. He is said to have lived as a banana planter in the valley above Hi‘ilea in Ka-u district on Hawaii, which bears his name. There he incurred the wrath of Pele and was overwhelmed in her fire. Today the huge boulder of lava which retains his shape in the bed of the valley is worshiped as a rain god. As late as 1914 a keeper escorted visitors to the sacred valley to see that the god was properly respected and his influence upon the weather restrained within bounds for the benefit of the district (Beckwith 1970:17).

The forest in Ka‘ū was strongly associated with life-giving rains. The following is a short account of Kalākolohe who was a *kahuna* of Ka‘ū. He could read the signs of the clouds and was asked by sugar plantation owner, Mr. Hutchinson to pray for rain when it was needed. The account of Kalākolohe is as follows:

Kalākolohe, the mischievous sun, was a famous *kahuna* of Ka‘ū. He was not a priest who took life but one who understood healing, a reader of the signs in the clouds. The sun was one of his gods. At Honokāne gulch was a *heiau* which had been kept by his ancestors up to the time when such things were abolished.

Mr. Hutchinson, of the Hutchinson Sugar plantation company, was the head of the sugar plantation adjoining the place where Kalākolohe lived...Mr. Hutchinson often heard of Kalākolohe’s power and of his ability always to obtain what he prayed for, so when the land got too dry, he went to the *kahuna* and asked him to be so kind as to pray for rain. The *kahuna* prayed, rain fell, and everything grew well...(Pukui and Green 1995:103–104)

An *‘ōlelo no ‘eau* gathered by Mary Kawena Pukui expresses a central truth about the value of the forests:

Hahai no ka ua i ka ululā‘au.

Rains always follow the forest.

The rains are attracted to forest trees. Knowing this, Hawaiians hewed only the trees that were needed.

The following chant was documented by Samuel Manaiakalani Kamakau on May 11, 1867 in the Hawaiian Language Newspaper *Ka Nūpepa Kū‘oko‘a*. The Ha‘ao rain that is spoken of in this chant is the name of the rain that falls at Wai‘ōhinu, Ka‘ū. Ha‘ao is also the name of a fresh water spring at Wai‘ōhinu that was named after the grand-daughter of Kūmauna. Kamakau notes that this *oli* was for the Ka‘ū chief, Keouakū‘ahu‘ula during the time that he was to be sacrificed at Pu‘ukoholā. He further states that “the chant is still chanted by the old people of Ka‘ū who retain their love of Keoua and hatred for Kamehameha” (1992:158). In *Ka Nūpepa Kū‘oko‘a*, it is written, “I ko Kaihekioi ‘ike ‘ana aku iā Keoua Kū‘ahu‘ula e amo ‘ia ana i luna o Pu‘ukoholā, puana akula ‘oia i kēia mau hua mele aloha penei:” (When Kaihekioi saw Keoua Kū‘ahu‘ula being carried onto Pu‘ukoholā, he uttered these loving words as follows:)

Ku‘u haku i ka ua Ha‘ao e	My lord of the rain of Ha‘ao
Ke lele a‘e la ka ua	The rain flies fast
Ma uka o ‘Au‘aulele	Flies over the upland of ‘Au‘aulele
Lele ka ua, lele pu no me ka makani	The rain flies driven by the wind
E lele po‘o ana ka wai o ka ha	The rain drives down from the cliff above
Ku‘u haku mai ka wai	The tears for my chief
Ha‘ule po‘o e	Drop down on the heads of the people

Place names that are documented and that still live on in *mele*, *oli* and *mo‘olelo* can help us decode the environment around us today to get a glimpse of how the Hawaiians of old viewed, understood, and utilized their surroundings. Background research conducted in association with the CIA for DOFAW files included a review of place names within all of the 39 *ahupua‘a* that are located within the boundaries of the Ka‘ū Forest Reserve. This will serve as a source to help study and perpetuation of the place names of the land to keep the memories and stories of the landscape alive.

Cultural Resources, Practices, and Beliefs Identified in the Ka‘ū Forest Reserve

Research on previous archaeology indicated no reports for the Ka‘ū Forest Reserve, as most archaeological research was done from the coastal areas of Ka‘ū to roughly 2,500 feet in elevation as well as Kahuku, but most forest activities are unlikely to have left easily detectable archaeological remains. Pre-Contact visitation to the heights of the Ka‘ū Forest is evident from the series of trails traversing the Reserve that are still used today by hunters. The post-Contact history of *mauka* areas in Ka‘ū has left remains of Historic-era sites dotting the landscape, including ranch walls and historic cabin sites that are outside the Reserve in former ranch lands. Inside, there are primarily remains of tunnels, water tanks and flumes in lower elevations.

Traditional cultural practices are based on a profound awareness concerning harmony between humans and our natural resources. Today, cultural practices continue to be perpetuated within the Reserve. Notably, the Reserve is used for gathering plants, such as *maile*, *māmaki*, *palapalai*, *‘a‘ali‘i*, and *‘olonā*. *Wai* is also collected from springs up *mauka*, which is used for ceremonial purposes. Additionally, hunters continue to use this area as a means of subsistence. The following section discusses consulted individuals’ knowledge and opinions regarding places that have special associations and resources that have ongoing cultural uses. Cumulatively, it is clear that the Reserve continues to support many cultural practices and has significant cultural meaning.

Hawaiian Agriculture

Ernest Breithaupt, also known as Uncle Peewee, shared that *‘ākala*, *kī*, *olonā*, plum trees, *loulou* palms and *‘ualakahiki* (Irish potatoes) are present in the Ka‘ū Forest Reserve. Kalani Decoito and Larry Galban shared that they would pick *pako* (or *piko*) for food, *māmaki* for tea, and *maile* for *lei*. Both, Uncle Kalani and Uncle Larry recalled that in an area known as Waterfalls (on Pane‘ene‘e Pali at the top of Hilea) there are roses, betel nut, palm trees, and other planted trees. Uncle Kalani recalls this area as being very quiet.

In the areas just below the Reserve are many *lo‘i*, or wetland taro patches, that are fed by the Hā‘ao springs. These lands made for ideal agricultural conditions for these kinds of crops as well as *mai‘a* (banana), *kō* (sugar cane), *ti*, *‘uala* (sweet potatoes), *‘ipu* (gourds), *niu* (coconut), *kukui* and *kou* trees.

Aunty Pele Hanoa shared that when they stayed up *mauka* at their family homestead by Wailau, they would grow taro there. Aunty Pele recalls that *Wai‘ōhinu* was once very productive and Hawaiians would grow banana, *‘ulu*, the sweet and soft Hawaiian cane, mountain apples, and all other types of food. Aunty Mabel Kaipō also remembers the rich agricultural grounds in *Wai‘ōhinu* because she grew up in this area. As a child, Aunty Mabel would often frequent the forest of *Wai‘ōhinu*, and she remembers seeing mangoes and coffee trees and taro that her uncle planted. According to Aunty Mabel, it used to be all forest in the back of *Wai‘ōhinu*.

Uncle Tommy Kaniho remembers an orchard above Kilohana where plums and apples were grown. He came across this orchard while building the road up to Mauna Loa. Uncle Tommy also spoke of Kalopake taro patch that is located above Lorenzo Road, inside the forest, by the red cinder road going up *mauka*. Uncle Tommy used to pick and eat Kalopake, or what he calls Chinese taro.

Gathering of Plant Resources

Uncle Peewee Breithaupt recalls using *‘ākala* raspberries to make wine and continues to utilize the root of *ti* plants to make *‘ōkolehao*, or as he refers to it, *kulu*, named for the drops of the liquid when making the beverage. People in Ka‘ū harvested the *ti* roots that grew along the edge of Makaanau, *makai* of the Reserve. Some of the roots weighed up to 2,000 pounds and everyone would work together to roll them into the back of the truck. His great-grandfather would make

‘ōkolehao to trade with other people in his community. He further mentioned that they would use the *iholena* banana trunk as a flume to divert the spring water to make ‘ōkolehao. Other plants that Uncle Peewee spoke of were plum trees along a fence line in the forest, *loulou* palms that were stolen from the mountain house, and Irish potatoes that he found growing at Kīpuka Nēnē. He said that he collected a few vines of the potato from Kīpuka Nēnē and grew them at Kiolaka‘a.

Uncle Kalani Decoito mentioned that they pick *maile* in the Forest Reserve for *lei* that are given out for special occasions in the community. He also commented that a lot of outsiders come to Ka‘ū and over-harvest *maile* and pick it wrong. If picked properly, like they were taught, the plant can regenerate. Uncle Kalani and Uncle Larry mentioned that people still go up into the forest and know what to pick for certain kinds of medicines. A protocol that they live by while collecting is to “only pick what you eat.” If there is extra, community members will give to each other so that nothing is wasted. Other resources that they collect from the forest include, *pako* for food and a very dark purple *māmaki* to make tea.

Aunty Pele Hanoa shared that she gathers a variety of plants from the forest to make *lei*. She gathers *palapalai* and uses this fern to wrap around the *wili* or string so you do not see it in the *lei*. She also gathers *maile* from the forest because it is abundant in Ka‘ū. Another plant she gathers for *lei* is ‘a‘ali‘i. Uncle Tommy Kaniho would also gather *maile* in the forest, and he shared that when they would get down to the corral there would be a lot of *maile*, and Kahuku had a lot of *maile* too.

Olonā, a rare native plant species today, was known to have been abundant on the top of Kūmauna, according to Uncle Peewee. Aunty Mabel Kaipo was also familiar with this plant and learned how to make fiber from ‘olonā.

Aunty Susan Pua recalls picking ‘ōhelo to make jam. She also would pick the shoots of the ‘ōhelo, and boil it to drink for medicine. She explained that remedy would help strengthen her kidneys. Aunty Susan also picked *pōpolo* and *kukui* for medicine, and she sadly expressed that she cannot remember the names of some of the plants that she collected for medicine in the forest.

Fresh Water Resources

Uncle Peewee Breithaupt shared that the people from Kama‘oa would travel to Kiolaka‘a, uplands of Wai‘ōhinu, on donkeys and bring their calabashes to fill them up with water from the springs. He said that the Kama‘oa trails had caves along the side that people could stay in and collect water from as they traveled. However, according to Uncle Peewee, when the County made the roads they destroyed the caves within Kiolaka‘a.

According to Uncle Peewee, Kapuna is located above the waterfall on Kūmauna. Another spring he mentioned not included with the five springs of Hā‘ao is the spring in Kahuku forest, which

he refers to as Kahuku spring. He explained that water from Kahuku spring used to run down almost to Kalae.

Aunty Mabel Kaipo shared that her uncle told her that the name of the river in Wai‘ōhinu is called Na‘u-ke-po‘o, which meant “take off the flea and smash.” She recalls that this river was still flowing in the 1940s until the plantation diverted it for the cane field.

Uncle Tommy Kaniho recalls that Kilohana and Punalu‘u Kahawai had two catchment tanks, and all the materials to construct them were hauled up the mountain by mules. Uncle Tommy also shared his knowledge about Punalu‘u Kahawai, explaining that there is a big opening about a half a mile from Punalu‘u Kahawai where you can hear the water running but you cannot see it. He was told that the water runs from Punalu‘u Kahawai and Mountain House all the way to Kāwā and Punalu‘u, and that is why there are fresh water springs at Kāwā and Punalu‘u beaches because they water is running underground.

Kama Dancil collects *wai a Kāne* from springs found up *mauka* in the forest. Gathering *wai* remains important to Kama, and he hopes that he will continue to maintain this practice in the future and that the water resources will remain healthy and abundant for generations to come.

Wahi Pana and Cultural Resources

There are many *wahi pana*, or legendary and storied places, in Ka‘ū, as illustrated in the numerous *mo‘olelo*, *‘ōlelo no‘eau* and *mele*, including Pu‘u Enuhe, the home of the distinguished caterpillars of Ka‘ū, revered as an *‘aumākua*. The forest area is known to have been used for traditional practices, and it is likely that *wahi pana* and resources such as *ahu*, ancient trails, habitation and agriculture features, boundary walls, burial caves and lava tubes existed in the vast area that is now the Reserve. Most of the Ka‘ū Forest Reserve has not been surveyed for cultural and historical sites, and such sites may still be present. Most of the participants interviewed did not recall seeing any cultural sites in the Forest Reserve, except for historic ranching walls along the boundaries. Uncle Tommy shared that he never saw any *heiau* or other traditional Hawaiian sites in the forest when he would travel through there. He noted that *heiau* are only known from the lower portions of Ka‘ū. He and others named a *heiau* and other sites Makanau Hill (*makai* of the Reserve).

Trails and Access

Uncle Peewee Breithaupt shared that he would often ride horse along the trails in the forest and would travel the ‘Ainapō Trail to the Punalu‘u-Kahawai Trail to check the rain gauge at the cabin at Kapāpala.

Uncle Tommy Kaniho spoke of the ‘Ainapō Trail which he said goes up *mauka*, then across the lava flow which is now Saddle Road, and then connects to other trails that can take one all the way to Humu‘ula, where a sheep ranch is located. He had also traveled on the Mountain House Trail in Ka‘ū, which starts off at the bottom of the 1868 lava flow, then goes *mauka* to Kīpuka

Nēnē, then continues on to the Mountain House, then to Keapohina, where the 1868 and 1950 flows are located. The next stop is Punalu‘u Kahawai, followed by the Charlie Stone camp, and the last location on the trail is Kilohana before you hit the Forest Reserve Boundary and further on Kapāpala Ranch.

‘Alalā

Although scientists have no evidence that the bird is still present in the wild, the ‘Alalā, Hawai‘i’s native crow, is still a part of Ka‘ū lore. It is considered to be an *‘aumākua* (ancestral/spiritual guardians) to the Hawaiian people. Their feathers were utilized for many traditional cultural practices and were caught by means of poles or snares. The feathers were used for *kahili* and the flesh was eaten (Handy et al 1991:257).

In Uncle Peewee’s opinion, the *‘alalā* are intelligent birds. The last time that he saw ‘Alalā in the forest was in the 1960s. He would see most of the *‘alalā* above Hā‘ao Spring. He also mentioned that there were ‘Alalā at Manukā and in the uplands of Hōnaunau in Kona. He remembered that they would sit high up in the *‘ōhi‘a* trees and when people or pigs came around, they would make a lot of noise. According to Uncle Larry, there were some ‘Alalā in the Ka‘ū forest and years ago were mostly in the slopes way up in the mountains. Uncle Tommy Kaniho also remembers seeing the ‘Alalā at Punalu‘u Kahawai in the Reserve, at Ocean View by the main road, in Kahuku, and in the uplands of Miloli‘i. He mentioned that there were so many around, but then they just disappeared, and he no longer sees them where he used to. He shared that the *‘alalā* eat *‘ōhelo* berry.

Aunty Mabel recalled that when she was younger, she would walk up a trail that had a lot of *‘ōhi‘a*, and ‘Alalā could be heard and seen there. Today, this area is pasture land and sadly she no longer sees the ‘Alalā. She would also see ‘I‘iwi birds, and she remembers a tree with red blossoms that grew on the hillside of Wai‘ōhinu which represents the ‘I‘iwi.

In conversation with some of the participants, it was shared that some hunters have seen the ‘Alalā in the Ka‘ū Forest but did not reveal exactly where. It was also shared that some hunters have been known to shoot the ‘Alalā because they make loud noises when they see pigs or hunters, and this has affected the hunter’s ability to catch pigs.

Hunting

One of the most prevalent and popular cultural practices is hunting, which has occurred for generations in Ka‘ū. Many of the interview participants either hunt themselves, or have a husband or family member that hunts food for them. In Ka‘ū, hunting is a way of life. As Uncle Kalani Decoito emphasized, people in Ka‘ū depend on hunting for food to save money, and it is part of their lifestyle. According to Uncle Kalani, Aunty Susan Pua, Uncle Larry Galban, and Uncle Peewee Breithaupt, among others, hunting is not a sport, but a means of subsistence, and they only take what they need.

Ka'ū is well known for its rich hunting grounds. Uncle Tommy Kaniho expressed that when he used to go up into the Reserve to hunt he did not even need to bring dogs with him because the pigs were just out in the open. He shared that it was easier to just walk up slowly and shoot them with a gun than to have dogs chase them down.

Uncle Kalani and other hunters respect the *pua 'a* and value its place in the local ecosystem. According to Uncle Kalani, during the summer, the pigs go higher up into the mountains to cool down and breed. Then during the winter months, when the mountains get colder, the pigs come down and give birth. His great-grandfather was a forester, and he told Uncle Kalani that the birds spread more seeds than the pigs. In his view, the pigs help to cultivate the forest by creating compost out of plant material such as the *hāpu 'u* that allows plants to grow.

Archaeological Sites

As discussed above, research by Keala Pono uncovered no previous archaeological reports for areas within the Ka'ū Forest Reserve. Most work has been done in association with government projects and proposed development near towns and in coastal areas. Based on the traditional uses known from ethnographic reports and *kama 'āina* testimonies, features such as *kauhale manu* (bird-catcher's shelters), *kahua kalaiwa 'a* (canoe-makers clearings), *oioina* (trailside resting places and shelters), *alahahele* (trails) were built in the forest. Most of these features would leave little modern evidence in the present-day, as they constructed of perishable materials and involved minimal ground disturbance, and were eventually simply reabsorbed into the landscape. No burial sites have been documented or were reported in interviews within the Reserve, but with lava tubes and caves present, undetected burials are possible.

Because of continuing use, some trails still survive, and some of recognized historic sites. One of the most important was the 'Ainapō Trail, which was nominated to the National Register of Historic places. Located in Kapāpala, it is currently used by the public to access the western side of the Ka'ū Forest Reserve and Mauna Loa. Foreigners began using it as early as 1790. The Kahuku Trail connects to the 'Ainapō Trail, also known as the historic Kahuku-'Ainapō Trail. This trail is located primarily above the Reserve in the Kahuku section of Hawai'i Volcanoes National Park; however portions of the trail are within the Reserve. Old maps also show a trail from Mountain House to Kahuku as well as numerous trails from the bottom of the Reserve boundary leading to tunnels systems within the Reserve.

Impacts and Mitigation Measures

The CIA identified cultural impacts, which fell into several general categories:

- **Lifestyle Changes:** The general sentiment of the individuals who participated in this study was that they love their home of Ka'ū because it is like no other place in Hawai'i. The unique cultural, environmental and community makeup of Ka'ū is what makes this place special, and locals do not want to see their country lifestyle significantly change. There is a fear that implementing certain of the actions of the Management Plan will produce

unacceptable changes in lifestyle due to outside management, increased visitation, changed access patterns, more formal requirements, etc.

- **Restricted Access:** Some participants expressed concerns that fences and other management actions would restrict residents' access for plant gathering, hunting, protocols, and education. The forest is a resource that is utilized for gathering, water sources, and living off the grid, so to deny access would ultimately affect livelihoods. There is concern that requiring permits for gathering is unreasonable and out of character with local practice and actually sets people up to break the law and endangers the perpetuation of cultural practices. There is great concern that the entire Reserve will be fenced off in the future and that the Ka'ū people will not have access to the resources and will not be able to perpetuate and pass on their lifestyle to future generations.
- **Excessive or Inappropriate Access:** While most participants expressed that access into the forest is too limited, others commented that access is too open, and needs to be better monitored. They feel that "community use/access" may be preferable to "public use/access," because expanded public access may bring increasingly large numbers of people from outside the Ka'ū community, reducing pig populations and *maile* abundance. Outsiders may take advantage of new access and trails and come to Ka'ū and impact the health of the forest by over-harvesting *maile* to make money, and not picking it correctly.
- **Watershed Management:** Some Ka'ū community participants recognize how important the Ka'ū watershed is for the forest and for their community and they expressed concern that this project does not negatively impact the watershed. Many also recognized that the very purpose of the project was to protect the forest and its biological, hydrological and cultural treasures and viewed DOFAW's management plans as a solution rather than an impact.

DOFAW has also considered the potential for impacts to archaeological sites. Archaeological studies in similar areas of the island (Rechtman 2001; Raymond and Valentine 2007) have found very few sites in the wet upper-elevation rainforest. 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. Management actions will likely not affect any significant historic properties for several reasons. The actions (primarily fencing) are proposed for areas in remote, heavily vegetated upper elevation rainforest terrain with no known archaeological or historic sites. They are limited in scope and involve minimal ground disturbance (e.g., hand-clearing of vegetation, construction of fences with no use of heavy machinery). Although the precise locations for proposed management actions such as fencing, trails and 'Alalā management structures have not yet been finalized, these locations are flexible. Should any historic resources be found in the field, projects can readily be relocated to avoid disturbance.

It is important to note that the Reserve's native Hawaiian ecosystems and species are an essential part of the overall cultural-historical 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.

Comparison of Impacts by Alternative

With regard to the alternatives, those who hunted tended to prefer Alternative B over the other alternatives as it would affect hunting the least. Access for hunters is very difficult and the steep terrain in the *mauka* area of Alternative B makes it hard for pigs to roam around there as well. It should be noted that many do not concur that fencing and removing ungulates would produce the beneficial impacts that scientists claim, and thus do not support any fencing at all. Some also warned of the constant labor that is required to maintain fences in the wet, vog-affected Ka‘ū Forest Reserve, and questioned how realistic DOFAW plans were.

One interviewee said that he favored fencing the entire upper half of the Reserve in order to provide an appropriate level of benefit spread out over the Reserve; if just one area was chosen, it would just push the ungulates and invasive species to other areas of the Reserve.

Some suggested other alternatives be considered, such as closing portions of the forest for specific amounts of time would help the plant and animal (both native and non-native) populations reproduce and regenerate.

Mitigation Measures

DOFAW has carefully reviewed the information in the CIA, including opinions on the potential cultural and social impacts expressed by members of the community in interviews and the mitigation measures they suggested to reduce the severity of these impacts. DOFAW will:

- Implement the actions in such a way as to maintain the local character, control, and involvement, or “*Keep Ka‘ū, Ka‘ū.*”
- Maintain local residents’ access to all areas of the Reserve, including fenced areas, and work proactively with The Nature Conservancy and cooperating landowners to better educate the public about existing accesses and provide appropriate and secure routes just *makai* of the Forest Reserve and *mauka* of farms and pastures. DOFAW will explore working with local residents to monitor access in order to prevent inappropriate access and provide security and a sense of community stewardship.
- Work with cultural practitioners on permit procedures to find permanent solutions such as establishing a local DOFAW office to issue permits, on-line permits and/or longer permit periods, particularly for those wanting to practice cultural gathering rights.
- Use local hunters as part of the first steps when removing pigs from a management unit whenever safe, feasible and effective, and explore the ideas of one-way gates for pigs.
- Look at establishing native plant nurseries in Ka‘ū to generate local employment and involvement and ensure the appropriateness of outplanted plants.
- Provide education to children (through schools and youth programs) and the general public to encourage involvement in forest management and Hawaiian use of the forest, incorporating volunteer opportunities in the Reserve so people can give back to the land and their communities and be an integral part of the management team for the Reserve.

- Maintain more of a DOFAW presence in Ka‘ū so staff can get to better know the place and the community in order to work together, in recognition that Ka‘ū community members are the best stewards of the land because they are connected to and deeply care for their home.
- Ensure that no impacts will occur to archaeological sites. If possible evidence of past human activity, including artifact scatters, human bones, lava tubes, rock alignments, mounds, stacked architectural features, excavations or areas of broken pahoehoe, are observed during construction of fencing or access roads or other activities with the potential to disturb sites, DOFAW will report the find to State Historic Preservation Division (SHPD). 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.

Impacts and Mitigation Measures: No Action Alternative

Under the No Action Alternative, habitat and watershed values will degrade and many resources important for gathering and for other cultural associations will be diminished or lost altogether, including native plants and birds. Some cultural practices such as pig hunting would not be adversely affected, however. Access to the Reserve would continue but would not be improved for either the general public or Ka‘ū residents.

3.5 Socioeconomic Conditions, Hunting and Recreation

Existing Conditions: Social Characteristics of Ka‘ū

The population of the Ka‘ū District grew steadily and rapidly over the last three decades, from 3,034 in 1980, to 4,048 in 1990, to 5,554 in 2000, and to 8,451 in 2010. This average growth rate of over 35 percent each decade masks the fact that Ocean View, a community on the edge of Ka‘ū with inexpensive subdivision lots that has attracted residents from around the country and world, has accounted for nearly all of that growth. The traditional community of Ka‘ū anchored by Nā‘ālehu and Pāhala was severely affected by the closure of sugar plantations at the end of the last century. Pāhala and Nā‘ālehu both experienced negative population growth during this same time period (-5.8 percent and -1.6 percent, respectively).

Table 3-6 provides information on the socioeconomic characteristics of Ka‘ū from the U.S. 2010 Census of Population and the 2005-2009 American Community Survey summaries. With 15 percent over 65 years old (compared to about 14 percent for the State as a whole), and a median age of 44.8 years (compared to 38.6 for the State), the population is skewed towards the elderly. Only 21.5 percent of households include children under 18, compared to over 27 percent for the State. There are many retirees, with the younger working-age residents who grew up in Ka‘ū having relocated to other districts, islands or states to find work. The median age in Nā‘ālehu is 36.5 years and 44.3 years in Ocean View. Ka‘ū has relatively low median income levels, high poverty rates, and a large immigrant population. Although the ethnic distribution is typical for the County of Hawai‘i, the

relatively high proportion of Whites in the population (38.7 percent) reflects the influence of Ocean View, with 4,437 residents officially counted in the 2010 Census, almost half of them White.

Table 3-6. Selected Socioeconomic Characteristics, Ka‘ū District

U.S. CENSUS OF POPULATION, 2010		
CHARACTERISTIC	Number	Percent
POPULATION		
Total population	8,451	100.0
Under 20 years old	1,614	19.1
65 years and older	1,266	15.0
Median Age	44.8 years	(X)
RACE		
White	3,272	38.7
Asian	1,392	16.5
Native Hawaiian and Other Pacific Islander	1,333	15.8
Two or More Races	2,224	26.3
HOUSEHOLDS AND HOUSING		
Family households with children under 18 years	678	21.5
Householder living alone	954	30.2
Occupied housing units	3,154	75.1
Vacant housing units	1,048	24.9
AMERICAN COMMUNITY SURVEY 2005-2009, ESTIMATES		
CHARACTERISTIC	Percent OR Value	
Median household income (in 2009 inflation-adjusted dollars)	\$41,352	
Individuals below poverty level	21.8%	
With Food Stamp/SNAP benefits in the past 12 months	14.1%	
Born in U.S.	88.5%	
Born in different state	36.5%	
Foreign born	10.2%	
Speak language other than English in home	16.2%	
Persons 25 or older, high school graduate or higher	88.9%	
Population 16 years or older in labor force	63.5%	
OCCUPATION		
	Percent	
Management, business, science, and arts occupations	26.8%	
Service occupations	21.6%	
Sales and office occupations	15.2%	
Natural resources, construction, and maintenance occupations	26.3%	
Production, transportation, and material moving occupations	10.1%	

Source: U.S. Census Bureau, 2010 Census. 2010 Census Redistricting Data (Public Law 94-171) Summary File, Tables P1, P2 P3, P4, H1; and American Community Survey (U.S. Census Bureau American Factfinder Webpage). (X) data not available or applicable. Note: for small populations such as Ka‘ū, error estimates are often large.

Existing Conditions: Historical Relationship of People of Ka‘ū to the Forest

Demographic statistics are useful but not sufficient for describing the relationship of the people of Ka‘ū to the Ka‘ū Forest Reserve. In pre-Western Contact times, as described in the previous section, the forest was in the *wao*, the wilderness. It was generally not inhabited, but was important for being the source of life-giving waters and the resources that supplied, wood, fiber, medicine and ceremonial products. Its integrity was integrally tied to the general wellbeing of Hawaiian society.

As Western patterns began to dominate land tenure and the economy, and the population began to reflect immigrant plantation labor, residents had less of a deep connection with the forest. At first, ecological degradation occurred as the forest became overrun by cattle and were exploited for sandalwood, timber and *hāpu‘u pulu*. At the beginning of the 20th century the plantation sugar interests that dominated the economy and employment began to consider the forest a vital part of protecting their economic water interests, and the concept of Forest Reserves was born. Fences were erected to keep cattle out and the cattle were removed. Today, few realize the extent of fencing that occurred with the original Forest Reserves. Forester Ralph Hosmer summarized the locations and condition of existing fences to protect the forest in a 1912 report on the Reserve in DOFAW files. The report noted that the Hawaiian Agricultural company completed 35 miles of fencing to protect the eastern half of the Reserve in 1896, including fencing through the interior of the forest from Kahuku to Pu‘u Enuhe. In 1903-1904, the Hutchinson Sugar Plantation Company constructed a fence, about 17 miles in length, around most of the western end of the Ka‘ū Forest Reserve, connecting on the *mauka* side with the existing Hawaiian Agricultural Company’s fence. Only some portions of the lower boundary of the Reserve were left unfenced, most being protected by cane field and other fences.

As discussed above, pigs are not native to Hawaiian forests and pig hunting was not a practice in ancient Hawai‘i (Burrows et al 2007; Maly and Maly 2004). The feral pigs that today inhabit much of Hawai‘i’s forests, including those of the Reserve, are not the same physically and not used in the same cultural manner as the smaller, domesticated pigs brought to the islands by voyaging Polynesians. Nevertheless, as hybridized pigs spread into the forest over the last century or so, hunting feral pigs with dogs and guns or knives became a common practice, and an important source of food, an enjoyable sport, and connection to the wild forest.

As the value of Forest Reserves for watershed slowly diminished with the demise of sugar and its water infrastructure, the Reserve became associated primarily as a site for hunting, as well as for the gathering practices that may have lessened but never died out. More subtly, the forests have critical cultural value, for they are still the *wao akua* and their health is inextricably linked to the well-being of the *ahupua‘a* and the people.

Today, most of the hundreds of Ka‘ū residents with whom the project team discussed the Reserve and the Plan had not spent much time in the Reserve, or even set foot inside it. Although many knew that the State managed the moist, green misty uplands crowning all inland vistas in the district, few were clear as to the purposes that have guided the management of the Reserve to date, nor were they familiar with the abundance of resources present within. The exceptions tended to be

hunters, plant gatherers, farmers and ranchers who use (or would like to use) the water from the springs and tunnels, and *kama'aina* who had maintained water infrastructure during the plantation days. Some of these individuals were intensely familiar with a portion of the Reserve, but few had a comprehensive familiarity with all of the vast, 61,000-acre area. With forbidding terrain, dense vegetation, misty weather and few trails, it retains an aura of mystery.

Existing Conditions: Hunting and Recreational Use of the Reserve

The Ka'ū Forest Reserve is currently part of State Hunting Unit B, and the Reserve is used by local residents for hunting. Due to the extraordinarily high quality of the native ecosystems and watersheds in the Reserve, it is not among State properties designated as an area where habitat should be manipulated to enhance game populations. It is unknown how many people use the Reserve for hunting or gathering. Hunter use data is not available, as there are no hunter check stations for Reserve. Discussions with local residents indicate that feral pigs are the primary game for hunting in the Reserve, although mouflon with home ranges in the Kahuku area are also present in the Reserve. In 2010, State records indicate 139 licensed hunters in the Ka'ū District in 2010 out of 3,265 licensed hunters on Hawai'i island, representing about 1.6 percent of the Ka'ū population (DOFAW internal data). However, an unknown number of residents without hunting licenses also hunt in the Reserve. DOFAW has no records of any permits issued for gathering of forest resources in the Reserve. It is clearly inconvenient for residents to obtain permits, because they are issued through the DOFAW office in Hilo; furthermore, many residents do not agree that gathering in the forests of their community should involve a permit.

The Ka'ū Listening Project found that the subsistence economy of fishing, gathering and hunting and gardening remains important today for many families (James Kent Associates 2007). For many, hunting (as well as and fishing) is an essential element of being a real *kama'aina* of Ka'ū. Hunting is a rite of passage, a bonding time among the densely interwoven network of friends and family, a treasure trove of stories for retelling, and a tradition that the community feels needs to be protected for many reasons. The Ka'ū Community Development Plan includes objectives that seek to preserve and enhance what is termed the *nā 'ohana* economy, reflecting the importance of the subsistence and sharing system prevalent in Ka'ū, which depends on gathering, hunting, fishing, and small scale agriculture.

Despite the importance of the Reserve for hunting and gathering, the quality and quantity of access to the Reserve and facilities that could promote use is severely lacking. The transition of lands from sugar production to numerous private landowners and State leases has reduced public access to the Reserve. There are currently no officially designated State-managed trails or camping areas within the Reserve.

The National Park Service is in the process of developing a general management plan for the Kahuku section of Hawai'i Volcanoes National Park. This plan may increase access to and recreational uses of Ka'ū Forest Reserve, as this section of the Park surrounds Ka'ū on two sides.

Impacts and Mitigation Measures: Action Alternatives

public activity and recreational uses of the Reserve, including hunting, gathering and hiking, are a high priority, as long as these activities are compatible with the protection of watershed and natural resources. The Plan's Draft Management Guidelines (sub-appendix C of Appendix 1) propose the Reserve for "light use" for recreation. Recreational uses will be limited to certain areas to minimize impacts on natural resources, and pedestrian trails would be the main recreational facility for this classification. DOFAW management of recreational uses of the Reserve will emphasize low-impact activities, such as hunting, gathering for personal use, and hiking, and minimal improvements consistent with the remote, wilderness nature of the Reserve.

Many aspects of the Plan will affect use of the Reserve for hunting, gathering and other recreational activities in ways that will be perceived as positive, negative, or mixed, depending on the user. Of particular importance are the following:

- DOFAW will maintain and improve public access for recreational uses, hunting, and traditional and cultural practices. DOFAW seeks to balance the objective of continuing to provide public hunting opportunities in the Reserve with the protection of native ecosystems and watersheds. At 61,641 acres, the Reserve large enough to accommodate both management objectives. The Plan emphasizes increasing access to lower portions of the Reserve to allow for public hunting while increasing watershed and native ecosystem protection in more remote, inaccessible upper portions of the Reserve through fencing of management units and removal of feral ungulates. Public hunting will be a priority action in the initial stages of hooved animal removal in fenced areas wherever safe, feasible, and effective. DOFAW will implement increased public access to the Reserve through various methods including developing easements, land acquisition or public access agreements with adjacent landowners, with particular attention when private lands *makai* of and adjacent to the Reserve get sold and developed. Additional forest access to Ka'ū Forest Reserve currently are being assessed by DOFAW and partners such as TNC, and community input will be sought on priority access routes. DOFAW has hired an Access and Acquisitions Program Coordinator to work on Statewide access issues, including access for hunting. DOFAW has received two grants with funding identified to increase access to the lower portions of the Reserve. The Voluntary Public Access grant from USDA Farm Services includes \$100,000 for surveys, private landowner incentives, educational outreach and other costs to increase access to the lower boundaries of the Reserve. In addition, a National Shooting Sports Foundation grant for \$35,000 will be used to survey portions of the lower Reserve boundary to guide decisions about how to facilitate access.
- The Plan calls for DOFAW to work cooperatively with the National Park Service on the development of additional trails and access routes through the Park in association with the National Park Service's general management plan for the Kahuku section of Hawai'i Volcanoes National Park. Trails through the Reserve could potentially connect to other trails in the Park, including historic trails such as the Kahuku-'Ainapo trail across the top of Ka'ū Forest Reserve as part of a larger Mauna Loa trail system. For example, historic maps depict a trail from Mountain House through the Reserve to Kahuku (connecting with the Kahuku-

‘Ainapo trail), which may be suitable for public use. Additional specific plans will be developed in conjunction with completion of the Park’s General Management Plan.

- The Plan specifies that DOFAW will actively seek community input and recommendations on the potential development of and locations for additional recreational amenities for the Reserve, such as picnic and camping areas, trail development and public cabins/shelters, in appropriate locations. An important focus of the early consultation process was to solicit input on specific facilities; owing to the unfamiliarity of much of the public with the geography of the Reserve, few specific suggestions have emerged, although there has been general agreement that more trails and possibly other facilities are needed. Mainly the hunting community and water infrastructure users have been specific. Suggestions include utilizing a number of the flume and pipeline trails that already exist and are slated for upgrade as part of water infrastructure leases. These include Double Arch Trail, the Noguchi Tunnel trails, and Kaumaikeohu (also known as Cloud Rest or Toenail). In addition, Pake Camp Trail could be improved. Residents who commented on trails in early consultation meetings spoke in favor of regional trail systems that would link the National Park and the Reserve, as well as trails within the Reserve that would offer maximum scenic diversity and vantage points (e.g., a trail to the Waterfalls area).
- A key aspect of the Plan is to ensure the long-term availability and sustainability of native plant resources such as *maile* for traditional resource gatherers in the Reserve. The sustainability of these resources will be enhanced by protection of native forest ecosystems through fencing, feral ungulate control and weed control.

Environmental justice is a term that refers to social inequity in bearing the burdens of adverse environmental impacts. Certain socioeconomic groups in the United States, including ethnic minorities and low-income residents, have historically experienced a disproportionate share of undesirable side-effects from locally undesirable land uses such as toxic waste dumps, landfills, and freeway projects (Cutter 1995). Executive Order (EO) 12898 requires federal agencies to take appropriate and necessary steps to identify and avoid disproportionately high and adverse effects of federal projects on the health and environment of minority and low-income populations.

Although the Plan is not a federal action subject to NEPA, in Act 294 of 2006, the Hawai‘i Legislature called for agencies to implement similar policies, directing consideration of environmental justice concerns where there are disproportionate impacts on the environment, human health, and socioeconomic conditions of Native Hawaiian, minority, and/or low-income populations. Like all parts of the State of Hawai‘i, minority populations in Ka‘ū are actually the majority, with over 60 percent of the population identified as other than white. The proportion of the population below the poverty line is estimated at over 21 percent, versus about 16.7 percent for the County as a whole (see Table 3-6 above). Ka‘ū is also recognized as one of the lowest-income districts in the State of Hawai‘i, with poverty rates chronically over 20 percent. It is clear that low-income and minority populations are present. The Plan involves protection of many of the resources of the Reserve, including culturally important plants for gathering and especially natural water. These are benefits that are shared across all socioeconomic strata, but because of water’s central importance for the subsistence and commercial agriculture that plays such a vital role in the economic lives of Ka‘ū’s inhabitants, the protection of water resources is especially critical for low-

income and minority residents. Long-time Ka‘ū residents also stated that hunting has a central role in subsistence and they are concerned about substantial reductions of area available to hunting or major effects to game availability. DOFAW will minimize any potential adverse impacts to hunting by consulting intensively with Ka‘ū residents on the location of fenced management areas, by increasing access to large portions of the Reserve still available for hunting, and by involving hunters in ungulate removal and other aspects of the Plan.

Comparison of Impacts by Alternative

As discussed previously, each alternative would involve increased access for hunters and other users (particularly across private lands), additional trails and other recreational facilities, and coordination with residents, neighboring land owners, and the National Park to leverage efforts to improve recreational opportunities. Each alternative would thus involve benefits for all recreational users, including hunters. However, there would be a loss of hunting area in each action alternative as well. The Plan includes opportunities for public hunters to assist with the removal of feral pig and sheep removal in fenced, management units prior to staff control.

Alternative A involves fencing and ungulate removal in about 12,000 acres of the southwestern portion of the Reserve above 4,000 to 4,500 feet in elevation (Figure 2-1a). Residents report that they frequently hunt for pigs and gather *maile* from Lorenzo Road, Kiolakaa Road and Ha‘ao Springs Road, because these are some of the few roads that provide direct access to the Reserve.

Alternative B involves about 12,000 acres in the central portion of the Reserve above 4,500 to 5,000 feet in elevation (Figure 2-1b). No public accesses are present nearby. The remoteness of this area, coupled with the rugged terrain and dense vegetation of surrounding areas, means there is relatively little use, although hunters report that they sometimes access it through hunting trails from *makai*.

Alternative C involves about 12,000 acres in the northeastern portion of the Reserve above 4,500 to 5,000 feet in elevation, near Kapāpala (Figure 2-1c). This area is accessible to the general public from public roads with managed access through Kapāpala Ranch, and is reportedly frequently hunted. Other trails through private lands that lead *mauka* as far as the proposed fenced management area are accessible through prior permission.

In discussions to date between the project team and the hunting community, every hunter opposed the originally proposed Alternative D (fencing the entire upper half of the Reserve) because of the loss of area in which to hunt pigs. Some hunters expressed at least limited support for Alternative B. The Final EA will include discussion of comments received during the public comment period for the Draft EA in order to confirm this preliminary finding.

Impacts and Mitigation Measures: No Action Alternative

Under the No Action Alternative, the efforts at expanding recreational access and improvements would not be undertaken, and the potential recreational value would not be fully realized. The initiatives to develop new routes to increase hunter access, particularly across private and State

leased lands below the Reserve, would not be undertaken. At the same time, the entire Reserve would continue to be open for hunting for the foreseeable future, instead of a portion of the *mauka* part of the Reserve being managed for native ecosystem and watershed values with fenced management units in which feral ungulates were removed.

3.6 Scenic Resources

Existing Environment

As noted in the Hawai‘i County General Plan and illustrated in the photos in Figure 1-3, Ka‘ū is notable for containing most of Hawai‘i Volcanoes National Park, a vast natural area with great contrasts between open lava land with little or no vegetation, dense native ‘ōhi‘a-*lehua* forests, extensive shrublands and grasslands, and spectacular coastline. In the southern part of Ka‘ū the natural beauty of the landscape is characterized by vistas from the mountain slopes to the ocean. The coast is highlighted by Manukā Bay, Green Sands Beach, and Punalu‘u Black Sand Beach. Crowning views from most *makai* vantages are the misty uplands of the Ka‘ū Forest Reserve, containing scenic eroded mountain forms that contrast with the immense shield of the remainder of Mauna Loa, truly the largest mountain on earth.

Impacts and Mitigation Measures: Action Alternatives

Implementation of the Plan would help restore and preserve the native vegetation of the Reserve, one of the contributing scenic elements. It would also provide additional accesses and trails and other facilities to enable users to enjoy different vantages and vistas.

Comparison of Impacts by Alternative

As depicted in Figures 2-1a-d, implementation of Alternative A would provide fenced management units within approximately 12,000 acres in the upper southwestern portion of the Reserve; Alternative B involves fenced management units within approximately 12,000 acres in the upper central portion of the Reserve; and Alternative C involves fenced management units within approximately 12,000 acres in the upper northeastern portion of the Reserve. Each alternative involves areas with scenic values that can benefit from restoration and preservation. There are no clear or important differences among the scenic resources preserved in Alternatives A, B and C.

Impacts and Mitigation Measures: No Action Alternative

Under the No Action Alternative, the benefits of the Plan relative to restoring and enhancing native vegetation, and thus views, along with additional accesses and trails with which to enjoy them, would not occur.

3.7 Consistency with Government Plans and Policies

3.7.1 Hawai‘i State Plan

Adopted in 1978 and last revised in 1991 (Hawai‘i Revised Statutes, Chapter 226, as amended), the Plan establishes a set of themes, goals, objectives and policies that are meant to guide the State’s long-run growth and development activities. The three themes that express the basic purpose of the *Hawai‘i State Plan* are individual and family self-sufficiency, social and economic mobility and community or social well-being. Implementation of the Plan would be consistent with State goals and objectives that call for preservation and restoration of natural, cultural and recreational resources.

The Plan is in keeping with one of the goals in the Hawai‘i State Plan, which is maintaining stable natural systems, as stated in Section 226-4:

In order to guarantee, for present and future generations, those elements of choice and mobility that insure that individuals and groups may approach their desired levels of self-reliance and self-determination, it shall be the goal of the State to achieve: ... (2) a desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.

The Plan also conforms with the “overall direction” of the Hawai‘i State Plan, namely that of improving the quality of life through proper management of the State’s land resources, as presented in Section 226-102:

The State shall strive to improve the quality of life for Hawaii’s present and future population through the pursuit of desirable courses of action in five major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, and quality education.

Discussion: Implementation of the Plan will help fulfill the overall direction of the Hawai‘i State Plan by contributing to management of land resources, namely native forests that are being degraded by ungulates and invasive plants, along with the watersheds and other values these forests protect.

Among the sections of the Hawai‘i State Plan most relevant to the Plan are those centered on the theme of the physical environment.

The following objective and policies are taken from Section 226-11, which deals with land-based, shoreline and marine resources in the physical environment:

Objectives: Planning for the State’s physical environment with regard to land-based, shoreline and marine resources shall be directed towards achievement of the following objectives: (1) prudent use of Hawai‘i’s land-based, shoreline and marine resources and (2)

effective protection of Hawai‘i’s unique and fragile environmental resources. To achieve those objectives, the Plan notes it shall be the policy of the state to:

- (a) Exercise an overall conservation ethic in the use of Hawai‘i’s natural resources.
- (b) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.
- (c) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.
- (d) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.
- (f) Pursue compatible relationships among activities, facilities, and natural resources.
- (g) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.

And from Section 226-12, regarding the scenic, natural beauty, and historic resources of the physical environment:

Objective: Planning for the State’s physical environment shall be directed towards achievement of the objective of enhancement of Hawai‘i’s scenic assets, natural beauty, and multi-cultural/historical resources. To achieve that objective, it shall be the policy of this State to:

- (a) Promote the preservation and restoration of significant natural and historic resources.
- (b) Provide incentives to maintain and enhance historic, cultural, and scenic amenities.
- (c) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.
- (d) Protect those special areas, structures, and elements that are an integral and functional part of Hawai‘i’s ethnic and cultural heritage.

Also relevant is Section 226-13, which concerns land, air and water quality of the physical environment:

Objectives: Planning for the State’s physical environment with regard to land, air, and water quality shall be directed towards achievement of the following: (1) Maintenance and pursuit of improved quality in Hawai‘i’s land, air, and water resources, and (2) Greater public awareness and appreciation of Hawaii’s environmental resources. To achieve those objectives it shall be the policy of the State to:

- (a) Foster educational activities that promote a better understanding of Hawai‘i’s limited environmental resources.
- (b) Promote the proper management of Hawaii's land and water resources.
- (c) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

- (d) Foster recognition of the importance and value of the land, air and water resources to Hawai‘i’s people, their cultures and visitors.

Discussion: Hawai‘i’s natural resources continue to be threatened by invasive species, including feral ungulates and weeds, which diminish the scenic beauty, biodiversity and watershed values of the native forest. Implementation of the Plan would help protect rare and or endangered plant as well as animal species dependent upon native food and habitat. The Plan also includes enhancement of access (including hunter access), recreational activities, education, and involvement of the Ka‘ū residents as well as the wider community in the management and enjoyment of the Reserve. This involvement will increase the “stake” the community has in the sound management of resources.

Other sections of the Hawai‘i State Plan relevant to the Plan are those centered on the theme of socio-cultural advancement. The following objective and policies are taken from Section 226-25 dealing with culture:

Objective: Planning for the State’s socio-cultural advancement with regard to culture shall be directed toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawaii’s people. To achieve the objective, it shall be the policy of this State to:

- (a) Foster increased knowledge and understanding of Hawai‘i’s ethnic and cultural heritages and the history of Hawai‘i.
- (b) Support activities and conditions that promote cultural values, customs, and arts that enrich the lifestyles of Hawai‘i’s people and which are sensitive and responsive to family and community needs.
- (c) Encourage increased awareness of the effects of proposed public and private actions on the integrity and quality of cultural and community lifestyles in Hawai‘i.

The following objective and policies are taken from Section 226-23 regarding leisure and socio-cultural advancement:

Objective: Planning for the State’s socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations. To achieve the leisure objective it shall be the policy of the State to:

- (a) Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.
- (b) Ensure opportunities for everyone to use and enjoy Hawaii’s recreational resources.
- (c) Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.
- (d) Assure adequate access to significant natural and cultural resources in public ownership.

Also relevant to the Plan project is the objective from Section 226-27 pertaining to government and socio-cultural advancement:

Objective: Planning the State’s socio-cultural advancement with regard to government shall be directed towards the achievement of efficient, effective, and responsive government services at all levels in the State. To achieve that objective, it shall be the policy of this State to:

- (a) Provide for necessary public goods and services not assumed by the private sector.

Other relevant portions of the sections pertaining to socio-cultural advancement include §226-20, which calls for the fulfilling of basic individual health needs and maintaining environmentally healthful conditions in Hawai‘i’s communities through the prevention of contamination by pesticides and other potentially hazardous substances; and §226-21, which seeks the promotion of educational programs which enhance understanding of Hawai‘i’s cultural heritage. Also applicable is §226-8, objective and policies for the economy as it involves the visitor industry, which calls for the fostering of an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawai‘i’s culture and values.

Discussion: Implementation of the Plan would help protect native plants and other resources that are traditionally collected and used for cultural purposes, as well as the watershed that ensures a continual supply of fresh water, which itself is a profound cultural resource in Hawai‘i. Protecting those resources would further the Hawai‘i State Plan’s objective to promote educational programs which enhance the understanding of Hawai‘i’s cultural heritage for residents and visitors alike. It will also improve access for cultural practitioners and others interested in experiencing the forest firsthand, whether residents and visitors.

3.7.2 Hawai‘i Forest Reserve Laws, Regulations and Policies

Chapter 183, Part II, Hawaii Revised Statutes, Forest Reserves

This law provides for the establishment and maintenance of Forest Reserves. Most relevant to the discussion of consistency are the duties of DLNR and the ability to remove feral cattle and horses.

§183-1.5 Duties in general.

- (3) Have the power to manage and regulate all lands which may be set apart as forest reserves;
- (4) Devise ways and means of protecting, extending, increasing, and utilizing the forests and forest reserves, more particularly for protecting and developing the springs, streams, and sources of water supply to increase and make that water supply available for use;
- (5) Devise and carry into operation, ways and means by which forests and forest reserves can, with due regard to the main objectives of title 12, be made self-supporting in whole or in part;

§183-19 Exclusion of livestock from forest reserves, game management areas, public hunting areas, and natural area reserves; notice. When branded wild cattle or horses are found on any forest land, game management area, public hunting area, or natural area reserve in the State, which land is duly set apart and established as a forest reserve, game management area, public hunting area, or natural area reserve, or if the land is privately owned and surrendered as defined in section 183-15, the department, in all cases where the land is so set apart and established as a forest reserve, game management area, public hunting area, or natural area reserve, whether from privately owned lands or public lands, may remove, shoot, or destroy the cattle or horses without compensation to the owner, after thirty days' public notice of the intended action in the county where the cattle or horses are found.

Discussion: The Plan has been specifically designed to fulfill and be consistent with the all aspects of Chapter 183, Part II, including the sections cited above.

Division of Forestry and Wildlife Management Guidelines (Draft)

DOFAW prepared DRAFT Management Guidelines in 2001 to balance desired levels of human activities on DOFAW managed lands. DOFAW is planning to update these draft management guidelines. The guidelines emphasize three program areas with conflicting resource demands or user groups. Current management guideline maps show classification of native vegetation according to its relative intactness and habitat quality and recommended levels of human use within these vegetation classifications for the following activities: Outdoor Recreation, Forest Products, Game Management and Hunting. Sub-appendix B of Appendix 1 contains a detailed assessment, including maps, of how the Plan has been developed with respect to the objectives related to each classification. In short, the permitted activities in the Plan have been designed to be consistent with the each classification. It should be noted that the high quality native ecosystems over nearly all the area require DOFAW to manage the area so as to protect and perpetuate them, by preventing non-sustainable activities.

3.7.3 Hawaii's Comprehensive Wildlife Conservation Strategy

Hawaii's Comprehensive Wildlife Conservation Strategy (CWCS) is an interagency initiative that comprehensively reviewed the status of the full range of the State's native terrestrial and aquatic species (Mitchell et al 2005). The DLNR took the lead in preparing the CWCS. A combination of traditional outreach, such as public meetings and technical workshops, with "modern" outreach, such as the development of a website and use of email, was used to invite and expand participation in the development of the CWCS. The collaborative nature of the effort, which involved resource managers, biologists, and concerned individuals statewide, indicates broad support and the likelihood that the conservation strategies identified will be implemented by multiple partners, including DLNR. Development of the CWCS allows as participation in the State Wildlife Grant (SWG) program administered by the U.S. Fish and Wildlife Service. The CWCS of every state required the following eight elements:

- 1) Information on the distribution and abundance of species of wildlife identified as “species of greatest conservation need,” including low and declining populations, as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State’s wildlife;
- 2) Descriptions of the locations and relative condition of key habitats and community types essential to the conservation of species identified in (1);
- 3) Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats;
- 4) Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions;
- 5) Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions;
- 6) Descriptions of procedures to review the plan at an interval not to exceed ten years;
- 7) Plans for coordinating the development, implementation, review, and revision of the plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats;
- 8) Provisions to ensure public participation in the development, revision, and implementation of projects and programs.

As part of the research and policy formulation, the CWCS determined the major threats facing Hawai‘i’s native wildlife, including degradation of habitat, invasive species, uneven management, extractive uses, and inadequate funding, among others.

To address these threats, the CWCS identifies multiple strategies to implement the following seven priority conservation objectives for the State:

- 1) Maintain, protect, manage, and restore native species and habitats in sufficient quantity and quality to allow native species to thrive;
- 2) Combat invasive species through a three-tiered approach combining prevention and interdiction, early detection and rapid response, and ongoing control or eradication;
- 3) Develop and implement programs to obtain, manage, and disseminate information needed to guide conservation management and recovery programs;
- 4) Strengthen existing and create new partnerships and cooperative efforts;
- 5) Expand and strengthen outreach and education to improve understanding of our native wildlife resources among the people of Hawai‘i;
- 6) Support policy changes aimed at improving and protecting native species and habitats; and
- 7) Enhance funding opportunities to implement needed conservation actions.

Discussion: Successful implementation of the CWCS includes efforts by the State of Hawai‘i in partnership with private and other government parties to manage its Forest Reserves to protect native habitat and watershed value. The Plan is specifically designed to accomplish this and is fully consistent with the CWCS.

3.7.4 Hawai‘i County General Plan and Ka‘ū Community Development Plan

The *General Plan* for the County of Hawai‘i is a policy document expressing the broad goals and policies for the long-range development of the Island of Hawai‘i. The plan was adopted by ordinance in 1989 and revised in 2005 (Hawai‘i County Planning Department). The *General Plan* itself is organized into thirteen elements, with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawai‘i. Most relevant to the proposed project are the following Goals, Policies and Standards of particular chapters of the General Plan:

Environmental Quality – Goals

- Define the most desirable use of land within the County that achieves an ecological balance providing residents and visitors the quality of life and an environment in which the natural resources of the island are viable and sustainable.
- Maintain and, if feasible, improve the existing environmental quality of the island.
- Control pollution.

Environmental Quality – Policies

- Take positive action to further maintain the quality of the environment.
- Advise the public of environmental conditions and research undertaken on the island’s environment.

Environmental Quality – Standards

- Pollution shall be prevented, abated, and controlled at levels that will protect and preserve the public health and well being, through the enforcement of appropriate Federal, State and County standards.
- Incorporate environmental quality controls either as standards in appropriate ordinances or as conditions of approval.
- Federal and State environmental regulations shall be adhered to.

Discussion: The Plan will fulfill the specifications of the Hawai‘i County General Plan by maintaining and improving the environmental quality of the island through protecting native forest habitat and watershed values.

Natural Beauty – Goals

- Protect, preserve and enhance the quality of areas endowed with natural beauty, including the quality of coastal scenic resources.
- Protect scenic vistas and view planes from becoming obstructed.
- Maximize opportunities for present and future generations to appreciate and enjoy natural

and scenic beauty.

Discussion: Implementation of the Plan would help restore and preserve the native vegetation of the Reserve, one of the contributing scenic elements. It would also provide additional accesses and trails and other facilities to enable users to enjoy different vantages and vistas.

Natural Resources and Shoreline – Goals

- Protect and conserve the natural resources from undue exploitation, encroachment and damage.
- Protect and promote the prudent use of Hawaii’s unique, fragile, and significant environmental and natural resources.
- Protect rare or endangered species and habitats native to Hawaii.
- Protect and effectively manage Hawaii’s open space, watersheds, shoreline, and natural areas.

Natural Resources and Shoreline – Policies

- Encourage a program of collection and dissemination of basic data concerning natural resources.
- Coordinate programs to protect natural resources with other government agencies.
- Encourage public and private agencies to manage the natural resources in a manner that avoids or minimizes adverse effects on the environment and depletion of energy and natural resources to the fullest extent.
- Encourage an overall conservation ethic in the use of Hawaii’s resources by protecting, preserving, and conserving the critical and significant natural resources of the County of Hawaii.
- Encourage the protection of watersheds, forest, brush and grassland from destructive agents and uses.
- Work with the appropriate State, Federal agencies, and private landowners to establish a program to manage and protect identified watersheds.
- Create incentives for landowners to retain and re-establish forest cover in upland watershed areas with emphasis on native forest species.

Natural Resources and Shoreline – Standards

- The following shall be considered for the protection and conservation of natural resources:
- Areas necessary for the protection and propagation of specified endangered native wildlife, and conservation for natural ecosystems of endemic plants, fish and wildlife.
- Lands necessary for the preservation of forests, park lands, wilderness and beach areas.

Discussion: The Plan is designed to protect native forests and watersheds, specifically fulfilling the Natural Resources and Shoreline elements of the Hawai‘i County General Plan.

Land Use – Public Lands - Goal

- Utilize publicly owned lands in the best public interest and to the maximum benefit for the

greatest number of people.

Land Use – Public Lands – Policy

- Encourage uses of public lands that will satisfy specific public needs, such as housing, recreation, open space and education.

Land Use – Public Lands - Standard

- Public lands with unique recreational and natural resources shall be maintained for public use.

Discussion: The Plan maintains and enhances recreational opportunities. Although the establishment of fenced management units from which ungulates will be removed reduces total hunting area, the improvements to access and facilities will counteract this loss, which is necessary to balance the management of the Reserve towards the intended goals of preserving native habitat and watershed values. Ultimately, it is these values that will provide the soundest basis for public land use.

Ka‘ū Community Development Plan (CDP)

This CDP encompasses the judicial district of Ka‘ū, and is being developed under the framework of the February 2005 County of Hawai‘i General Plan. Community Development Plans are intended to translate broad General Plan Goals, Policies, and Standards into implementation actions as they apply to specific geographical regions around the County. CDPs are also intended to serve as a forum for community input into land-use, delivery of government services and any other matters relating to the planning area. The General Plan now requires that a Community Development Plan shall be adopted by the County Council as an “ordinance”, giving the CDP the force of law. This is in contrast to plans created over past years, adopted by “resolution” that served only as guidelines or reference documents to decision-makers. According to the County’s CDP website (<http://www.hcrc.info/community-planning/kau-cdp/where-are-we-and-whats-next/>)

“The first draft of the CDP is under development. It is taking longer than expected because of contractual matters, but the goal continues to be to produce an exemplary CDP that is consistent with all of the community input. The first draft will likely be ready for review in 2012.”

In response to early consultation, the Planning Department, which is charged with guiding the CDP, offered the following (see Appendix 3a for full text of letter):

“Though the subject parcel is State-owned land in the State Conservation District, it is part of several watersheds in Ka‘u. As part of the Ka‘u Community Development Plan (CDP) process, the CDP Steering Committee has adopted several objectives related to the area’s watersheds, including:

- Protect, restore, and enhance ecosystems, including mauka forests and the shorelines, while assuring responsible access for residents and for visitors
- Encourage community-based management plans to assure that human activity doesn't degrade the quality of Ka'u's unique natural and cultural landscape
- Establish a rural transportation network, including ... a regional trail system....
 - Preserve and greatly enhance nā 'ohana economy (this is a reference to the importance of the subsistence and sharing system prevalent in Ka'u, which depends on gathering, hunting, fishing, and small scale agriculture)
- Increase the number and diversity of income sources for residents, including jobs and entrepreneurial opportunities that complement Ka'u's ecology, culture and evolving demographics.

Similarly, though alternative CDP strategies are still under development, several relate to and/or complement management actions being considered in the subject EA, including:

- Protecting and enhancing a “green infrastructure” network of existing and proposed protected areas, hubs (e.g., recreational, natural, geological, cultural sites), and linkages (e.g., trails, scenic byway)
- Collaborative, community-based management of cultural resources, trails, and shoreline and forest access and use
- Developing watershed management plans for priority watersheds
- Securing community credits and income for protected and enhanced ecosystem services
- Establishing Ka'u as an ag/eco/geo-tourism gateway community.

All of these strategies will require collaboration with various public and private entities. We particularly appreciate, therefore, your efforts to reach out to community stakeholders while drafting the EA. We also look forward to collaborating with DOFAW and other members of the Three Mountain Alliance watershed partnership during implementation of the Ka'u Forest Reserve Management Plan and the CDP.”

Discussion: Implementation of the Plan would fulfill the Ka'ū Community Development Plan in many respects. It would protect important native habitat and watershed resources that have ecological, cultural and economic value; enhance recreational access, including trails and hunting accesses, albeit with some loss to overall hunting area; and help position Ka'ū for small-scale tourism focused on natural resources. The outreach effort conducted during development of the Plan and analysis of its impacts demonstrates DOFAW's understanding of the importance of collaboration in any planning for Ka'ū.

3.7.5 Federal and State Endangered Species Laws and Plans

The federal Endangered Species Act (ESA) of 1973, as amended (16 USC 1531-1544) and the State of Hawai'i's Chapter 195D, Hawai'i Revised Statutes, provide protection for threatened and endangered species of plants and animals. These laws jointly provide a program for the

conservation of threatened and endangered plants and animals and the habitats in which they are found. The lead federal agencies for implementing ESA are the U.S. Fish and Wildlife Service (USFWS) and the U.S. National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS; jointly, the Services). The USFWS maintains a worldwide list of endangered species. Species include birds, insects, fish, reptiles, mammals, crustaceans, flowers, grasses, and trees.

The federal endangered species law requires federal agencies, in consultation with the U.S. Fish and Wildlife Service and/or the NOAA Fisheries Service, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. The law also prohibits any action that causes a “taking” of any listed species of endangered fish or wildlife. Likewise, import, export, interstate, and foreign commerce of listed species are all generally prohibited. State laws also prohibit taking of endangered species.

In addition to listing species, the ESA requires the federal government to designate “critical habitat” for any species it lists. Critical habitat is defined as specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation, the Services determine the areas.

The Services also prepare, in consultation with other agencies and organizations, recovery plans for individual species or groups of species that spell out the measures necessary to recover the populations of threatened or endangered species. Section 4(f) of the Endangered Species Act (ESA) directs the Services to develop and implement recovery plans for threatened and endangered species, unless such a plan would not promote conservation of the species. These plans include a description of site-specific management actions necessary to achieve recovery of the species, objective, measurable criteria which, when met, would result in a determination that the species be removed from the list; and estimates of the time and costs required to achieve the plan’s goal. Many recovery plans are written and sometimes guided by recovery teams.

The Ka‘ū Forest Reserve Management Plan was developed in consideration of, and is highly consistent with, the intent of recovery plans and critical habitat designations are listed in Table 3-7. Some plans, particularly those dealing with Hawaiian birds, rely particularly on actions that could occur in the Reserve, as it represents one of the largest areas of relatively intact bird habitat in the State.

Table 3-7
U.S. Fish and Wildlife Service Recovery Plans/Critical Habitat Designations

Recovery Plan/Critical Habitat Designation	Notes
Revised Recovery Plan for the ‘Alalā (<i>Corvus hawaiiensis</i>) (2009)	<p>Recommendations for management actions for the benefit and recovery of the ‘Alalā.</p> <p>http://www.fws.gov/pacific/ecoservices/endangered/recovery/documents/AlalaDraftRevisedRecoveryPlan.pdf</p>
U.S. Fish and Wildlife Designation of Critical Habitat for 12 Species of Picture-Wing Flies From the Hawaiian Islands (2008)	<p>Provides recommendations for habitat management for <i>Drosophila heteroneura</i></p> <p>http://www.gpo.gov/fdsys/pkg/FR-2008-12-04/pdf/E8-27664.pdf#page=2</p>
U.S. Fish and Wildlife Revised Recovery Plan for Hawaiian Forest Birds (2006)	<p>Recommendations for management actions for the benefit and recovery of native forest birds.</p> <p>http://ecos.fws.gov/docs/recovery_plan/060922a.pdf</p>
U.S. Fish and Wildlife Final Designation and Nondesignation of Critical Habitat for 46 Plant Species From the Island of Hawai‘i, HI (2003)	<p>Discusses management actions for the benefit and recovery of <i>Cyanea stictophylla</i>, <i>Melicope zahlbruckneri</i>, and <i>Phyllostegia velutina</i></p> <p>http://www.fws.gov/policy/library/2003/03-14143.pdf</p>
U.S. Fish and Wildlife Big Island II: Addendum to the Recovery Plan for the Big Island Plant Cluster (1998a)	<p>Provides recommendations for management of <i>Phyllostegia velutina</i> and <i>Melicope zahlbruckneri</i></p> <p>http://ecos.fws.gov/docs/recovery_plan/980511a.pdf</p>
U.S. Fish and Wildlife Recovery Plan for the Hawaiian Hoary Bat (1998b)	<p>Supports objective 2: protect and manage current populations and identify and manage threats</p> <p>http://ecos.fws.gov/docs/recovery_plan/980511b.pdf</p>
U.S. Fish and Wildlife Recovery Plan for Four Species of Hawaiian Ferns (1998c)	<p>Provides recommendations for management of <i>Asplenium peruvianum var insulare</i></p> <p>http://ecos.fws.gov/docs/recovery_plan/980410e.pdf</p>
U.S. Fish and Wildlife Recovery Plan for the Big Island Plant Cluster (1996)	<p>Provides recommendations for management of <i>Clermontia lindseyana</i>, <i>Cyanea stictophylla</i>, and <i>Nothocestrum breviflorum</i></p> <p>http://ecos.fws.gov/docs/recovery_plan/960926a.pdf</p>

3.8 Cumulative and Secondary Impacts

Cumulative effects are environmental effects that may occur when the effects of proposed action are added to other past, present, and reasonably foreseeable future actions of any government or private entity. Other than ongoing, and slightly expanding, farming and ranching activities, no large scale actions with potential for significant impacts are proposed by government or other parties for areas

within or near the Reserve. Repair and maintenance of water systems for agriculture may disturb areas of the Reserve. These activities will likely be permitted by DLNR and other agencies with conditions for invasive species control actions that may actually reduce the density of certain weeds. The Nature Conservancy and Kamehameha Schools will likely be implementing actions that improve habitat in properties near the Reserve.

Under the No Action Alternative, the slow and insidious degradation of the forest ecosystems and watersheds of the Ka'ū Forest Reserve would continue to occur. The cumulative effect of inaction combined with similar trends on many nearby properties would eventually reduce the area of healthy native forest on the island of Hawai'i to perhaps unsustainably low levels for recovery of certain rare plants, animals and habitat.

For any action alternative, cumulative effects are mostly beneficial. In terms of biological resources and watersheds, actions on nearby properties may include both degradation and enhancement of habitat and watershed value, but the ultimate enhancement in the native character of the ecosystem that implementation of the Plan will make possible will help offset any losses and leverage gains to provide a cumulative net benefit.

For most other resources – including scenery, recreation, agriculture and economy – there would be cumulative benefits as the improved conditions in the Reserve were added to beneficial impacts from other actions to help make Ka'ū a better place to live, work and produce food.

Cumulative effects from local, short-term disturbances caused by any action alternative of fence construction and similar actions (noise, water quality, emissions, traffic disruptions, etc.) are expected to be extremely minor, temporary and insignificant.

In general, cumulative effects are either minor and do not require special mitigation, or they are beneficial. Many hunters are concerned about the cumulative effects on hunting because they observe the increase in acreage of areas proposed for fencing as part of National Park and National Wildlife Refuge management, watershed initiatives, private actions, and Forest Reserve and Natural Area Reserve management plans and feel there is an alarming loss of hunting area. However, DOFAW provides over 950,000 acres of hunting areas with over 600,000 acres of public hunting area on the Island of Hawai'i (Forest Reserve, Game Management Area and NAR). Only about 4 percent is currently fenced with hooved animal populations effectively controlled. Under the most ambitious current plans for fencing and ungulate removal over the next decade, about 17 percent of DOFAW lands on the island would be affected, most of which would occur on Mauna Kea. In Ka'ū, hunting occurs on both private and State land. With the acquisition of 116,000 acres by the National Park Service for the Kahuku section of Hawai'i Volcanoes National Park, a large area of private land that offered commercial hunting and on which ranch employees could occasionally hunt was no longer available. The Park has, however, periodically provided opportunities for supervised hunting in line with management goals. Many hunters think that fencing at Kahuku has not only reduced hunting acreage but also changed game animal abundance outside Kahuku by restricting animal movement patterns, particularly mouflon. Hunters consulted stated that they see a decrease in pig numbers and attribute it mainly not to drought and vog, the factors often pointed out

as most significant by scientists, but rather to restrictions on the ability of the pigs to travel up and down the forest.

It is evident from discussions with local hunters that they consider fencing and ungulate removal over half or more of the 61,641-acre Reserve as adding to the impacts of the loss of hunting land and restrictions on game animal movement from other actions, especially if that action occurred in areas that are reported to be most actively hunted, i.e., in the lower parts of the Reserve and near Kapāpala. It should be noted that implementation of Alternatives A, B and C do not propose fencing and removing ungulates over more than about 20 percent of the Reserve, implemented over 15 years. After selection of the alternative and during implementation of the project, DOFAW and its partners may monitor pig activity in different portions of the Reserve, as well as hunter reports and harvest data, and determine whether additional actions might be necessary to acquire and/or manage non-sensitive land in Ka‘ū for hunting.

Secondary impacts occur when projects induce physical and social impacts that are only indirectly related to the project. Infrastructure expansion projects frequently involve secondary impacts, as they create opportunities for additional development. Large natural area projects such as the creation of a National Park can induce substantial population influx, economic activity and demand for local services. Few if any secondary impacts are expected from the habitat and watershed improvements that are the focus of the Plan. As discussed above, additional recreational opportunities may draw more visitors and benefit the economy, but the magnitude of these effects will be small and no substantial demand on new services is expected.

3.9 Summary of Mitigation Measures

**Table 3-8
Summary of Mitigation Measures***

Subject (Reference)	Mitigation	Enforcement Responsibility
Vegetation and Flora (3.1.1)	<p>For any action with potential to disturb plants: Prior monitoring for rare plants, crew training, and adjusted alignment to avoid removing large trees. Narrow fence corridor to avoid vegetation disturbance.</p> <p>For weed control: combination of control techniques (manual, mechanical and herbicides) to be based on target species, area sensitivity, and effectiveness of control technique(s). Herbicide use will strictly follow labeling requirements. All biocontrol agents will be approved. Protocols for cleaning of boots, equipment and vehicles.</p> <p>For public use: focused education on native plants, weeds, etc., in brochures, kiosks, website.</p>	DLNR-DOFAW
Fauna (3.1.2)	<p>For actions with potential to harm habitat: Prior monitoring for habitat plants, crew training; helicopter transport of construction materials and crew not scheduled during endangered bird and hawk breeding season.</p> <p>For bats: no barbed wire fencing, not clearing large trees during pupping season.</p>	DLNR-DOFAW

	<p>For non-native animal control: Use of toxic baits done in accordance with toxicant registration using approved baits with a low toxicity to non-target wildlife, enclosed bait stations to limit the availability of bait blocks to rodents only.</p>	
Wildfire, Pests and Disease (3.1.3)	<p>Management actions to protect watershed values and native ecosystems are themselves mitigation for threats from fire, insects and disease. Remote automatic weather station.</p>	DLNR-DOFAW
Geology, Climate, Soil Erosion and Watersheds (3.2)	<p>Management actions protect watershed and prevent erosion. For actions with potential to disturb substantial soil areas: Best Management Practices to prevent erosion and sedimentation and conformance with Chapter 27, County Code. Consider warning signs emplaced at trailheads to advise potential users about geologic hazards and flooding.</p>	DLNR-DOFAW and County Dept. of Public Works (DPW)
Agriculture and Economy (3.3)	<p>Management actions promote water production. DOFAW will work with Agricultural Development Corporation to enable agency and users to conduct environmentally sound repair, maintenance and use of the water sources.</p>	DLNR-DOFAW
Cultural Resources (3.4)	<p>Implement actions in such a way as to maintain the local character, control, and involvement, or “Keep Ka‘ū, Ka‘ū.” Maintain local residents’ access to all areas of Reserve, work with TNC and others educate public about existing accesses and to provide appropriate and secure access <i>makai</i> of Reserve and <i>mauka</i> of farms and pastures. Work with local residents to monitor access in order to prevent inappropriate access and provide security and sense of community stewardship. Work with cultural practitioners to find permanent solutions for gathering permits issues. Use local hunters as part of the first steps when removing pigs from a management unit Look at establishing native plant nurseries in Ka‘ū to generate local employment and involvement and ensure the appropriateness of outplanted plants. Provide education to children (through schools and youth programs) and the general public to encourage involvement in forest management, incorporating volunteer opportunities to allow communities to be integral part of the management team. Maintain DOFAW presence in Ka‘ū. Ensure that no impacts will occur to archaeological sites. If evidence of past human activity is observed during fencing or other activities with the potential to disturb sites, DOFAW staff will contact SHPD and report find. SHPD will assist in determining age, function and significance of find and in determining appropriate mitigation. If find is determined to have, or potentially have, traditional cultural</p>	State Historic Preservation Division (SHPD)

	value, consultation with Native Hawaiian Organizations and knowledgeable individuals will also occur during planning of mitigation/protection measures.	
Socio-Economics, Hunting and Recreation (3.5)	<p>Maintain and improve public access for recreational uses, hunting, and traditional and cultural practices by developing easements, land acquisition or public access agreements with adjacent landowners, with particular attention when private lands <i>makai</i> of and adjacent to the Reserve get sold and developed.</p> <p>Work cooperatively with National Park Service on additional trails and access routes through Par.</p> <p>Work with community through Draft EA and other input on potential development of and appropriate locations for additional recreational amenities for the Reserve, such as picnic and camping areas, trail development and public cabins/shelters.</p>	DLNR-DOFAW
Scenic Resources (3.6)	None warranted (Plan improves visual quality).	
Secondary and Cumulative (3.15)	DOFAW to monitor hunter reports and determine whether additional actions might be necessary to acquire and/or manage non-sensitive land in Ka‘ū for hunting.	
Consistency with Plans and Policies (3.17)	None warranted (Plan is consistent).	

* There are no substantial differences in mitigation among alternatives.

PART 4: DETERMINATION

Based on the information to this point, the Hawai‘i State Department of Land and Natural Resources (DLNR) is expected to determine that implementation of the Ka‘ū Forest Reserve Management Plan will not significantly alter the environment, in relation to the following criteria identified in the Hawai‘i Administrative Rules § 11-200-12. It is therefore anticipated that an Environmental Impact Statement is not warranted and that the DLNR will issue a Finding of No Significant Impact (FONSI). A final determination will be made by the DLNR after consideration of comments on the Draft EA.

PART 5: FINDINGS AND REASONS

Chapter 11-200-12, Hawai‘i Administrative Rules, outlines those factors agencies must consider when determining whether an action has significant effect.

1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource. Implementation of the Plan would benefit biological and watershed resources, including natural resources utilized for cultural practices. Impacts to pig hunting, which is considered by many to be a cultural practice, would occur but be less than significant because of the proposed locations of management areas. DOFAW seeks to balance providing public hunting opportunities in the Reserve with the protection of native ecosystems and watersheds, and the Plan includes actions to substantially facilitate public hunting in the Reserve.

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

No aspect of the Plan would curtail any beneficial use in the long term, and implementation would sustain many beneficial habitat and watershed uses that would otherwise be jeopardized if not lost.

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 action is consistent with the environmental policies and guidelines established in Chapter 344, Hawai'i Revised Statutes (HRS) and contributes to the conservation of threatened and endangered species, as covered by Chapter 195D, HRS. It is also consistent with priorities identified in the *Hawaii's Comprehensive Wildlife Conservation Strategy* (2005), the *Recovery Plan for the Big Island Plant Cluster* (1996), the *Draft Revised Recovery Plan for Hawaiian Forest Birds* (2003), the *Revised Recovery Plan for the 'Alalā (Corvus hawaiiensis)* (2009) and the *Three Mountain Alliance Final Management Plan* (2007).

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

The proposed action will not substantially affect the economic or social welfare of the community or State. It is expected to contribute to the economic and social well-being of local communities and the State through long-term improvement in the health of native forests and watersheds. Effects to pig hunting will not be significant, and other subsistence resources produced in or by the Reserve would be substantially enhanced. Healthy native forests offer recreational, cultural and watershed values that contribute to social welfare.

5) *Substantially affects public health.*

The proposed action is not anticipated to substantially affect public health in any adverse way. The project helps sustain water production for springs that are used for domestic water supply.

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

No adverse secondary effects are foreseen.

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

The proposed action does not involve a substantial degradation of environmental quality. Instead, the proposed action is expected to contribute to long-term protection of environmental quality associated with healthy native forests and watersheds.

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

In general, cumulative impacts are highly beneficial, and there is no commitment for larger actions. DOFAW will monitor hunting impacts to determine if adverse impacts occur that could accumulate with impacts from other actions and mitigate accordingly.

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

The project protects rare, threatened and endangered species and their habitat.

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

The proposed action will have no detrimental effects on air quality, water quality, or noise levels. Long term benefits to water quality are expected as a result of protecting forest health.

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 proposed action is not expected to adversely affect any environmentally sensitive areas.

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

The proposed action is not anticipated to adversely affect any vistas or view planes identified in county or State plans or studies and will benefit visual quality through maintenance of native forests.

13) Requires substantial energy consumption.

The proposed action does not require substantial energy consumption.

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ENVIRONMENTAL ASSESSMENT

Ka‘ū Forest Reserve Management Plan

**State of Hawai‘i
Department of Land and Natural Resources**

**APPENDIX 1
Ka‘ū Forest Reserve Management Plan**

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Ka'ū Forest Reserve Management Plan

May 2012

Prepared by:

State of Hawai'i
Department of Land and Natural Resources
Division of Forestry and Wildlife

EXECUTIVE SUMMARY

This plan is one in a series of site-specific plans to be prepared by the Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) for individual forest reserves in the State of Hawai'i. These plans present a brief history of the specific forest reserve, a description of cultural and natural resources, and proposed management actions for the area.

The Ka'ū Forest Reserve (or Reserve) was established by Governor's Proclamation on August 2, 1906 to protect the forest on the lower slopes of Mauna Loa in the Ka'ū District on the southeastern side of the island of Hawai'i. The Reserve is public land, managed by the DOFAW, and consists of 61,641 acres (ac) (24,945 hectares (ha)) of forested lands. The Reserve was established to maintain the necessary water supply for agricultural lands in Ka'ū. Native Hawaiians recognized the importance of forests in water production and water quality, as is reflected in the saying, "Haihai ka ua i ka ulu la au" (The rain follows the forests). Early foresters also recognized the importance of Hawaiian forests as the primary water source. For example, Ralph Hosmer, Hawaii's first Territorial Forester, stated "In Hawai'i, the most valuable product of the forest is water, rather than wood."

The Ka'ū Forest Reserve is a critical watershed for the people of Ka'ū. The Reserve's water sources are used for domestic supplies as well as agriculture, and maintaining this water supply is important for the future viability of agriculture in Ka'ū. The native forest replenishes springs and other groundwater, and reduces flooding and erosion. The water resources of Ka'ū are threatened by invasive animals and plants, which degrade the native forest and lead to reduced quantity and quality of water.

The Ka'ū Forest Reserve is important for preserving Hawaii's unique native forest ecosystems and its species. These include a wide variety of rare or endangered plants and animals. Endangered birds for which the continuing health of the Reserve may be a critical factor include the 'Akiapōlā'au (*Hemignathus munroi*), Hawai'i Creeper (*Oreomystis mana*) and Hawai'i 'Akepa (*Loxops coccineus*). Survival and recovery of these rare native plants and animals depend upon preservation of habitat by reducing impacts from threats such as ungulates, disease-bearing mosquitoes and other invasive insects, non-native predators, introduced diseases and invasive plants.

Up until the 1970s the Ka'ū Forest Reserve supported the endangered 'Alalā or Hawaiian Crow (*Corvus hawaiiensis*). The 'Alalā is extinct in the wild. The entire population of less than 100 birds is housed in two captive breeding facilities, making the 'Alalā one of the rarest birds in existence. The 'Alalā was restricted to the forests in the western and southern portions of the island, associated with 'ohi'a and 'ohi'a-koa forests with an understory of native fruit-bearing trees and shrubs. This understory is essential to the survival of the 'Alalā in the wild, providing food as well as cover from natural predators. The Ka'ū Forest Reserve has been identified by the 'Alalā Recovery Team as one of the high priority sites to restore this rare bird.

The Ka'ū Forest Reserve contains resources that are vital for maintaining Hawaiian culture and practices. Hawaiians consider native plants and animals as family and have a strong spiritual connection to the mountain landscape and the forest itself. Gathering plants such as ferns, maile (*Alyxia oliviformis*), flowers, fruits, and other materials cannot be perpetuated into the future unless the forest remains relatively pristine.

The Ka'ū Forest Reserve is an important area for public use which includes hunting, recreational opportunities, cultural uses, personal gathering, and educational programs and activities. There is currently limited public access to much of this large Reserve, and existing access needs to be maintained as well as improved by working with adjacent landowners to provide additional access, particularly across state-leased and private land below the Reserve.

The Ka'ū Forest Reserve Management Plan describes the natural resources found in the Reserve, identifies the threats to those resources, and proposes management actions to address threats and better protect the area. Proposed management activities will benefit watershed, native forest ecosystems and unique native species as well as the people who use the area for recreation and cultural practices. The following management actions would be undertaken throughout or in selected parts of the Ka'ū Forest Reserve as part of a 15 year management plan for this area:

- Fence management areas in an approximately 12,000 acre portion of the Reserve and remove feral and introduced ungulates from within fenced management areas for watershed and native ecosystem health.
- Remove high priority non-native, invasive plants.
- Implement non-native predator control.
- Restore 'Alalā to the wild.
- Continue forest bird surveys to assess changes in bird population and distribution.
- Survey and inventory rare native plants and animals (including insects and snails).
- Improve habitat and recover rare and endangered plants by propagation and re-introduction of plants into appropriately fenced and protected habitat.
- Maintain existing public access roads and develop new routes to increase access, particularly across private and state-leased lands below the Reserve.
- Continue to facilitate public hunting in the Reserve by developing new access routes to increase hunter access.
- Develop trails and recreational amenities.
- Hire outreach staff and work with partners to provide outreach and education (e.g. volunteer service trips, student internships, and school programs) for the community to enhance public understanding of the Reserve's unique native forest.
- Respond to fires, as needed.
- Monitor forest for insects and disease and conduct other management as required (control of damaging insects, slugs, and/or plant disease).
- Consider environmentally and socially appropriate ways to make the Reserve economically self-supporting to support protection and management.
- Work with adjacent private landowners on cooperative management to make better use of limited funding and resources and more effectively manage interconnected landscapes.

Table of Contents

I.	INTRODUCTION	6
II.	PROJECT AREA DESCRIPTION.....	7
A.	Location and Description.....	7
B.	Physical Site Data	9
1.	Geology.....	9
2.	Soils	10
3.	Climate and Rainfall	10
4.	Water Resources	13
C.	Land Use.....	17
1.	Reserve History.....	17
2.	Surrounding Communities.....	19
3.	Regional Partnerships.....	20
4.	Related Land Use Planning Efforts.....	21
D.	Forest Ecosystems.....	23
1.	Native Forest Communities.....	23
2.	Native Flora.....	27
E.	Wildlife	28
1.	Native Wildlife	28
2.	Non-Native Wildlife.....	38
F.	Cultural Resources.....	38
1.	Archaeological and Historical Sites	39
2.	Traditional and Cultural Practices	39
G.	Public Access and Recreation.....	39
H.	Infrastructure	40
I.	Revenue.....	42
J.	Threats	42
1.	Ungulates.....	42
2.	Invasive Non-Native Plant Species.....	43
3.	Invasive Species - Other Animals	44
4.	Wildfire.....	45
5.	Disease.....	46
6.	Climate Change, Volcanic Activity and Hurricanes	46
7.	Illegal Human Activity.....	47
III.	KA‘Ū FOREST RESERVE MANAGEMENT	47
A.	Summary of Existing Management and Research Activities	47
1.	Watershed Values and Native Ecosystems	47
2.	Threatened and Endangered Species Management.....	47
3.	Invasive Species Control and Resource Protection	48
4.	Public Activity	48
B.	Management Goals and Objectives	48
C.	Proposed Management.....	49
1.	Watershed Values and Native Ecosystems	49

DRAFT Ka'ū Forest Reserve Management Plan - May 2012

2.	Invasive Species Control	53
3.	Threatened and Endangered Species Management.....	54
4.	Public Activity.....	57
5.	Resource Protection	59
6.	Game Animal Management	61
7.	Commercial Activity	61
D.	Management Plan Implementation.....	62
1.	Management Plan Cost.....	62
2.	Staffing.....	62
3.	Timetable	62
E.	Overall Measures of Success.....	63
IV.	FUTURE RECOMMENDATIONS.....	63
V.	REFERENCES	68
VI.	APPENDICES	76
A.	Ka'ū Forest Reserve Additions and Withdrawals.....	77
B.	DOFAW DRAFT Management Guidelines for Ka'ū FR	79
C.	U.S. Fish and Wildlife Service Recovery Plans/Critical Habitat Designations for Ka'ū Species of Plants and Animals	82

I. INTRODUCTION

The Division of Forestry and Wildlife (DOFAW) has management responsibility for the Ka'ū Forest Reserve (Reserve), which is part of the State Forest Reserve System. The Reserve has numerous assets that this plan aims to protect and manage for current and future generations:

- fresh water supply for humans (capturing and filtering rainwater and fog drip for drinking water and agricultural uses)
- native forest ecosystems
- native birds, plants and invertebrates
- cultural and recreational resources for people

DOFAW conducts on-going planning efforts to develop and update management plans for all forest reserves across the State. These efforts serve to organize field management and assist in budgeting and funding requests. DOFAW aims to make the planning process transparent and will seek input and guidance on the plan from its partners and the general public throughout the planning process.

This plan was developed using a variety of methods, including:

- Use of DOFAW's standard management plan format
- Review of DOFAW historic and current files (both at the Administrative and Hawai'i Branch office) and documents obtained from the Land Division, Survey Division, Bureau of Conveyances, as well as State Archives
- Reviewing State of Hawai'i Geographic Information Systems (GIS) maps of biological, historical, and environmental resources in the forest reserve
- Reviewing other plans that identified the forest reserve or the area, such as the Hawaiian Forester and Agriculturalist, the Hawai'i Biodiversity and Mapping Program reports, Hawai'i's Comprehensive Wildlife Conservation Strategy, and U.S. Fish and Wildlife Service Recovery Plans
- Input from DOFAW staff from all program areas both at the Hawai'i Island Branch and Administrative offices

The plan identifies management actions for the Reserve to protect the native forest and watershed, and may also be used to help the agency plan budget and staffing needs.

The development of the plan may trigger the following actions:

1. Preparation of regulatory compliance documents such as an Environmental Assessment and associated public review process.
2. DOFAW efforts to secure operational and planning funding for plan objectives.
3. Prioritized implementation of plan objectives by DOFAW.
4. Periodic solicitation of requests for proposals or bids for implementation of plan objectives, including issuance of permits, licenses, or contracts (Hawai'i Administrative Rules §13-104-22), as necessary.

II. PROJECT AREA DESCRIPTION

A. Location and Description

The Ka'ū Forest Reserve is located in the Ka'ū District on the southeastern side of the island of Hawai'i (Figure 1). The Reserve is adjacent to the Kahuku section of the Hawai'i Volcanoes National Park, on Mauna Loa Volcano and extends from 2,000 - 7,000 feet (ft) (610 - 2,134 meters (m)) elevation. The nearest towns are Pāhala, Nā'ālehu and Wai'ōhinu.

On Hawai'i Island, DOFAW has direct management responsibility for 20 Forest Reserves, which include approximately 476,000 ac (192,630 ha). Adjacent DOFAW lands in the Ka'ū District include Kapāpala Forest Reserve and Kapāpala Koa Canoe Management Area. These lands are not included in this plan, and their management needs will be addressed in the future through the development of other management plans and/or revision of this plan.

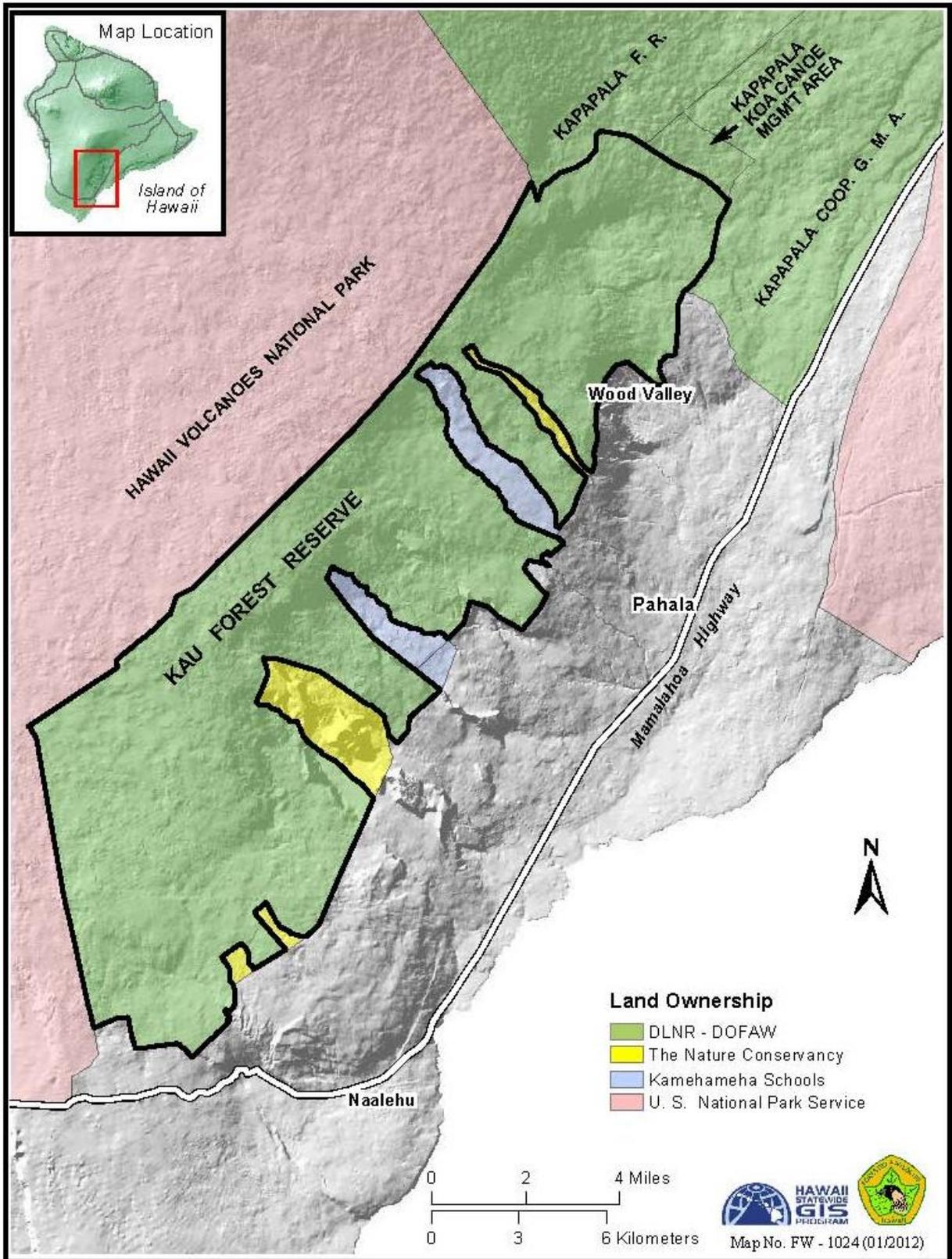
The Reserve is adjacent to federal, private and other state lands managed for natural and cultural resource protection. Adjacent major landowners include the U.S. National Park Service (NPS), Kamehameha Schools (KS), and The Nature Conservancy of Hawai'i (TNC) (Figure 1). DOFAW and these adjacent landowners are all members of the Three Mountain Alliance (TMA), a watershed partnership with the goal of cooperative management of Hawai'i's natural and cultural resources. The Reserve is also bordered by multiple private land owners, including ranchers, farmers, and residents.

Table 1. Ka'ū Forest Reserve and Adjacent TMA Partnership Lands*

*Data obtained from Hawai'i Statewide GIS Program and DOFAW archives.

Name	TMK Number	Owner	GIS Acres
Hawai'i Volcanoes National Park – Kahuku Ka'ū	(3) 9-2-001:002	NPS	150,194
Ka'ū Forest Reserve	(3) 9-7-001:001,009,013,014,015,016,017,018,019,020,021,022; (3) 9-6-006:009,010,015,018; (3) 9-5-015:003 [portion]	DOFAW	61,641
Kapāpala Forest Reserve	(3) 9-8-001:004	DOFAW	37,276
Kapāpala Cooperative Game Management Area	(3) 9-8-001:010	State (DLNR)	22,109
Kapāpala Koa Canoe Management Area	(3) 9-8-001:014	DOFAW	1,244
TNC Ka'ū Preserve	(3) 9-7-001:002,003,004,007	TNC	3,561
Kamehameha Schools Ka'ū Forest	(3) 9-7-001:005,006,012; (3) 9-6-006:011	KS	2,891

Figure 1. Ka'ū Forest Reserve and Adjacent TMA Partnership Lands



B. Physical Site Data

1. Geology

The island of Hawai'i is the youngest and largest of the main Hawaiian Islands and lies at the southeastern end of the Hawaiian Archipelago. The island was formed by five shield volcanoes that are less than 1 million years old: Kōhala, Hualālai, Mauna Kea, Mauna Loa, and Kīlauea (Stearns and MacDonald 1946). Mauna Loa and Kīlauea are currently active (Takasaki 1993) and their lava flows cover almost two-thirds of the island's land surface.

The geology of the Ka'ū District is derived from volcanic eruptions from Kīlauea and Mauna Loa volcanoes. The forests of the Reserve lie over a variety of different types and ages of volcanic materials from these eruptions. The age and type of volcanic material influences the development of soils and types of forest in the Reserve as well as watershed features such as stream channels and underground water collection.

Geological series (age/type of volcanic material) found in the area include Ninole, Kahuku, Pāhala, and Ka'ū (U.S. Geological Survey 2007, Figure 2). The oldest exposed rocks found in the area originated from the Ninole Volcanic Series and can be seen in steep slopes such as Pu'u Enuhe (Stearns and MacDonald 1946). The Kahuku lava flows are highly permeable and consist of pāhoehoe and 'a'ā flows with some interbedded ash. The Kahuku lava flows lie on top of the Ninole Volcanic Series and underneath the Pāhala Ash. Pāhala Ash consists of pumice fragments carried by the wind from lava fountains during eruptions of Kīlauea, Mauna Loa, and Mauna Kea as well as dust from Ka'ū Desert. The Ka'ū Volcanic Series covers the majority of the district and includes pāhoehoe and 'a'ā basalts of more recent eruptions.

Mauna Loa is still active and has erupted 33 times between 1843 and 1984 (Lockwood and Lipman 1987). Forty percent of Mauna Loa's surface is covered by lava flows less than 1,000 years old, and flows in 1950 reached the upper elevation of Ka'ū Forest Reserve. Portions of the Reserve could potentially be covered by lava from future volcanic eruptions. The Ka'ū Forest Reserve is located within Volcanic Hazard Zones 3 and 6 for Mauna Loa (USGS). During the past 750 years, lava flows have covered about 15 to 20 percent of Zone 3 on Mauna Loa. The portion of the Reserve above Nā'ālehu is classified as Zone 6 because it is currently protected from lava flows by the local topography.

Kīlauea Volcano is also currently active. The Ka'ū District is in the path of volcanic emissions from Kīlauea, particularly from the second active vent at Halema'uma'u. Trade winds blow the volcanic fumes to the southwest, towards Ka'ū, and at times volcanic emissions (which contains sulfur dioxide and other pollutants) have built up to levels that are hazardous to human health and damaging to agriculture. Volcanic emissions may also adversely affect the health of some native plant and animal species (USGS 1997; UH 2008).

The Reserve may also be affected by the frequent seismic activity, including earthquakes and associated landslides and tsunamis. Seismic activity in the region is related to the movement of magma within Kīlauea and Mauna Loa or due to movement along numerous fault lines. In 1868, an earthquake caused a large destructive landslide that buried a village in Wood Valley and caused a large seismic sea wave that swept away numerous settlements along the Ka'ū coast (Stearns and MacDonald 1946).

2. Soils

Soils in Ka'ū have developed from volcanic rocks, cinders, and ash. Soil age and composition is a major influence on plant community composition and hydrology. Pāhoehoe, 'a'ā, cinders, and weathered ash provide differing contributions of minerals and drainage characteristics (Mitchell *et al.* 2005). Accumulations of organic matter in the soil and ground litter are the most important factor in soil development on these relatively young substrates. In areas with greater rainfall, deposits of Pāhala Ash developed into soils that are important for agriculture in lower elevations and for watershed functions in higher elevations (University of Hawai'i 1965). The USDA Natural Resources Conservation Service has mapped 36 types of soils in Ka'ū Forest Reserve (U.S. Department of Agricultural 2011) (Figure 3, Appendix A).

3. Climate and Rainfall

Average temperature for the Ka'ū Forest Reserve decreases with increasing elevation and ranges from 55° to 75°Fahrenheit (13 - 24°Celsius). Rainfall in the Hawaiian Islands depends greatly on topography and the mountains affect the pattern of annual rainfall (Giambelluca *et al.* 1986). Average annual rainfall in the area ranges from 60 in (1,500 mm) - 120 in (3,000 mm) (Juvik and Juvik 1998) and is highest in the central portions of the forest reserve (Figure 5). Mauna Loa affects the climate in the area, as winds are driven around and upward creating three rainfall regimes: trade wind dominated (Pāhala to Nā'ālehu), rain-shadow (southwest of Kīlauea summit), and high elevation. The frequent rainfall between Pāhala and Nā'ālehu is thought to be caused by a combination of trade winds and a thermally-driven sea breeze/land breeze cycle (Scholl *et al.* 1995).

The region experiences flooding from storm runoff and steep slopes. Flash flooding occurs often along the Mamalahoa Highway when streams in the area exceed culvert and bridge capacity. Flooding causes major disruption to Ka'ū communities as it can geographically isolate them and warrant emergency government response, as in 2000.

Figure 2. Ka'ū Forest Reserve Geologic Age

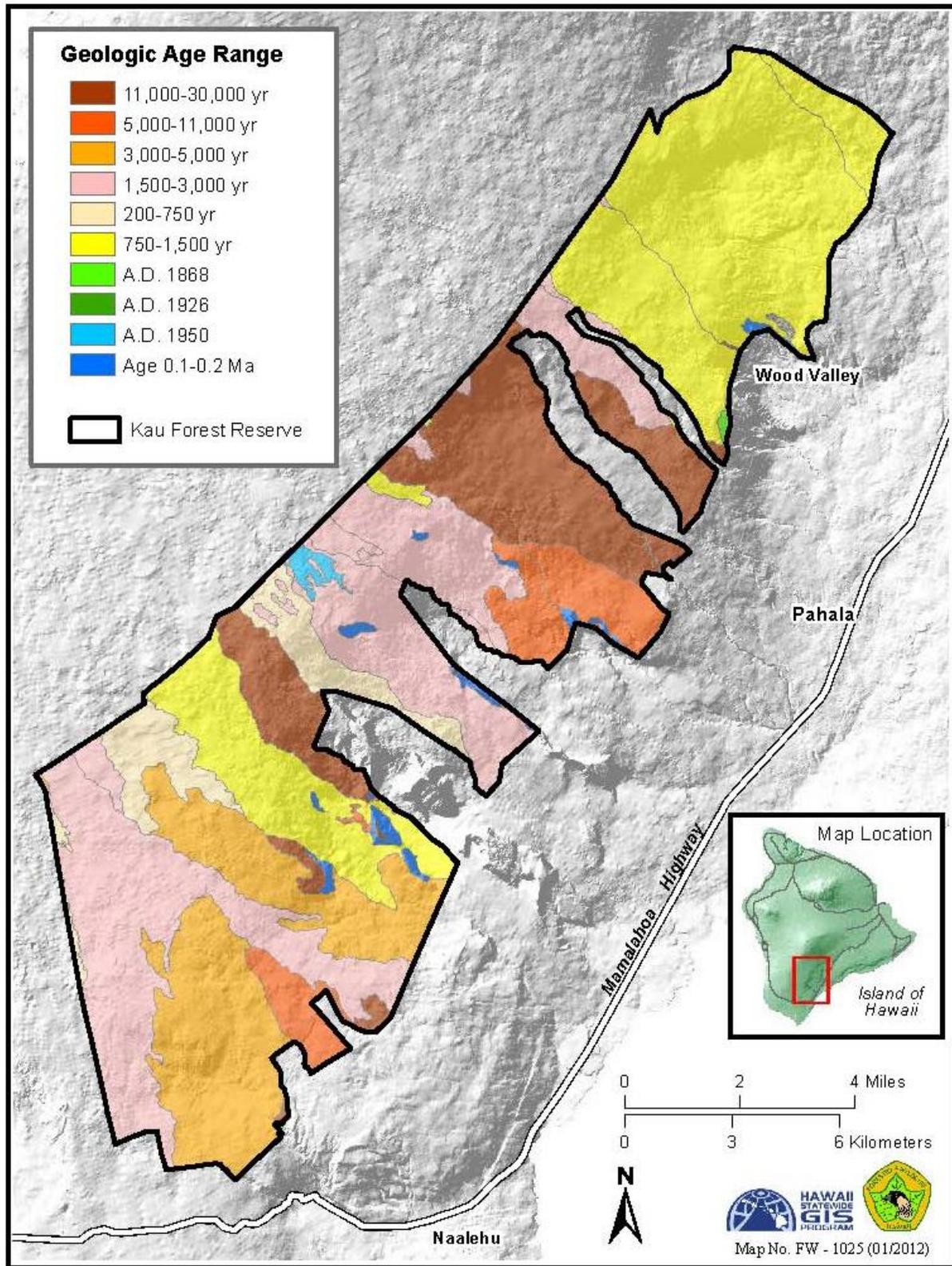
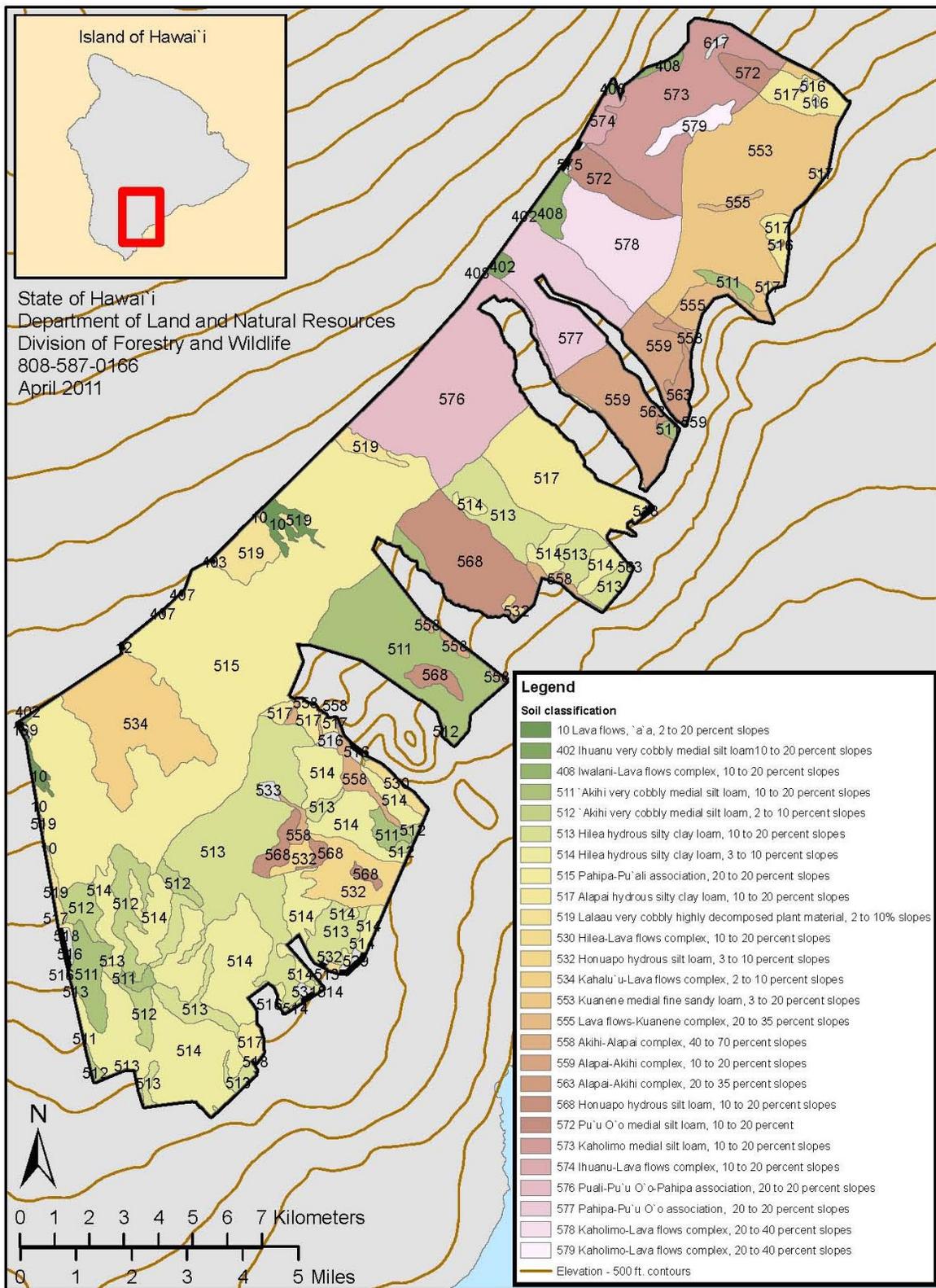


Figure 3. Soils



4. Water Resources

The Reserve was originally established in 1906 to protect the water supply of the district, and the forest continues to provide important watershed services for the community. Native Hawaiians recognized the importance of forests in water production and water quality, as reflected in the Hawaiian proverb, “Haihai ka ua i ka ulu la au” (The rain follows after the forests). Early foresters also recognized the importance of Hawaiian forests as watershed. Ralph Hosmer, the first Territorial Forester stated "In Hawai'i, the most valuable product of the forest is water, rather than wood."

The Hawai'i Stream Atlas defines a watershed as a catch-basin or drainage basin for rain and condensate funneled into stream beds that either join other stream beds or terminate at the edge of the sea (Parham et al. 2008). The Stream Atlas identifies eight watershed basins within the Ka'ū District (Table 2, Figure 5).

Watershed services include providing a fresh water supply, habitat for native plants and animals, allowing better flood control, mitigating climate change impacts, and providing economic, social, recreational and educational opportunities for the human communities in the area. Watershed economic value can be measured in dollars. A University of Hawai'i study estimated the economic value of watershed services provided by the Ko'olau Mountains watersheds on O'ahu to be between \$7.44 billion to \$14 billion (Roumasset et al. 1997). Although a similar analysis has not yet been done for Ka'ū Forest Reserve, the economic value of the Reserve's watersheds is undoubtedly high.

Table 2. Watersheds of the Ka'ū Forest Reserve

Watershed Basin Name	Streams
Hī'onamoa Gulch	Hī'onamoa, Mo'a'ula, Uwēwale, Ka'ala'ala, Pā'au'au, Waiakaloa Kauhuhuula, Peleli'ilī'i, Waihaka, Keāiwa, Pi'ikea, Waloala, Makakupu, Punalu'u
Ninole Gulch	Ninole
Hīlea Gulch	Hīlea
Honuapo	Honuapo
Kaunāmano	Kaunāmano
Nā'ālehu	Alapai Gulch
Wa'ōhinu	Kaluapuhi, Wa'ōhinu
Kawela	Kaalualu

Protecting the forests of the Reserve is important because of the direct impact to humans and our water supply. While many people are familiar with the water cycle and how rainfall ends up in groundwater that is used by humans, fewer people may be aware of the large role forests play in supplying and purifying our fresh water. Fog condensing on trees is an important source of moisture and can increase measurable precipitation by 20% (Juvik and Perreira 1973; Juvik and Nullet 1995). Forests collect and filter water into the groundwater and streams. A healthy forest without soil

disturbance limits aquatic pollutants (e.g. siltation, suspended solids, turbidity, nutrients, organic enrichment, toxins and pathogens) due to erosion and runoff. Forests may also reduce the impacts of flooding and erosion by slowing down water as it flows down the mountain.

Despite the large amount of rain in the upland forests of Ka'ū, there are no perennial streams because the water is absorbed quickly into the highly permeable lava flows (Davis and Yamanaga 1966). Surface water reaches the sea only after periods of heavy rainfall and flooding. The water absorbed into the lava sinks rapidly to the basal water table where it either floats on salt water or is perched on impermeable ash beds and becomes groundwater. Some basal water seeps out at springs at or near sea level along the coast (Stearns and MacDonald 1946).

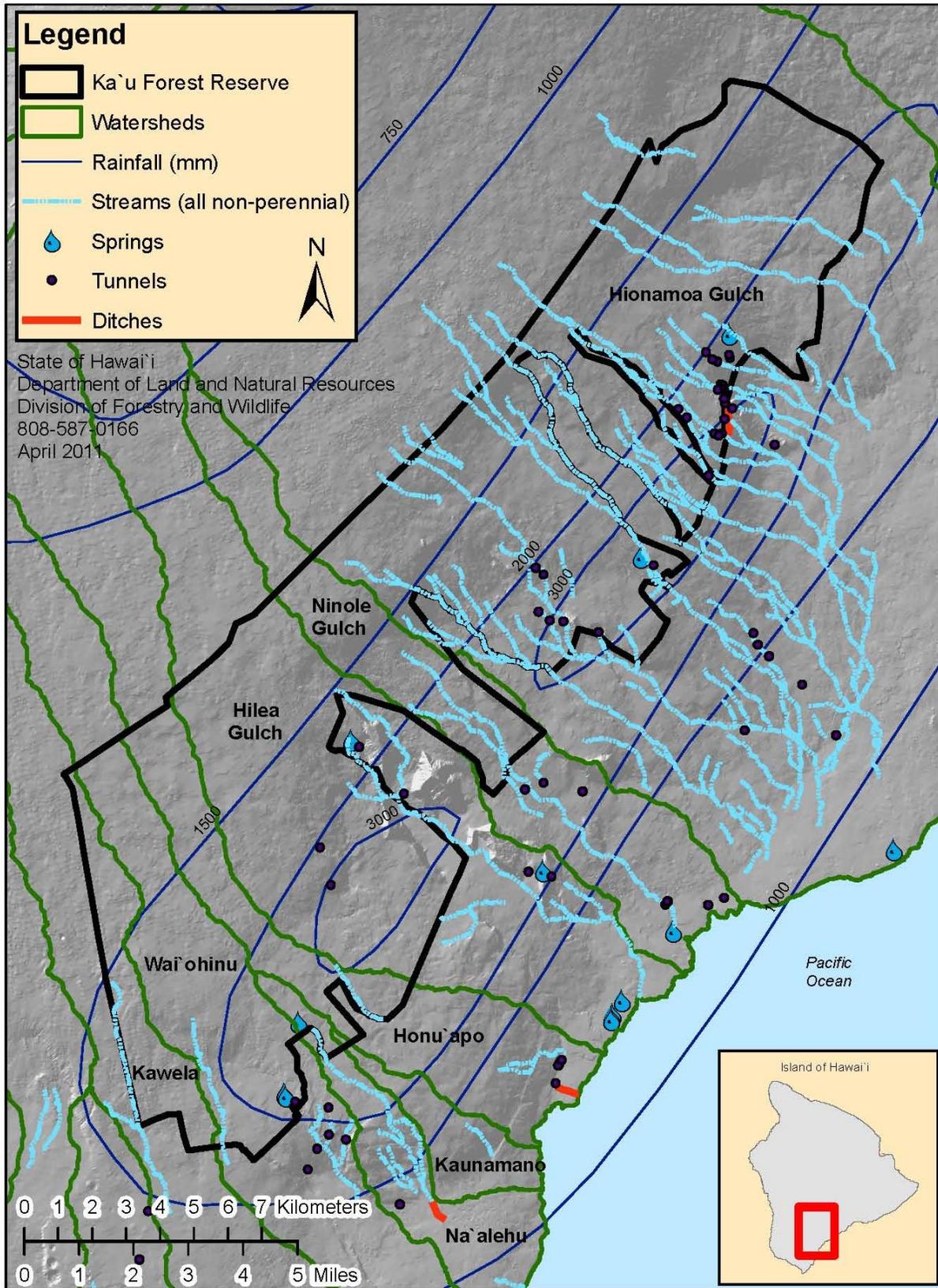
Water from Ka'ū Forest Reserve has been particularly important for Ka'ū agriculture. From the early 1920's to the late 1930's the two sugarcane companies in the district, Hawaiian Agricultural Company in the Pāhala area and Hutchinson Sugar Company in the Nā'ālehu area developed tunnels to recover perched groundwater for sugarcane irrigation and transport to mills via flumes (County of Hawai'i 2005). By 1950, the tunnel and flume transport system had fallen into disrepair (County of Hawai'i 2005). Sugarcane company leases for the water expired in 1973.

Of the 30 tunnels in the Reserve, three are currently being used under an agreement with the Hawai'i County Department of Water Supply (DWS). The DWS receives water for its Pāhala Water System from the Alili Tunnel and the Pāhala well. After the closure of the sugar plantation, the DWS also assumed management of the Wai'ōhinu-Nā'ālehu Water System which serves the communities of Wai'ōhinu, Nā'ālehu and South Point. This system depends primarily on the New Mountain House Tunnel Spring and Haao Spring for its water supply. Over 20 percent of the water drawn from the DWS system is used for agriculture.

The Department of Agriculture's Agribusiness Development Corporation (ADC) is actively working on getting a long-term agreement from DLNR to manage and improve various springs, tunnels and water infrastructure in Ka'ū Forest Reserve for agricultural uses. The ADC was established in 1994 to provide direction for the transition of Hawaii's agriculture industry from one dominated by sugar and pineapple to one composed of a diversity of crops. The mission of the ADC is to acquire and manage in partnership with farmers, ranchers and aquaculture groups high-value lands, water systems and infrastructure for commercial agriculture use for the economic, environmental, and social benefit of the people of Hawai'i. The ADC achieves its goals by facilitating the transition of agricultural infrastructure from plantation operations into other agricultural enterprises; by organizing farmers and users into cooperatives that benefit from participants' common interests and collective efforts; by conducting economic and feasibility studies relating to agriculture; and by providing leadership for the development, financing, improvement, and enhancement of agricultural enterprises. In Ka'ū, many users of springs and tunnels in Ka'ū Forest Reserve formed the Ka'ū Agricultural Water Cooperative (KAWC) in 2006 to work with the ADC on getting the

long-term agreement for the use of water and water infrastructure in Ka'ū Forest Reserve. The Ka'ū Forest Reserve Management Plan recognizes the established uses and planned upgrades to water infrastructure for agricultural and domestic systems. The ADC will be coordinating with DLNR to obtain a long-term agreement and implement practices that protect that values of the Forest Reserve and maintain consistency with the Management Plan.

Figure 5. Ka'ū Forest Reserve Water Resources



C. Land Use

The Forest Reserve System was created by the Territorial Government of Hawai'i through Act 44 on April 25, 1903. With Hawaii's increase in population, expanding ranching industry, and extensive agricultural production of sugarcane and later pineapple, early territorial foresters recognized the need to protect mauka (upland) forests to provide the necessary water for the agriculture and surrounding communities.

DOFAW has management responsibility for the Ka'ū Forest Reserve, which is part of the State Forest Reserve System. Forest reserves provide recreational and hunting opportunities; aesthetic benefits; watershed restoration; native, threatened, and endangered species habitat protection and management; cultural resources; and fire protection, among many other things.

The Hawai'i State Constitution Article 11 states: "For the benefit of present and future generations, the State ... shall conserve and protect Hawaii's natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State. All public natural resources are held in trust by the State for the benefit of the people." The Forest Reserve System is managed under the guidance of the Hawai'i Revised Statutes (Chapter 183) and associated Hawai'i Administrative Rules (Chapter 104). Through these directives, DOFAW focuses its resources to protect, manage, restore, and monitor the natural resources of the Forest Reserve System, with the highest priority placed on watershed function and native ecosystem preservation, as applicable.

The public is generally welcome into any forest reserve provided it is not dangerous to human life or detrimental to public trust resources such as watershed. The Forest Reserve System accounts for over 642,000 acres of state managed land. Without continued management, these resources would disappear, jeopardizing Hawaii's fresh water supply for people, as well as contributing to the further loss of native ecosystems. Information on the Forest Reserve System can be found at:

<http://hawaii.gov/dlnr/dofaw/forestry/FRS>

1. Reserve History

The Ka'ū Forest Reserve was established by Governor's Proclamation on August 2, 1906 to protect the forest on the lower slopes of Mauna Loa. The Reserve was established because of its importance in maintaining the favorable conditions on which the water supply of the agricultural lands in the Ka'ū District depend (Hawaiian Forester and Agriculturist 1906).

In 1906, The Board of Commissioners of Agriculture and Forestry, on the basis of a report by Ralph S. Hosmer, Superintendent of Forestry, recommended to the Governor that a forest reserve be established in Ka'ū. Lands proposed for this Reserve had been

under a lease to Hawaiian Agricultural Company and Hutchinson Sugar Plantation Company and many of those leases were about to expire. The leases required protection of the forest, including fencing out cattle, and these companies installed 52 miles of fencing around the forest and developed a water supply with tunnels and ditches.

Although the sugar plantations had installed a system of irrigation, it was deemed the responsibility of the Territory to perpetuate the forest for the procurement of water. The Ka'ū Forest Reserve boundaries were drawn to exclude private land at Kahuku, grazing land at Kāpāpala and land considered important for agriculture along the lower Reserve boundary (Hawaiian Forester and Agriculturist 1906).

Ralph Hosmer, Hawaii's first Territorial Forester, noted the importance of the Ka'ū forest stating "perhaps nowhere in the Territory is there a finer example of the fern jungle, with its dense mass of tree and other high-growing species". Hosmer also noted that "since the forest fence was completed ten years ago [1896] a wonderful difference has been noticed in the appearance of the forest" (Hawaiian Forester and Agriculturist 1906).

Hosmer's report recommending the establishment of the Reserve discussed both the direct benefits to the plantation as well as indirect economic benefits to the Territory through taxation and agricultural activities. Most portions of the Reserve were recommended for protection, with no cattle grazing proposed and limited areas for growing trees for timber and fuel collection (Hawaiian Forester and Agriculturist 1906).

Hosmer summarized the locations and condition of existing fences to protect the forest in a 1912 report on the Reserve in DOFAW files. The report noted that the Hawaiian Agricultural company completed 35 miles of fencing to protect the eastern half of the Reserve in 1896, including fencing through the interior of the forest from Kahuku to Pu'u Enuhe. In 1903-1904, The Hutchinson Sugar Plantation Company constructed a fence, about 17 miles in length, around most of the western end of the Ka'ū Forest Reserve, connecting on the mauka side with the existing Hawaiian Agricultural Company's fence. Only some portions of the lower boundary of the Reserve were left unfenced, most being protected by cane field and other fences.

Various parcels have been added and withdrawn from the Reserve since its establishment (summarized in Appendix A). The Board of Land and Natural Resources has approved the addition of two additional parcels, Kamilo and Kāpāpala Canoe area, which will be added to the Ka'ū Forest Reserve sometime in the next decade, following survey and subdivision. As written, this plan does not apply to those areas; once they are added, the management plan will be revised to address them.

DOFAW lands in the vicinity of Ka'ū Forest Reserve include the Kiolaka'a Ranger Station, which was originally turned over to the Board of Land and Natural Resources for a nursery, arboretum and ranger station in 1929. DOFAW staff currently use the Kiolaka'a Ranger Station to house staff and volunteers working in the area. DOFAW

also owns a cabin situated on NPS lands in upper Kahuku, which DOFAW staff use when working in the upper elevations of Ka'ū Forest Reserve.

2. Surrounding Communities

The Ka'ū District is rural and historically isolated. However, the population has grown substantially over the past 40 years. According to the 2010 U.S. Census, the Ka'ū District experienced a 45% increase in population growth from 5,827 individuals to 8,451 between 2000 and 2010. Increases in population growth during this time were primarily due to 103.7% population growth in the Hawaiian Ocean View area. Pāhala and Nā'ālehu both experienced negative population growth during this same time period (-5.8% and -1.6% respectively). The overall growth rate for the island was 24.5% (U.S. Census 2010).

There are few economic resources in the Ka'ū District. Commercial centers are located in Pāhala, Nā'ālehu, Wai'ōhinu, and Ocean View. Development in the area includes residential, small retail commercial centers, and family-owned or commercial farms. Major government facilities include schools, a police facility and a hospital. The median household income in 2000 was \$29,000. In 1999, 23.9 percent of the Ka'ū population was below the poverty level. Typically, residents live on fixed incomes or are young families and desire a rural lifestyle. The median age in Nā'ālehu is 36.5 yrs and in Ocean View is 44.3 (U.S. Census Bureau).

The primary economic resources in Ka'ū currently are macadamia nut farms, schools, medical services, cattle ranching, and construction. Agriculture is the region's main economic base and the Hawai'i Department of Agriculture classifies sections of land in the Wai'ōhinu, Nā'ālehu, and Pāhala area as Prime Agricultural Land. Sugarcane production dominated the economy between 1868 and 1996, when the last mill closed in Pāhala. Large tracts of plantation land were sold, and many of these lands are now owned or leased for agriculture or cattle ranching. Major crops include macadamia nuts, vegetables, citrus fruits, coffee, and ornamental flowers. There are several active cattle ranches in the region (County of Hawai'i 2005). The macadamia nut industry is one of the most prominent in the district with Mac Farms of Hawai'i in Nā'ālehu being the largest employer in the area. Residents also commute to the labor markets in Hilo, Kona, and the Kohala coast. Tourism is a growth industry in the region with its proximity to Hawai'i Volcanoes National Park (Ka'ū to South Kona Water Master Plan 2004).

The Ka'ū Listening Project, conducted in response to community concerns about large-scale resort development proposed for the area, found that residents generally believe that economic development needs to be balanced with conservation of the environment and the local community. This study also found that the subsistence economy of fishing, gathering, hunting, and gardening remains important today for many families (Kent 2007).

It is unknown how many people use the Reserve for hunting or gathering. Hunter use data is not available as there are no hunter check stations for Ka'ū Forest Reserve. There were approximately 139 licensed hunters in the Ka'ū District in 2010 out of 3,265 licensed hunters on Hawai'i island, approximately 1.6% of the population of the Ka'ū District (DOFAW internal data). However, additional residents that are not registered as licensed hunters may also be hunting in the Forest Reserve. DOFAW has no records of any permits issued for gathering of forest resources in the Reserve. It may be inconvenient for residents to obtain permits because they are issued through the DOFAW office in Hilo.

3. Regional Partnerships

The Ka'ū Forest Reserve is part of the TMA, a voluntary public-private watershed 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 the 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. TMA lands in the vicinity of Ka'ū Forest Reserve are shown in Figure 1.

TMA lands include the 116,000 ac (46,944 ha) Kahuku section of Hawai'i Volcanoes National Park, which was formerly used as a ranch and was then sold by Damon Estate to the park in 2003 (Figure 1). NPS is currently developing a General Management Plan (GMP) for the park, which will provide a framework to use in making decisions about how to protect resources, what levels and types of uses are appropriate, what facilities should be developed, and how people should access the park. Other ongoing resource management actions at Kahuku include replacing the boundary fence with Ka'ū Forest Reserve, removing feral ungulates, reforestation of pasture and non-native invasive plant control. NPS management of Kahuku provides new opportunities for cooperative management with adjacent DOFAW lands in Ka'ū (e.g. public access to the Reserve through Kahuku, recreational opportunities, fire protection, invasive species control etc).

TNC purchased the 3,511 ac (1,421 ha) Ka'ū Preserve in 2002 to protect biologically rich and intact native forest found there. TNC's Ka'ū Preserve consists of four separate sections that are adjacent to the Ka'ū Forest Reserve (Figure 1). The TNC Ka'ū Preserve is included in the state's Natural Area Partnerships Program, which provides state-matching funds on a 2:1 basis with private funds for the management of natural resources on private lands permanently dedicated to conservation. TNC has constructed a fence around a 1,200 ac (486 ha) portion of the preserve at Kaiholena and removed feral ungulates from within the fenced unit. Other management activities include: non-native invasive plant control and education and outreach. TNC has also worked to enhance public hunting in the Ka'ū Forest Reserve by coordinating access through the TNC preserve, maintaining roads and providing fence step-overs.

KS lands include two parcels of approximately 2,883 ac (1,167 ha) of conservation land (Figure 1). KS seeks to *mālama i ka 'āina*: practice ethical, prudent and culturally appropriate stewardship of lands and resources (KS 2000-2015 Strategic Plan). KS intends to integrate Hawaiian cultural values and knowledge into resource stewardship practices, incorporate ahupua'a management principles, and promote a broad understanding of stewardship efforts and, as appropriate, cultural resource management programs.

4. Related Land Use Planning Efforts

There are numerous completed and ongoing planning efforts that may have implications for the management of the Ka'ū Forest Reserve (Table 3). These include plans for adjacent conservation areas as well as plans that may identify goals, objectives and proposed actions for the management of various resources in Ka'ū Forest Reserve.

Table 3. Related Plans and Cooperative Efforts.

Plan/Cooperative Effort	Description
Ka'ū Community Development Plan (CDP) - Under Development http://www.hawaiicountycdp.info/kau-cdp	The CDP was mandated by the Hawai'i County General Plan to translate goals, objectives, and policies into implementation actions as they apply to specific geographical areas. CDP's are "intended to be a forum for community input into managing growth and coordinating the delivery of government services."
Hawai'i Volcanoes National Park General Management Plan (GMP) - Under Development (Draft scheduled to be completed in 2012-2013) http://www.nps.gov/havo/parkmgmt/gmp.htm	A GMP is the broadest level of planning for the future management of national parks. The GMP will describe the general path for managing Hawai'i Volcanoes National Park over the next 15 to 20 years. Alternatives will be developed and analyzed before a preferred direction is selected. The Draft GMP is scheduled to be finalized in 2014.
DOFAW Statewide Assessment and Resource Strategy (SWARS) 2010 http://www.hawaiistateassessment.info/SWARS/	Identifies areas of greatest need/opportunity for forests in Hawai'i and develops a long-term strategy. Objectives include: 1.1. Identify and conserve high-priority forest ecosystems; 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 forests to mitigate and adapt to global climate change.
Three Mountain Alliance (TMA) Management Plan (2008) and TMA Weed Management Plan (2009) http://hawp.org/library/documents/three-mountain-alliance/tma%20mgmt%20plan.final.2.pdf	TMA watershed partnership and TMA weed management plans identify the importance of natural resources in Ka'ū Forest Reserve and propose management activities.
TNC Ka'ū Preserve Long Range Management Plan: Fiscal Years 2006-2018 (2012) and Final Environmental Assessment http://oegc.doh.hawaii.gov/Shared%20Documents/E A and EIS Online Library/Hawaii/2000s/2006-09-23-HA-FEA-KAU-PRESERVE-NATURAL-AREA-PARTNERSHIP.pdf	This plan documents long-range goals and strategies for TNC's Ka'ū Preserve including the following activities: ungulate control, invasive plant control, resource monitoring, rare species protection and research, community outreach, and watershed partnership. TNC is currently preparing an updated plan to cover Fiscal years 2013 - 2018.
Hawai'i Comprehensive Wildlife Conservation Strategy (2005) http://www.state.hi.us/dlnr/dofaw/cwcs/index.html	Identifies species of greatest conservation need and their affiliated habitats. It includes strategies for addressing those needs and the conservation of the diversity of wildlife species. Ka'u Forest Reserve is identified as a priority area for the enhanced conservation management for the long-term conservation of native wildlife
County of Hawai'i General Plan (2005) http://www.co.hawaii.hi.us/la/gp/2005/main.html	8.2(c) Protect/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 collection/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.

D. Forest Ecosystems

1. Native Forest Communities

The Ka'ū Forest Reserve is one of the largest native forests remaining in the Hawaiian Islands. The forests of the Reserve currently consist almost entirely of native ecosystems. According to DOFAW's Draft Management Guidelines, most of the Reserve falls into highest quality native ecosystem vegetation classification, with minimal disturbance and low levels (less than 10%) of non-native plants (State of Hawai'i 2001). Also, TNC's Ecoregional Plan rates the condition of most of the Reserve as good or very good with regard to their overall ecosystem viability ranking (TNC 2006b).

Although much of the native forest upper canopy (large trees) is intact, DOFAW and TMA staff has observed serious degradation of large portions of the Reserve from feral ungulates and non-native weeds, threatening the long-term survival of high quality native forest. Upper elevation portions of the Reserve have widespread disturbance from feral ungulates resulting in a ground layer with exposed soil and leaf litter instead of native ferns, small plants and tree seedlings. These openings in the forest floor enhance erosion as soil washes away during storms. Large upper canopy trees may not be replaced as they die due to lack of regeneration of younger generations of native trees in the middle and lower forest layers. Lower portions of the Reserve have severe infestations of weeds that are spreading into the middle and upper areas of the Reserve due to openings in the forest created by feral ungulates. The long-term survival of the forest is threatened by the gradual disappearance of the native trees and plants and conversion to non-native weedy species. Management is needed to address these threats, slow the decline of this unique forest ecosystem and restore areas that have been severely impacted.

There are five major native-dominated natural communities in the Ka'ū Forest Reserve (Figure 7) (UH 2005; Jacobi 1989; Price unpublished data). The wet forest types typically receive > 75 in (1900 mm) average annual precipitation while the mesic forest types receive 50 - 75 in (1300 - 1900 mm).

- (1) Wet 'Ōhi'a Forest
- (2) Wet Koa Forest
- (3) Mesic Koa Forest
- (4) Mesic 'Ōhi'a Forest
- (5) Montane and Subalpine Shrubland and Woodland

Wet 'Ōhi'a Forest is one of the most widespread wet forest types in the Hawaiian islands and covers a large portion of the the southwest portion of the Reserve in both lowland and montane areas. This forest type is generally dominated by 'ōhi'a, with a dense hāpu'u (*Cibotium* spp.) tree fern layer. Some areas, particularly steep slopes contain more open/stunted 'ōhi'a forest with an uluhe (*Dicranopteris linearis*) understory. An 'ōhi'a-dominated forest belt with more open canopy and shrub layer of kanawao

(*Broussaisia arguta*) occurs between 5,315 ft (1,620 m) and 5,724 ft (1,740 m) (Jacobi and Price 2007). This community type contains many rare and endangered plants, birds and invertebrates.

Wet Koa Forest occurs in the center of the Reserve and extends to the northeast. 'Ōhi'a and koa (*Acacia koa*) form the canopy with subcanopy layers rich in endemic trees, shrubs, sedges, and ferns such as 'ōlapa (*Cheirodendron trigynum*), kāwa'u (*Ilex anomala*), kōlea (*Myrsine lessertiana*), pilo (*Coprosma* spp.), manono (*Hedyotis terminalis*), and ālani (*Melicope* spp.). Native ferns, shrubs, and sedges such as 'uki (*Carex alligata*) are found beneath the hāpu'u layer. This forest type has older substrates than elsewhere in the area and supports many native forest birds and invertebrates (TNC 2006b, Jacobi and Price 2007).

Mesic Koa Forest is found at the highest elevation in the northeast and into the Kapāpala Forest Reserve. This forest type has a good representation of 'ōhi'a and koa forming the canopy layer, with native trees forming the subcanopy layer. Hāpu'u tree ferns typical of wet forests are scarce or lacking. In addition, plants more characteristic of drier areas, such as manena (*Melicope hawaiiensis*), 'aiea (*Nothocestrum breviflorum*), and pūkiawe (*Styphyelia tameiameia*) may be present. Where it has not been greatly disturbed, the ground cover is dominated by native ferns, often including large laukahi (*Dryopteris wallichiana*). The groundcover in portions of this forest is dominated by non-native grasses, primarily meadow ricegrass, which is not considered a habitat modifying weed in this area. A number of rare plants, including members of *Clermontia*, *Cyanea*, *Phyllostegia*, and *Stenogyne* occur here (TNC 2006b). This community provides important habitat for forest birds as well as specialized plants and animals such as 'Alalā (TMA 2007).

Mesic 'Ōhi'a Forest occurs near the upper Reserve boundary. This community is a transitional vegetation type between wet and mesic montane habitats and drier subalpine shrublands (Hawai'i Natural Heritage Program 1995). This forest type is dominated by an 'ōhi'a canopy with native trees and shrubs in the subcanopy. Similarly to mesic koa forests described above, there is a lack of large tree ferns and a ground cover of native ferns.

Montane and Subalpine Shrubland and Woodland occurs at the upper boundary of the Reserve and into Kahuku at the drier upper elevations. This forest type is generally more open canopy with scattered, shorter stature native trees and shrubs. Native grasses such as *Deschampsia nubigena* are found in the understory. This area also contains younger lava flows with less well-developed forests.

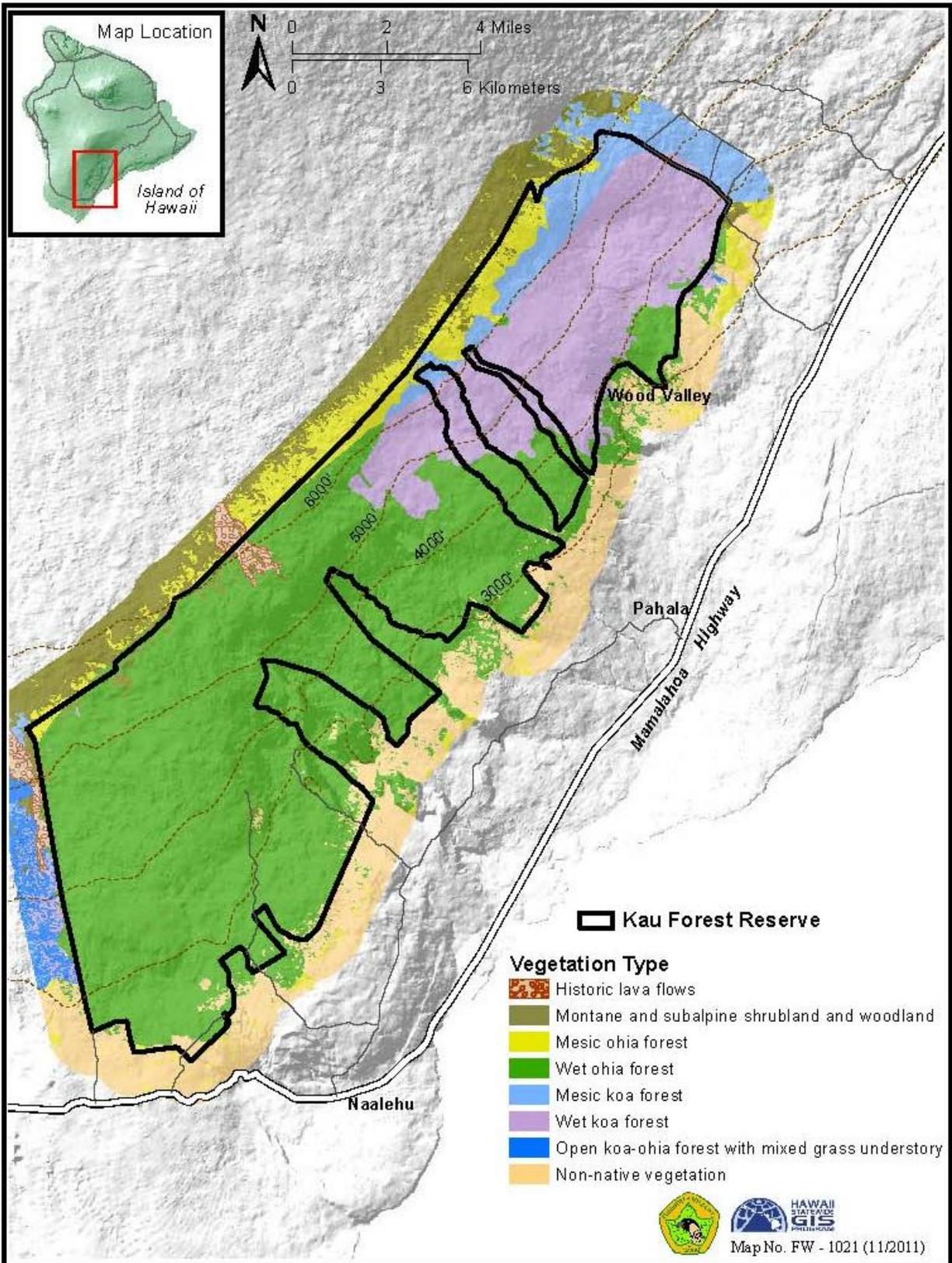
Open Koa-'Ōhi'a Forest with a Mixed Grass Understory is present adjacent to the Reserve, at Kahuku. Long-term use of these lands as pasture has resulted in open forest and with a non-native grass understory.

Non-Native Vegetation occurs just outside of the Reserve. The agricultural land along the lower boundary of the Reserve, adjacent to the forest, was cleared for sugar cane

production and is now mainly used for pasture. Serious infestations of habitat-modifying invasive weeds including strawberry guava (*Psidium cattleianum*), Koster's curse (*Clidemia hirta*) and night-blooming jasmine (*Cestrum nocturnum*) occur along the lower forest edge and into some sections of the lower Reserve.

In addition to the communities described above, intermittent streams provide habitat for aquatic insects and other stream-associated organisms. Lava tubes and caves are associated with pāhoehoe lava flows and most likely contain subterranean invertebrate communities, especially in forested portions of the area (Hawai'i Natural Heritage Program 1995).

Figure 7. Vegetation Communities of Ka'ū Forest Reserve



2. Native Flora

The mesic and wet forest ecosystems in the southeast portion of Mauna Loa (eastern side of the Southwest Rift Zone) support 153 endemic plant species and provide habitat for at least 32 known species of rare plants (Table 5). These species are known currently or historically from the Reserve or adjacent areas. Fourteen of these are listed as endangered by the U.S. Fish and Wildlife Service.

The U.S. Endangered Species Act defines Critical Habitat as areas that may or may not be occupied by a threatened or endangered species, but are essential to the conservation of the species. These areas may require special management considerations or protection (16 U.S.C. § 1532 (5)). The Reserve is Critical Habitat for three species of Hawaiian plants: *Phyllostegia velutina*, *Cyanea stictophylla*, and *Melicope zahlbruckneri* (U.S. Fish and Wildlife 2003) (Table 5, Figure 8).

Table 5. Rare Plants found in or near Ka'ū Forest Reserve

Species	Common Name	Federal Status*	Critical Habitat
<i>Argyroxiphum kauense</i>	Mauna Loa silversword	LE	
<i>Asplenium peruvianum</i> var <i>insulare</i>		LE	
<i>Asplenium schizophyllum</i>		-	
<i>Clermontia lindseyana</i>	'oha wai	LE	
<i>Cyrtandra menziesii</i>		SOC	
<i>Cyanea platyphylla</i>	'āku'āku	LE	
<i>Cyanea shipmanii</i>	hāhā	LE	
<i>Cyanea stictophylla</i>	hāhā	LE	X
<i>Cyanea tritomantha</i>		C	
<i>Eurya sandwicensis</i>		SOC	
<i>Fragaria chiloensis</i>	'ōhelo papa	SOC	
<i>Lobelia hypoleuca</i>		-	
<i>Marattia douglasii</i>	pala, kapua'ilio	-	
<i>Melicope zahlbruckneri</i>		LE	X
<i>Neraudia ovata</i>		LE	
<i>Nothocestrum breviflorum</i>		LE	
<i>Pittosporum hawaiiense</i>		SOC	
<i>Phyllostegia ambigua</i>		SOC	
<i>Phyllostegia floribunda</i>		C	
<i>Phyllostegia velutina</i>		LE	X
<i>Phyllostegia vestita</i>		-	
<i>Plantago hawaiiensis</i>		LE	
<i>Pritchardia lanigera</i>	loulu	SOC	
<i>Ranunculus hawaiiensis</i>	makou	C	
<i>Rubus macraei</i>		SOC	
<i>Sanicula sandwicensis</i>		SOC	

<i>Silene hawaiiensis</i>		LE	
<i>Sisyrinchium acre</i>	mau'u lā'ili	SOC	
<i>Stenogyne angustifolia</i>		LE	
<i>Strongylodon ruber</i>	nuku 'i'iwi	SOC	
<i>Trematolobelia wimmeri</i>	koli'i	SOC	
<i>Vicia menziesii</i>		LE	

* Key to Federal Status:

Listed Endangered (LE) = Taxa listed as endangered.

Candidate (C) = Taxa for which substantial information on biological vulnerability and threat(s) support proposals to list them as threatened or endangered.

Species of Concern (SOC) = Taxa for which available information meets the criteria for concern and the possibility to recommend as candidate.

E. Wildlife

Ka'ū Forest Reserve contains a variety of wildlife resources including both endemic species of birds and invertebrates as well as the 'Ōpe'ape'a, or the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). Non-native species include birds, mammals and invertebrates.

The Hawai'i Comprehensive Wildlife Conservation Strategy identifies the Reserve as a priority area for management for the long-term conservation of native wildlife on the island of Hawai'i. The area is a priority because it is one of the most diverse and intact forests on the island with high densities of common and rare forest birds and great potential habitat for restoration of some endangered forest bird populations. Lower portions of the Reserve harbor a diverse native insect fauna. As part of a broader landscape that includes Kapāpala Forest Reserve and Hawai'i Volcanoes National Park, the Reserve provides a range of elevations and rainfall that would allow wildlife populations to move in response to changing climate or weather conditions (Mitchell *et al.* 2005). Ka'ū Forest Reserve has also been identified as an important bird area by the National Audubon Society (National Audubon Society 2011).

1. Native Wildlife

Birds

The Ka'ū Forest Reserve is very important for the survival and recovery of native Hawaiian forest birds because it contains large tracts of upper elevation native forest. The Reserve provides habitat for eight native forest birds including five of the six birds that are endemic to Hawai'i Island, four of which are federally endangered. An additional five endemic or indigenous species likely use small areas of the Reserve (Table 6). In addition to supporting a diverse avifauna, the area provides habitat for the second largest concentration of native birds on Hawai'i Island and some of the highest densities in the State (Gorresen *et al.* 2007).

Populations of native Hawaiian forest birds in the Reserve and across the state have declined due to habitat loss and the ecological impacts of introduced species (threats are discussed in more detail in Section J. of this plan). Of the 46 historically known

forest bird species in Hawai'i, only 24 species still survive, and of these 13 species are listed as endangered. Ten species of endemic Hawaiian birds have likely gone extinct over the past 25 years - an average of one extinction every two years (Pratt *et al.* 2009).

The Reserve provides habitat for six honeycreepers (Subfamily Drepanidinae) endemic to the Hawaiian Islands (occur nowhere else in the world). These include three federally listed endangered species: 'Akiapōlā'au (*Hemignathus munroi*), Hawai'i Creeper (*Oreomystis mana*), and Hawai'i 'Ākepa (*Loxops coccineus*). The non-endangered honeycreepers found in the area include: Hawai'i 'Amakihi (*Hemignathus virens*), 'I'iwi (*Vestiaria coccinea*) and 'Apapane (*Himatione sanguinea*). Other native birds reported from the project area include the federally endangered 'Io or Hawaiian Hawk (*Buteo solitarius*), the Hawai'i 'Elepaio (*Chasiempis sandwichensis*), and the 'Ōma'o or Hawaiian thrush (*Myadestes obscurus*).

Native forest birds are primarily found in the upper elevations (above 4,000 ft (1,219 m)) where colder temperatures minimize the number of mosquitoes and limit avian malaria, a non-native disease carried by mosquitoes. The distributions of 'Akiapōlā'au, Hawai'i Creeper, and Hawai'i 'Ākepa within the Reserve are even more narrowly restricted to a narrow band of forest and adjacent woodland above 5,000 ft (1,524 m) (Figures 8-10). These species have been extirpated from habitat below this elevation at least since 1976 due to the prevalence of mosquito-borne avian malaria (Scott *et al.* 1986). Figures 8 - 10 show the observed density (bird counts are the number of individuals detected along monitoring transects) and ranges of these endangered species in Ka'ū Forest Reserve. Lower elevations are not generally habitat for endangered forest birds on Hawai'i Island due to the presence of mosquitoes but may be important for native forest birds that have developed resistance to avian malaria (Pratt *et al.* 2009).

The Akiapōlā'au, the rarest of the honeycreepers in the Reserve, forage preferentially on koa, but nest almost exclusively in 'ōhi'a. This species is concentrated in the northeastern portion of the Reserve, which supports a large percentage (approximately 56%) of the species' total population (Tweed *et al.* 2007, Table 7). Hawai'i Creeper and Hawai'i 'Ākepa densities are highest in mature 'ōhi'a and koa-'ōhi'a forests in the upper central portion of the Reserve and these two species have a larger distribution and population compared to the Akiapōlā'au. Populations of these three species in the Reserve are separated from other populations on Hawai'i Island. The 'Io, 'Ōma'o, and the other three honeycreeper species are broadly distributed across the Reserve, although the 'I'iwi is restricted to habitats mostly above 5,000 ft (1,524 m) in elevation.

The endemic Nēnē or Hawaiian Goose (*Branta sandvicensis*), 'Ua'u or Hawaiian Petrel (*Pterodroma sandwichensis*) as well as the indigenous 'Akē'akē or Band-Rumped Storm-Petrel (*Oceanodroma castro*), Kōlea or Pacific Golden Plover (*Pluvialis fulva*) and Pueo or Short-eared Owl (*Asio flammeus sandwichensis*) may use small portions of the Reserve; the importance of the Reserve to these species is unknown or low.

Finally, in recent years (1970's) the Ka'ū Forest Reserve also supported the 'Alalā or Hawaiian Crow (*Corvus hawaiiensis*). The 'Alalā is listed as endangered and the

species is extinct in the wild. The entire population, approximately 95 birds, is housed in two captive breeding facilities, making the 'Alalā one of the rarest birds in existence. Known from the island of Hawai'i (and from fossils on the island of Maui), the 'Alalā was restricted to the dry and mesic forests in the western and southern portions of the island. The species was associated with 'ōhi'a and 'ōhi'a-koa forests with an understory of native fruit-bearing trees and shrubs. This understory is essential to the survival the 'Alalā in the wild, providing food as well as cover from natural predators such as 'Io. Threats to wild 'Alalā include predation by non-native mammals, non-native diseases (avian malaria and toxoplasmosis), habitat degradation, fragmentation, and loss, and direct human impacts (e.g. shooting and harassment).

Although they are insulated from these threats in captivity, their small population size makes them vulnerable to inbreeding problems, which has resulted in genetic-related egg and chick death as well as to demographic problems (e.g. uneven sex ratio). Recently, this problem has been minimized and production of young in captivity has dramatically increased during the last three years. In addition, unpredictable environmental events such as hurricanes, droughts and volcanic activity will further complicate the restoration of this species to the wild. All of these threats will challenge the species for many years post-release.

The current captive population of 'Alalā is at the point where restoration of a wild population can proceed. Several potential release sites have been identified in the Ka'ū Forest Reserve and elsewhere. The Reserve is a high priority site to restore this wide ranging species to the wild due to the large size and elevational range of the forest, as well as the fact that the area recently supported 'Alalā. The restoration of a wild population of 'Alalā will require minimizing threats, including predator control, and protecting significant areas of forest protected from ungulates. In addition to the restoring 'Alalā, these efforts will benefit the watershed resources of the Reserve as well as native plants, invertebrates, and other birds. Restoring the 'Alalā to the wild will require human assistance, including providing supplemental food, a semi-permanent infrastructure and a constant, long-term human presence. Planning for initial releases is underway, although, the Reserve may not be the first release site.

Table 6. Native Birds with Habitat in Ka'ū Forest Reserve.

Species	Scientific Name	Island Distribution	Federal Status*	State Status*
Nēnē or Hawaiian Goose	<i>Branta sandvicensis</i>	H, K, M, Mo	LE	LE
'Ua'u or Hawaiian Petrel	<i>Pterodroma sandwichensis</i>	H, L, K, M	T	LE
`Akē`akē or Band-rumped Storm Petrel	<i>Oceanodroma castro</i>	H, K	C	LE
Kōlea or Pacific Golden Plover	<i>Pluvialis fulva</i>	Throughout Hawai'i	MBTA	Indigenous
'Io or Hawaiian Hawk	<i>Buteo solitarius</i>	H	LE	LE
Pueo or Hawaiian Short-eared Owl	<i>Asio flammeus sandwichensis</i>	Throughout Hawai'i	MBTA	Endemic

DRAFT Ka'ū Forest Reserve Management Plan - May 2012

Ālalā or Hawaiian Crow	<i>Corvus hawaiiensis</i>	Captivity	LE	LE
Hawai'i 'Elepaio	<i>Chasiempis sandwichensis</i>	H	-	Endemic
'Ōma'o	<i>Myadestes obscurus</i>	H	MBTA	Endemic
Hawai'i 'Amakihi	<i>Hemignathus virens</i>	H, M, Mo	MBTA	Endemic
'Akiapōlā'au	<i>Hemignathus munroi</i>	H	LE	LE
Hawai'i Creeper	<i>Oreomystis mana</i>	H	LE	LE
Hawai'i 'Ākepa	<i>Loxops coccineus</i>	H	LE	LE
'I'iwi	<i>Vestiaria coccinea</i>	H, K, O, M, Mo	MBTA	Endemic
'Apapane	<i>Himatione sanguinea</i>	Throughout Hawai'i	MBTA**	Endemic

* Key to Federal and State Status:

Listed Endangered (LE) = Taxa listed as endangered.

Threatened (T) - Taxa listed as threatened

Candidate (C) = Taxa for which substantial information on biological vulnerability and threat(s) support proposals to list them as threatened or endangered.

Migratory Bird Treaty Act (MBTA) = It is illegal to harass or kill birds listed under the MBTA

Endemic and Indigenous species are protected under Hawai'i Revised Statutes 183D and 195D

** USFWS is reviewing the status of this species and will decide within a year whether it should be LE.

Table 7. Estimated Population Status of Endangered Forest Birds in Ka'ū Forest Reserve (Gorresen *et al.* 2007)

Species	Total Population	Ka'ū Population
Ālalā	~95	0
'Akiapōlā'au	1,900	1,073 (616 - 1,869)
Hawai'i Creeper	14,000	2,268 (1,159 - 4,438)
Hawai'i 'Ākepa	12,000	2,556 (1,340 - 4,876)

Figure 8. Hawai'i 'Ākepa - Observed Density in Ka'ū Forest Reserve

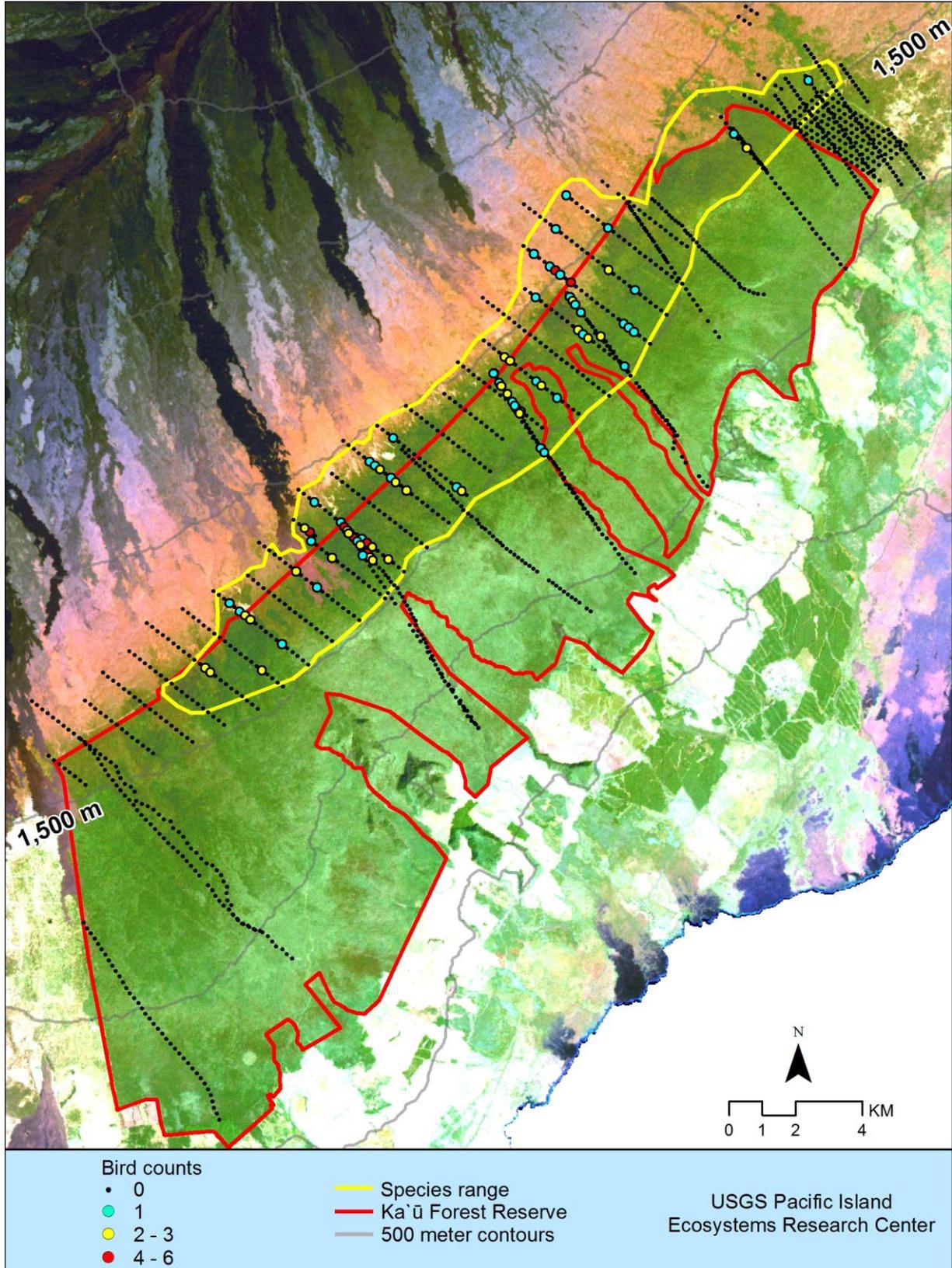


Figure 9. Hawai'i Creeper - Observed Density in Ka'ū Forest Reserve

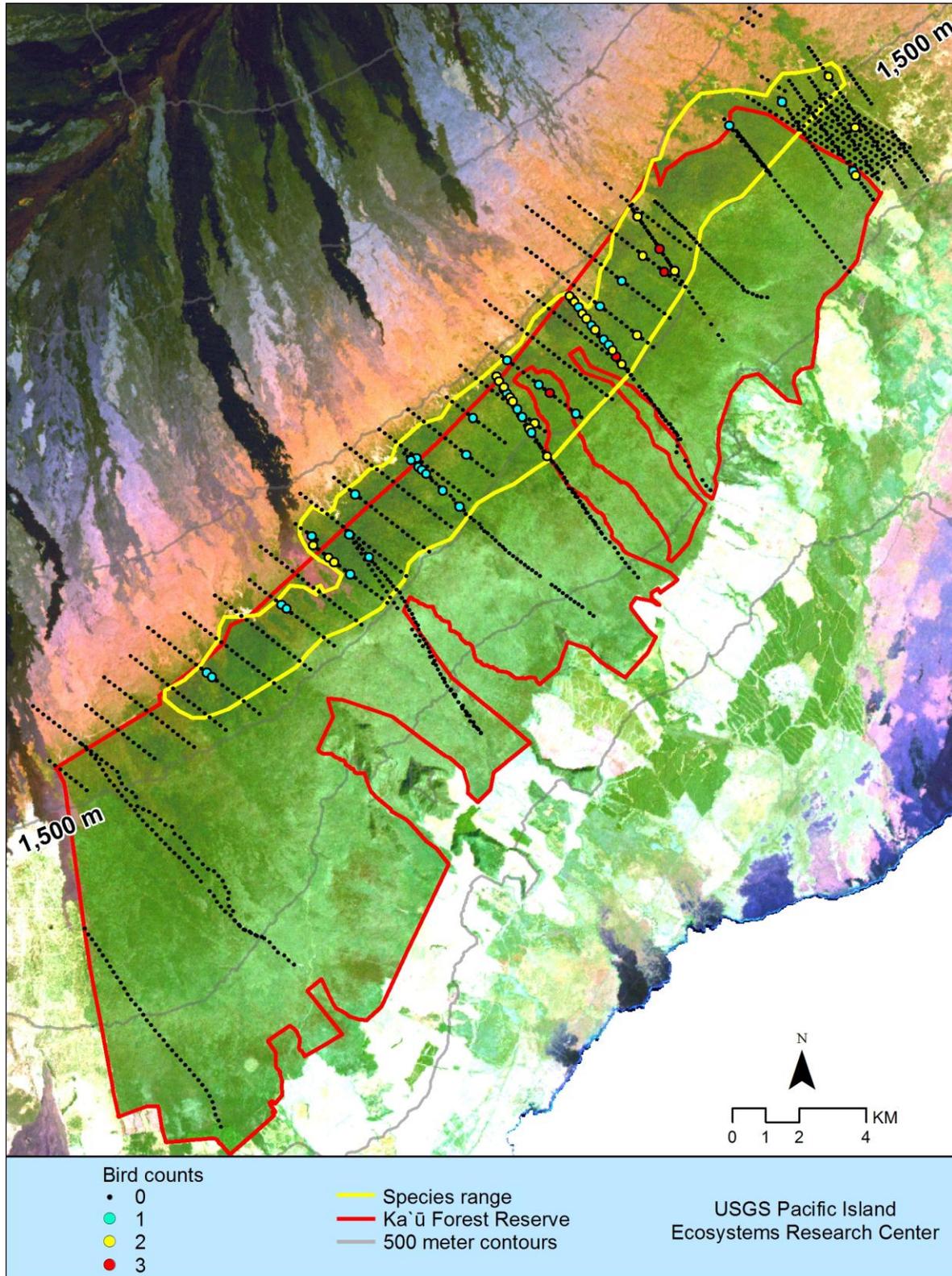


Figure 10. 'Akiapōlā'au - Observed Density in Ka'ū Forest Reserve

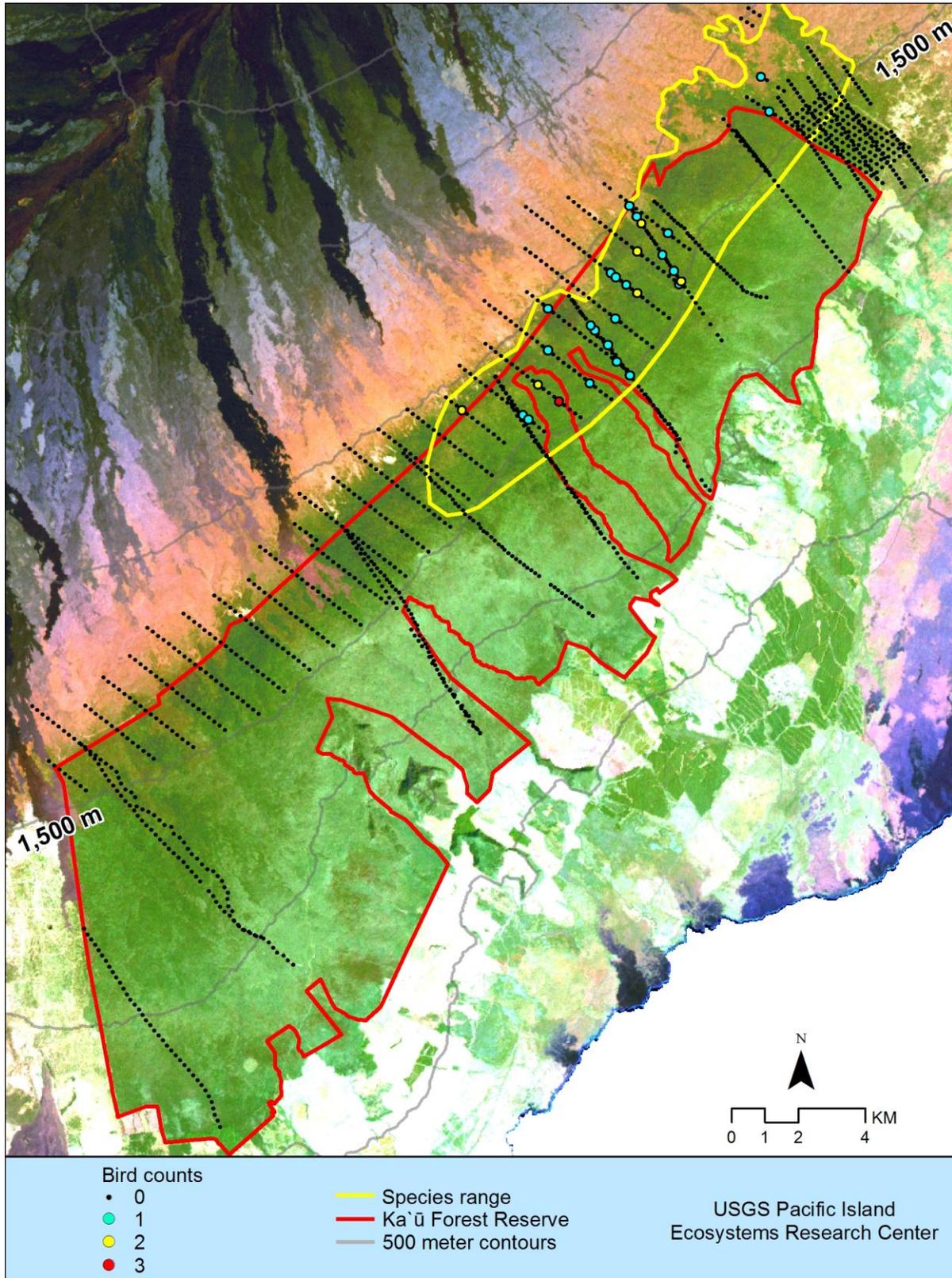
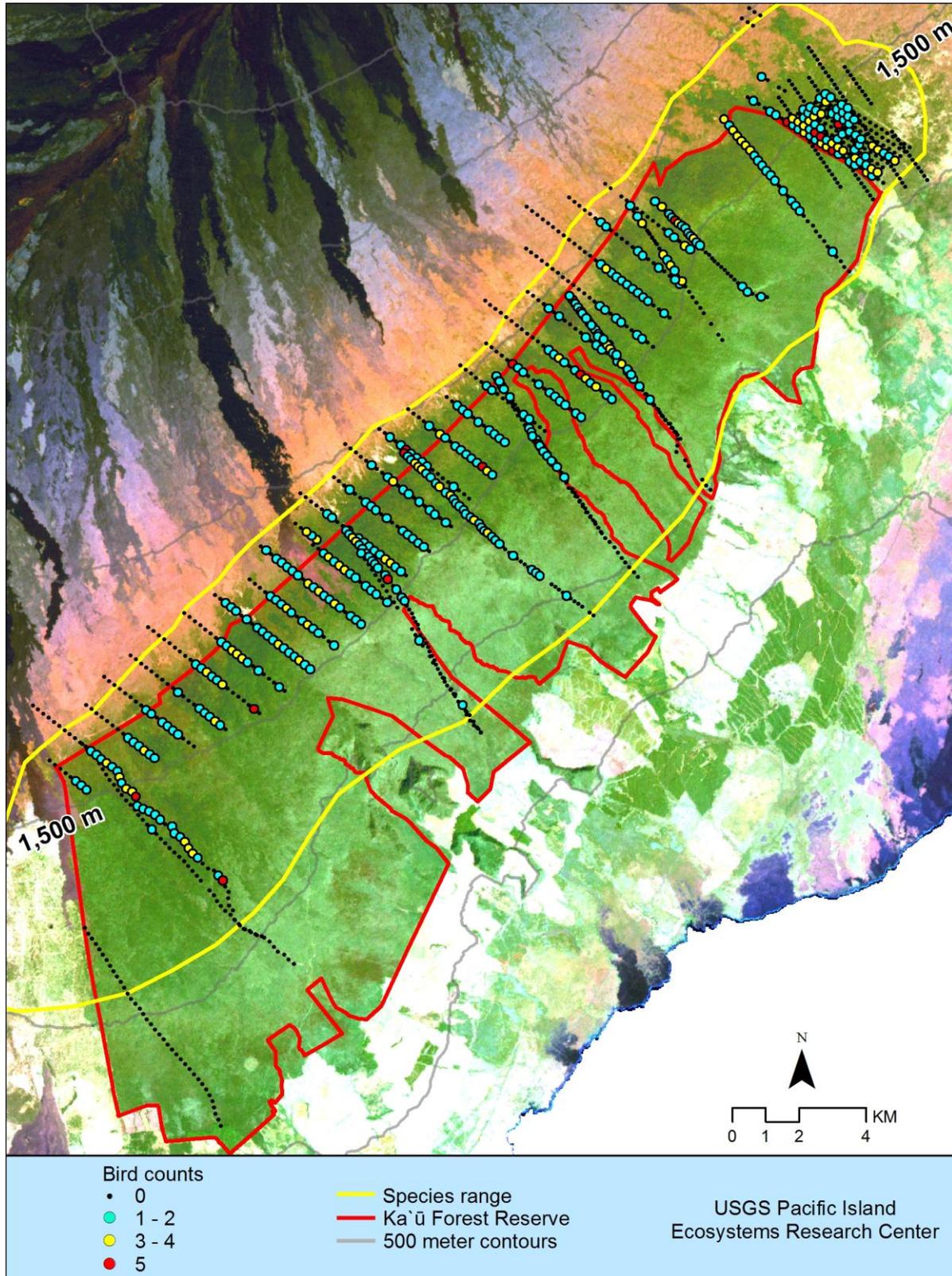


Figure 11. 'I'iwi - Observed Density in Ka'ū Forest Reserve



Mammals

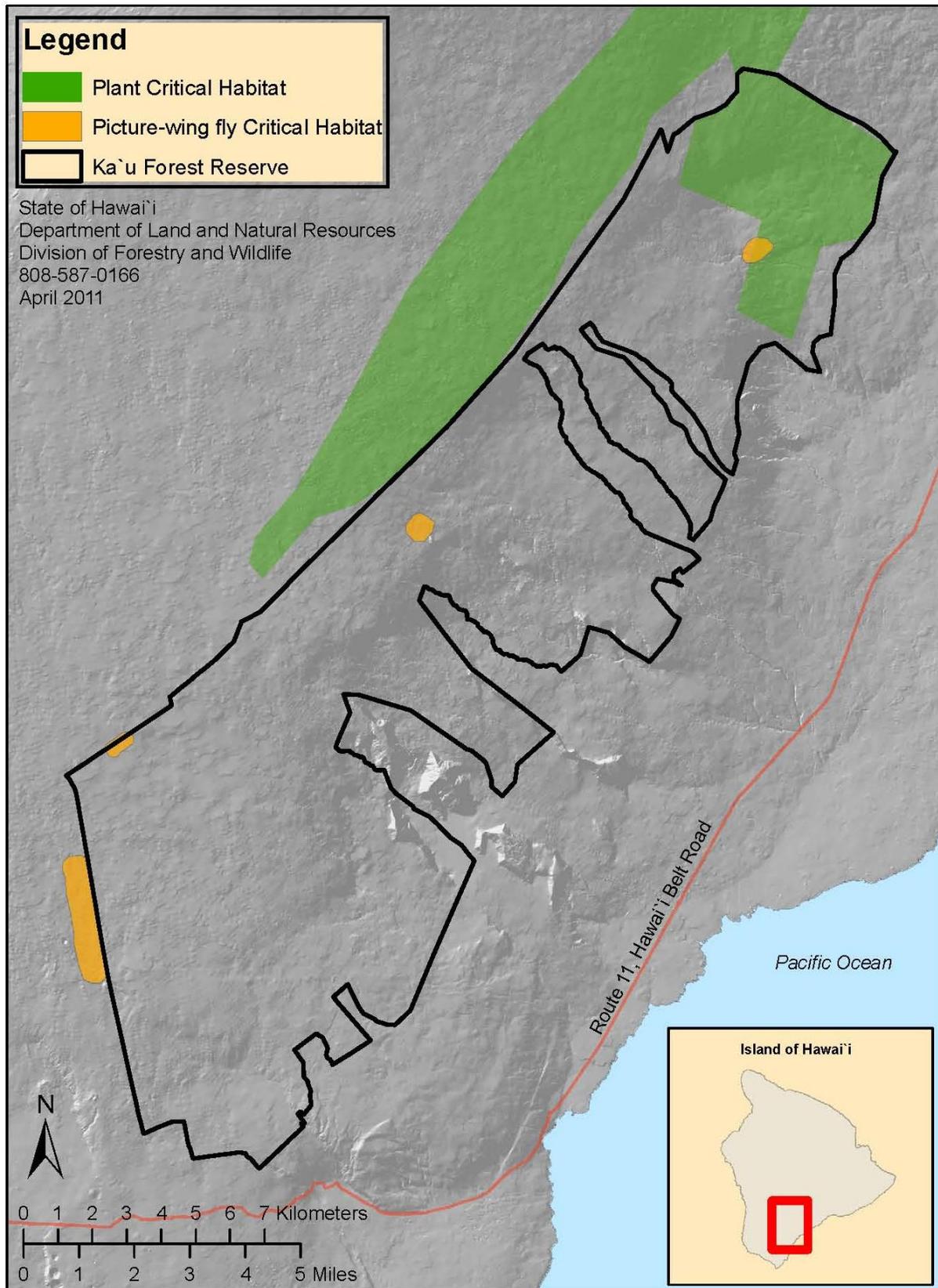
The 'Ōpe'ape'a, or the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), is the only endemic terrestrial mammal in Hawai'i (Hawai'i Natural Heritage Program 1995). The 'Ōpe'ape'a is listed as endangered under the U.S. Endangered Species Act. Recent surveys of TNC lands below the Reserve at Kaiholena and on NPS lands at Kahuku have noted the presence of the 'Ōpe'ape'a, and it is presumed that the species also uses the Reserve, as they use similar forested areas at that elevation across the island.

Invertebrates

Ka'ū Forest Reserve contains 245 ac (99 ha) of designated critical habitat in two separate areas for one endangered species of Picture Wing Fly (*Drosophila heteroneura*) (U.S. Fish and Wildlife 2008) (Figure 8). Habitat for this species is in wet, montane, 'ōhia and 'ōhia/koa forest and larval stage host plants include 'ōlapa, and *Clermontia* sp. (U.S. Fish and Wildlife Service 2006b). The Hawaiian Picture-Wing Fly group consists of 106 known species, most of which are relatively large with elaborate markings on their wings. The picture-wing *Drosophila* have been referred to as the "birds of paradise" of the insect world because of their relatively large size, colorful wing patterns, elaborate courtship displays and territorial defense behaviors. Each species is found only on a single island, and the larvae of each are dependent upon only a single or a few related species of native host plants.

Ka'ū Forest Reserve also contains habitat for three endemic species of Pinao or Hawaiian Damselfly: *Megalagrion blackburni*, *Megalagrion calliphya* and *Megalagrion xanthomelas*. *Megalagrion xanthomelas* is a candidate for listing as an endangered species and is known from Hīlea gulch (Parham *et al.* 2008).

Figure 12. Ka'ū Forest Reserve Critical Habitat



2. Non-Native Wildlife

Birds

A large variety of introduced birds inhabit the Ka'ū Forest Reserve. The most common species include the Japanese White-eye (*Zosterops japonicus*), Northern Cardinal (*Cardinalis cardinalis*), and Red-billed Leiothrix (*Leiothrix lutea*). The densities of these species appear stable and relatively low in the upper elevations. Japanese White-eye was the most abundant non-native species recorded in Ka'ū and occurs in forest and open habitat. Red-billed Leiothrix were widespread throughout the Reserve and most abundant at lower elevations (Gorreson *et al.* 2007).

Other species present in Ka'ū include the Japanese Bush-Warbler (*Cettia diaphone*), Hwamei (*Garrulax canorus*), Common Myna (*Acridotheres tristis*), House Finch (*Carpodacus mexicanus*), Erckel's Francolin (*Francolinus erckelii*), Kalij Pheasant (*Lophura leucomelanos*), Spotted Dove (*Streptopelia chinensis*), and Barn Owl (*Tyto alba*). Bush-Warblers are rapidly expanding their range on Hawai'i Island and are expected to be a common species on the island in the future (Tweed *et al.* 2007). Other species present along the open, grassy patches at the edge of the Reserve and in adjacent areas (Kahuku and Kāpapala) include Yellow-fronted Canary (*Serinus mozambicus*), Saffron Finch (*Sicalis flaveola*), Japanese Quail (*Coturnix japonica*), Chukar (*Alectoris chukar*), Zebra Dove (*Geopelia striata*), Wild Turkey (*Meleagris gallopavo*), and (Eurasian) Sky Lark (*Alauda arvensis*)

Mammals

A variety of non-native mammals such as feral pigs (*Sus scrofa*), feral cattle (*Bos taurus*), mouflon sheep (*Ovis musimon*), feral sheep-mouflon hybrids (*Ovis aries-Ovis musimon*), rats (*Rattus spp.*), mice (*Mus musculus*), cats (*Felis catus*), and small Indian mongoose (*Herpestes auropunctatus*) are present in the Reserve. Other ungulates including sheep (*Ovis aries*), feral goats (*Capra hircus*) and Axis deer (*Axis axis*) are not known from the Reserve, but may be present in adjoining areas.

F. Cultural Resources

DOFAW contracted Keala Pono Archaeological Consulting to prepare a comprehensive Cultural Impact Assessment for the project. This Assessment includes information on archaeological and historic sites as well as traditional and cultural practices. The Assessment consisted of archival research as well as community consultation with knowledgeable parties recognized as having a cultural, historical, genealogical, or managerial connection to the project area in Ka'ū. Sources included historic maps and photos, accounts from early visitors, Hawaiian language newspaper articles, mele, oli, 'ōlelo no'eau, collections of mo'olelo, and archaeological reports obtained from individuals and institutions across the State of Hawai'i and ethnographic surveys consisting of oral history interviews.

1. Archaeological and Historical Sites

Archaeological and historic sites are protected by state law and will not be impacted by management actions proposed in this plan.

Most of this dense forest area has not been surveyed for 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.

Other historical sites include ranching era walls along the Reserve boundary, tunnels and infrastructure from old water systems and historic trails.

The Ainapo Trail, a historic trail nominated to the National Register of Historic places, is located in Kapāpala, adjacent to Ka'ū Forest Reserve. This trail is currently used by the public to access the eastern side of the Reserve as well as used as a route up Mauna Loa. This trail was used by ancient Hawaiians as well as foreigners (beginning from as early as 1790). An undeveloped historic trail, the Kahuku- Ainapo Trail, connects to the Ainapo trail. This historic trail is primarily above the Reserve in the Kahuku section of Hawai'i Volcanoes National Park; however portions of the trail are within the Reserve. Old maps also show a trail from Mountain House to Kahuku as well as numerous trails from the bottom of the Reserve boundary leading to tunnel systems within the Reserve.

2. Cultural Practices

The Reserve's native Hawaiian ecosystems and species are an essential part of the overall cultural-historical landscape. Today, both traditional and more contemporary cultural practices continue to be perpetuated within the Reserve. Notably, the Reserve is used for gathering plants, such as maile, māmaki, palapalai, 'a'ali'i, and'olonā. Wai is also collected from springs up mauka, which is used for ceremonial purposes. Additionally, hunters continue to use this area as a means of subsistence. The Cultural Impact Assessment discusses consulted individuals' knowledge and opinions regarding places that have special associations and resources that have ongoing cultural uses.

G. Public Access and Recreation

Public access is allowed in the Reserve for recreational and cultural uses, including hunting, hiking and gathering of plant material (with a permit).

Vehicular Access: Access to Ka'ū Forest Reserve is via public roads including Lorenzo Rd, Kiolaka'a Rd, Mountain House Rd., Waterfall Rd. (known as Galimba access at Pu'u One), Honanui Rd. and Ainapo Rd. Ainapo and Honanui roads have locked gates and permission for access is through Kāpapala Ranch (call 982-8403 for combination for lock on gate between the hours of 7:30 and 8:30 p.m. Check-in is at 6:00 a.m. and check-out is at 6:00 p.m.

Trails: There are no officially designated state-managed trails in Ka'ū Forest Reserve.

Hunting: DOFAW manages public hunting on all Forest Reserve System lands, and hunting is allowed in Ka'ū Forest Reserve, which lies within Hunting Unit B. DLNR's Division of Conservation and Resource Enforcement (DOCARE) carries out enforcement of hunting regulations (Chapter 122 Rules Regulating Game Bird Hunting, and Chapter 123 Rules Regulating Game Mammal Hunting). General hunting regulations can be found in Hawai'i Revised Statutes Title 13 Chapter 121. Current information regarding hunting rules, seasons and bag limits for all game species can be obtained by contacting the DOFAW Hilo office at 19 East Kawili Ave. Hilo, Hawai'i, (808) 974-4221.

All persons are required to have a valid Hawai'i hunting license on their person to hunt or have a bagged game mammal in their possession. Hunting licenses may be purchased online from <http://www.ehawaii.gov/DLNR/hunting/>, from any DOFAW office or from any registered hunting license vendor. All hunting license applicants must show proof of having successfully completed a hunter education course that is recognized by the National Hunter Education Association.

Camping: No camping is currently allowed in the Ka'ū Forest Reserve.

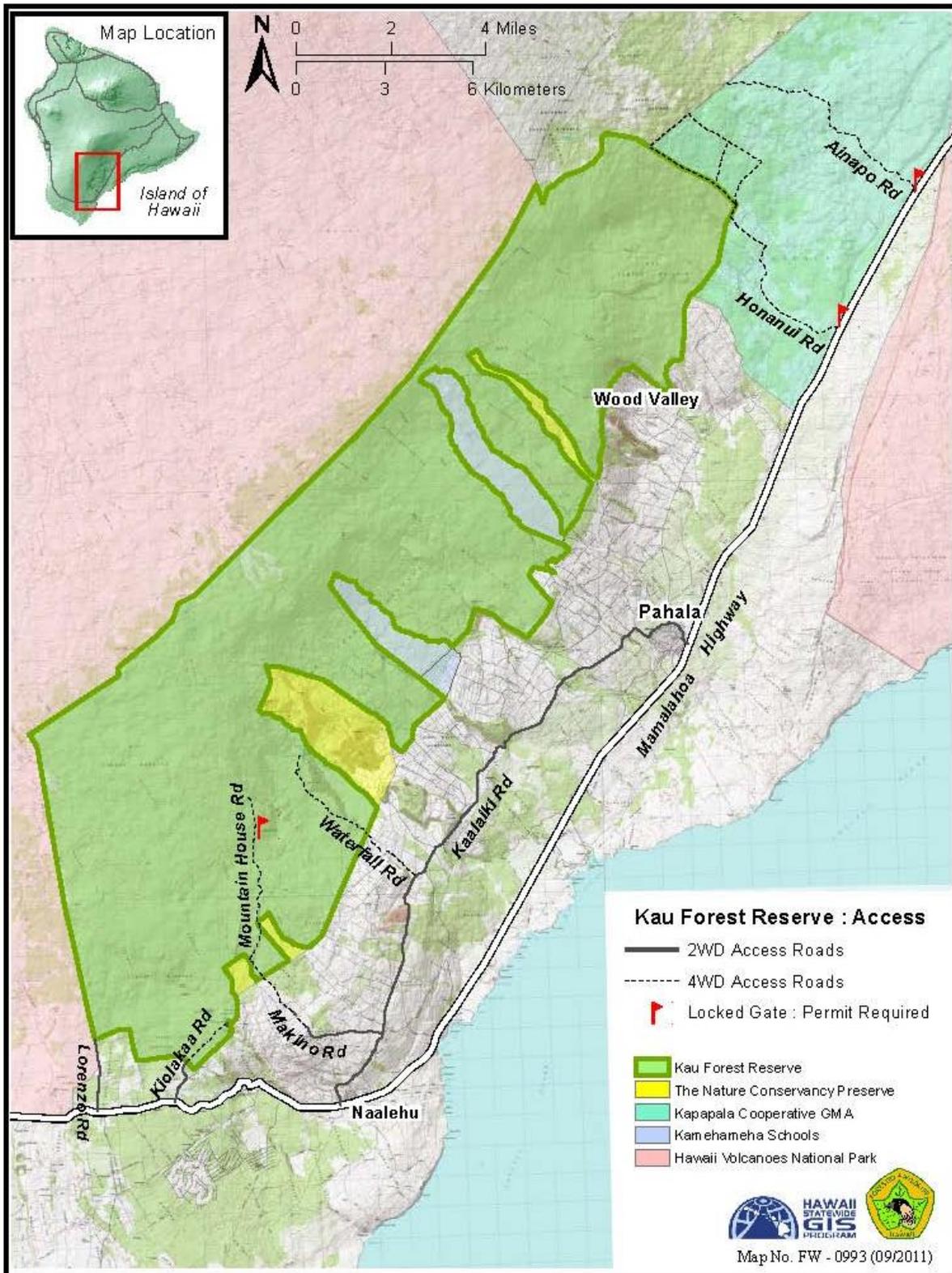
Forest Products: Small-scale non-commercial harvesting or salvage is allowed, such as materials for cultural uses. Non-timber forest products such as ferns, maile (*Alyxia oliviformis*), flowers, fruits, and lei-making materials etc for cultural or personal use may be collected from within the Reserve. Gathering of forest products is permitted and regulated by DOFAW through Forest Reserve System permit procedures. Permit applications for gathering plant material can be obtained from the DOFAW Hilo office at 19 East Kawili Ave. Hilo, Hawai'i, (808) 974-4221. These permits are available, upon approval, free of charge (for common, personal use items) or for a fee, depending on the purpose. Gathering of materials from listed species is not permitted.

H. Infrastructure

Infrastructure within the Reserve consists of unimproved trails and four wheel-drive roads. No recreational facilities (e.g. bathrooms, freshwater sources, improved campsites) exist within the Reserve.

The Reserve contains water system infrastructure including 30 water tunnels.

Figure 13. Ka'ū Forest Reserve Public Access



I. Revenue

According to HRS §183.5 (5), the department shall: Devise and carry into operation, ways and means by which forests and forest reserves can, with due regard to the main objectives of title 12, be made self-supporting on whole or in part.

There is not currently any revenue collected for DOFAW from the Ka'ū Forest Reserve.

J. Threats

The major threats to the Reserve integrity in this area include introduced plants, animals, diseases, climate change and volcanic activity (vog).

1. Ungulates

Ungulates are hoofed animals such as pigs, sheep, goats and cattle. The primary ungulates of concern in the Reserve are feral (wild) pigs, feral cattle and mouflon sheep. Feral ungulates are a threat to native ecosystems, species and watershed because they eat and trample native plants and cause increased erosion and soil runoff. Hawaiian plants evolved without such animals and have no defenses to protect themselves from browsing animals (e.g. thorns and chemicals). Feral ungulates are one source of watershed pollutants, (i.e. animal waste) and increase turbidity in streams due to soil erosion.

Feral cattle are one of the greatest threats to forests in Hawai'i. Small populations of feral cattle are currently located in the upper, northeastern portion of Ka'ū Forest Reserve. Grazing and trampling by feral cattle is extremely destructive to native forest, and removing cattle has been a management focus (through fencing and/or cattle control) since the Reserve was originally established in 1906.

Pigs were originally brought to Hawai'i with the first Polynesian settlers as a domesticated species (Tomich 1986). After the arrival of Captain Cook, the larger European wild boar was intentionally introduced and quickly became feral. Feral pigs in Hawai'i today are generally smaller in size to their mainland cousins as a result of over 200 years of interbreeding between the smaller Polynesian pig and the larger European boar (Tomich 1986).

Feral pigs are present throughout the Reserve. Pigs pose a significant threat to native biodiversity and watershed integrity of Hawaiian forests by damaging native vegetation and exposing soil to erosion (Stone 1985). In montane wet forests, there is a direct correlation between pig-induced soil disturbance and the increase of weeds (Aplet et al. 1991). In addition, feral pigs have been shown to spread root-rot fungi (Baker 1979), create muddy areas that provide mosquito breeding habitat that helps transmit avian diseases spread such as avian pox and malaria (Baker 1979, USGS 2005; USGS 2006c), eat native plants (Cooray and Mueller-Dombois 1981), and carry parasites and diseases transmittable to humans and dogs, such as leptospirosis (Warner 1959 –

1969) and tuberculosis (Giffin 1978). Decades of feral pig control in Hawai'i verify that the only successful method currently available to adequately protect an area from feral pigs is to use physical barriers such as fencing to exclude the animals (Stone 1985).

Mouflon sheep were introduced to Kahuku in 1968 and by 2008 the Kahuku population was estimated at approximately 1,500 individuals (Hess et al. 2006; Hess, personal communication). Mouflon are primarily present in the Kahuku section of Hawai'i Volcanoes National Park, Kapāpala Forest Reserve and the Kapāpala Cooperative Game Management Area, but their range has been expanding and mouflon have been documented throughout the Reserve.

Axis deer, a species introduced to Hawai'i from India, have recently been observed below the Ka'ū Forest Reserve. This species is not yet established on the island of Hawai'i and it is unknown how and when these deer were introduced to the Ka'ū area. Axis deer are established on Maui, where they cause major damage to native forest, agricultural crops and resort areas. They also pose a human health and safety concern due to vehicle collisions (Anderson 1999).

2. Invasive Non-Native Plant Species

Invasive non-native plants, or weeds, constitute a severe threat to the native ecosystems in the Reserve. Certain weeds are a problem 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 a diverse native forest plants to a monoculture of alien species, and encourage fire by increasing fuels. Invasive weeds can displace distinctive native flora, resulting in a loss of species diversity and eventually in changes to ecosystem function such as nutrient cycling. Many invasive weeds completely replace native vegetation resulting in total loss of native habitats thereby negatively affecting native birds and invertebrates (Cuddihy and Stone 1990; Vitousek 1992). In addition, forests that have been severely invaded by weeds such as strawberry guava show increased evaporation of water to the atmosphere, which reduces water available for human use (Giambelluca, unpublished research).

Invasive weeds with great potential for spreading and causing habitat modification are identified in this plan as high priority for control. 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) (Table 8).

Only a small portion of the Reserve has had systematic surveys for weeds. In general, the upper elevations and interior portions do not appear to be heavily infested with weeds. However, there are some localized areas, particularly in the lower elevations, that are heavily infested with high priority weeds and these are spreading into the interior portions of the forest.

Currently known locations for priority weeds include glory bush at Mountain House Road, strawberry guava on the southwest end of the Reserve, isolated patches of cat's claw and palm grass at Mauna Kea Springs Pipeline Road, cane tibouchina at Waterfall Road, and kahili ginger along the lower forest edge. The lower elevation forest edge, which is adjacent to lands originally cleared for sugarcane plantations and now are mainly used for pasture and cattle grazing, contains abundant priority weeds, particularly strawberry guava. Night-blooming jasmine is present along the forest edge on the east side of Pu'u Enuhe, and dominates the understory of the eastern portion of the forest, northeast of Wood Valley, and it is spreading. DOFAW staff have collected incidental location points of night-blooming jasmine at the far eastern extent of this population. *Bocconia* has been spreading into the Reserve from eucalyptus plantations in the Wood Valley area.

Table 8. High priority invasive weeds present in Ka'ū Forest Reserve

Species	Common Name
<i>Bocconia frutescens</i>	bocconia, plume poppy
<i>Caesalpinia decapetala</i>	cat's claw
<i>Cestrum nocturnum</i>	night blooming jasmine
<i>Clidemia hirta</i>	clidemia, Koster's curse
<i>Hedychium gardnerianum</i>	kahili ginger
<i>Morella faya</i>	faya
<i>Psidium cattleianum</i>	strawberry guava, waiawi
<i>Rubus ellipticus</i>	yellow Himalayan raspberry
<i>Setaria palmifolia</i>	palm grass
<i>Sphaeropteris cooperi</i>	Australian tree fern
<i>Tibouchina herbacea</i>	cane tibouchina
<i>Tibouchina urvilleana</i>	glory bush

3. Introduced Species - Other Animals

A variety of non-native mammalian predators are serious pests to the biodiversity found in Ka'ū Forest Reserve. Mongoose, feral cats, dogs, rats, and mice prey upon native species and have a severe impact on native birds in the Reserve. In addition, small mammals serve as vectors of diseases and can affect the water quality and cause human and wildlife diseases. Leptospirosis and Cryptosporidiosis are potentially fatal illnesses caused by water-borne microorganisms spread by pigs, dogs, mongooses and rats.

Feral cats kill forest birds as well as native sea birds and other species that nest on the ground or in burrows (USGS 2006a). Cats are the host of a potentially fatal disease called toxoplasmosis. In Hawai'i, toxoplasmosis has killed native Hawaiian birds such as the 'Alalā, the endangered Nēnē and even seabirds such as the Red-Footed Booby (*Sula sula*). Because the organism that causes toxoplasmosis (*Toxoplasma gondii*) can complete an important part of its life cycle in seawater, this disease also poses a threat to marine mammals such as the endangered Hawaiian monk seal (*Monachus*

schauinslandi) and spinner dolphin (*Stenella longirostris*). In addition to threatening wildlife, toxoplasmosis poses a significant health risk to pregnant women (USGS 2006a).

Rats prey on native bird eggs, nestlings, native land snails and also eat the fruits and/or strip the bark of native plants. Similarly, mice consume the seeds of native plants; seed predation can be a major factor contributing to species decline.

The Reserve has been invaded by non-native forest birds; however their impacts on native species have not been determined. Non-native birds may compete with native forest birds for food and other resources and act as vectors for avian diseases. Non-native birds may also contribute to the spread of weeds by eating the fruits of weedy species and spreading seeds.

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. Other non-native parasitoids adversely impact native moth species, and ants are a significant mortality factor for native invertebrates. 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 and humans.

Both Jackson's chameleon (*Chamaeleo jacksonii*) and Coqui frog (*Eleutherodactylus coqui*) have growing populations on the island, and these species can consume native invertebrates, such as insects, spiders, and small snails.

4. Wildfire

Fire poses a threat to the Reserve, particularly during times of drought and in areas adjacent to human activity. Hawaii's flora evolved with infrequent, naturally-occurring fire, so most native species are not fire-adapted and are unable to recover quickly after wildfires. Wildfires leave the landscape bare and vulnerable to erosion and non-native weed invasions. Continued feral ungulate damage to native ecosystems can convert native forest to non-native grasses and shrubs, which provide more fuel for fires. Weeds, 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 from catalytic converters and other hot surfaces of vehicles or heavy equipment and illegal campfires. The principal natural ignition sources are lightning and lava flows.

5. Disease

Introduced diseases and pathogens threaten native animals and plants. Given the lack of biosecurity in Hawai'i, the introduction of new diseases and pathogens is highly likely. Avian pox and avian malaria are mosquito-transmitted diseases that currently kill or weaken many native Hawaiian birds and are thought to be responsible for the extinction of numerous forest bird species. 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 many native forest bird species, infection with these diseases is almost always fatal (USGS 2005; USGS 2006c).

Introduced plant diseases such as 'ōhi'a rust (*Puccinia psidii*) and koa wilt (caused by the fungus *Fusarium sp.*) have the potential to impact the major components of the forest throughout the Reserve. 'Ōhi'a rust affects 'ōhi'a as well as other plants in the same family (Myrtaceae) (HEAR 2010). 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 (UH-CTAR 2010).

6. Climate Change, Volcanic Activity and Hurricanes

Climate change may affect the Reserve by 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 negatively affected by relatively rapid changes in precipitation, temperature, and humidity that result from a rapid and drastic change in regional or local climate patterns (e.g. prolonged drought, higher temperatures). 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).

Volcanic activity has the potential to impact the Reserve. Mauna Loa flows reached the top portions of Ka'ū Forest Reserve in 1950. The Ka'ū Forest Reserve is located within Volcanic Hazard Zones 3 and 6 for Mauna Loa (USGS). During the past 750 years, lava flows have covered about 15 to 20 percent of Zone 3 on Mauna Loa. The portion of the Reserve above Nā'alehu is classified as Zone 6 because it is currently protected from lava flows by the local topography. Kīlauea Volcano is also currently active. Volcanic gases or vog from nearby vents can cause high concentrations of gases that affect native plants, animals and people.

Although natural disturbances such as hurricanes and lava flows are regular occurrences in Hawai'i, native species and ecosystems may not be able to recover from these disturbances as readily due to small populations and/or invasion of non-native weed species.

7. Illegal Human Activity

Illegal human activity occurs on a small scale, primarily in the form of illegal camping, off-road all-terrain vehicle use, dumping, unpermitted harvesting (maile, hāpu'u, and other native trees and plants), marijuana cultivation, and vandalizing signs and fences. These activities destroy infrastructure and native species. Some illegal activities create openings in the forest that can be invaded by weeds.

III. KA'Ū FOREST RESERVE MANAGEMENT

A. Summary of Existing Management and Research Activities

1. Watershed Values and Native Ecosystems

DOFAW has been conducting feral cattle control to protect the watershed and native ecosystems in the Reserve. Hundreds of feral cattle have been removed since the 1980's, particularly from the northern and central portions of the Reserve. Currently, there are low numbers of feral cattle in the Reserve, and DOFAW staff are continuing to remove the remaining cattle. Adjoining ranchers have primary responsibility for maintaining and constructing fences to prevent additional cattle from entering the Reserve.

2. Threatened and Endangered Species Management

Seven forest bird surveys were conducted between 1976 and 2008 by DOFAW and other cooperating agencies and organizations. These surveys, generally conducted every five years, provide information on bird populations in the Reserve. 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. A summary of survey results is available at: <http://pubs.usgs.gov/of/2007/1076/of2007-1076.pdf> (Gorreson *et al.* 2007).

In 1995, DOFAW contracted TNC to inventory plant and animal species and prepare a report on the biological resources on the Waihaka portion of Ka'ū Forest Reserve, an area that had been proposed as a potential Natural Area Reserve (TNC 1995). This area was found to have important biological resources, including rare species of plants and birds.

Two sites in Ka'ū Forest Reserve (southwest and central) were included in a rapid assessment of vegetation at six potential 'Alalā release sites on the island of Hawai'i to rank sites for suitability as reintroduction sites for this species (Jacobi and Price 2007). Out of the six sites examined, the two Ka'ū study sites ranked first and second overall.

Several small fenced areas have been constructed for protection and/or outplanting of rare plant species.

3. Invasive Species Control and Resource Protection

DOFAW and Big Island Invasive Species Committee (BIISC) staff have controlled populations of priority weeds in Ka'ū Forest Reserve including cats claw, bocconia, palm grass, ginger, strawberry guava and night blooming jasmine.

Limited portions of the Reserve have been surveyed for weeds. Surveys have been conducted along the lower boundary and on Hawai'i forest bird survey transects. BIISC also surveyed portions of the Reserve for bocconia.

In 2010, TNC contracted with Resource Mapping Hawai'i to collect high resolution aerial imagery with a fixed wing aircraft in TNC's Ka'ū Preserve and also along the lower edge of the Ka'ū Forest Reserve, where the forest meets the pasture. These aerial images will help identify patches of priority weeds in the forest so they can be controlled. TNC and Resource Mapping Hawai'i have been analyzing, compiling and checking the accuracy of the imagery data which will allow resource managers to view the imagery and obtain information about priority weed locations. Three weed species are a focus of these efforts: strawberry guava, kahili ginger, and night blooming jasmine.

4. Public Activity

DOFAW staff maintain roads used for public access to the Ka'ū Forest Reserve.

B. Management Goals and Objectives

Forest Reserves are multi-use areas that encompass and incorporate a variety of public uses and benefits, from fresh water supply to recreation. Each Forest Reserve within the system has differing goals depending on the nature of the resources found within it. DOFAW manages the Forest Reserves individually for their unique resources as well as provides an overall management philosophy for the entire Forest Reserve System, in keeping with the rules it must abide by. Broad management action categories within the Forest Reserve System include:

- Watershed Values (aquifer recharge and erosion control)
- Native Ecosystems (landscape level protection)
- Invasive Species Control (incipient and established plants and animals)
- Threatened and Endangered (T&E) Species Management (Federally listed, State listed, and rare plants and animals)
- Public Activity (non-income generating uses, such as recreation, cultural activities, personal gathering, educational or research activities, and events, among others)
- Resource Protection (fire, insects, and disease)
- Game Animal Management (areas managed to enhance public access for hunting game birds and mammals)
- Commercial Activity (income generating activities such as timber, tours, etc.)

From within these broad management action categories, specific management goals for Ka'ū Forest Reserve were determined from the unique resources and management needs for the area, mandates that regulate DOFAW activities, including Draft Management Guidelines (Appendix C), past planning efforts and Administrative Rules, as well as input from DOFAW Staff. Goals for Ka'ū Forest Reserve include the following, in priority order.

1. Watershed Values: Protecting and managing the forested watersheds for production of fresh water supply for public uses now and into the future
2. Native Ecosystems: Maintaining native ecosystems and rare and endangered species
3. Public Activity: Providing public access, recreational and hunting opportunities

C. Proposed Management

Management objectives and proposed actions for each of the broad management action categories are discussed below. Proposed actions have been prioritized based on the three specific management goals for Ka'ū Forest Reserve. The highest priority actions proposed have multiple benefits and accomplish numerous management objectives.

1. Watershed Values and Native Ecosystems

Management Objective: Protect and manage forested watersheds to produce fresh water for public use, reduce land-based pollutants (e.g. soil erosion, animal waste), improve coastal water quality and maintain native ecosystems.

Actions:

1. Prevent damage to watershed and native ecosystems by removing all feral cattle from within the Reserve and controlling livestock trespass through maintenance of existing boundary fencing.
2. Protect watershed and native ecosystems from feral ungulate damage by construction of approximately 12,000 ac (4,856 ha) of new fenced management units in the upper elevation central portions of the Reserve.
3. Remove feral ungulates from within fenced management units using a variety of approved methods including special public hunts, trapping, and staff control.
4. Inspect, maintain and replace fences.
5. Monitor fenced management units for ungulate presence following complete removal and control ingress ungulates, if necessary.
6. Protect and maintain biological diversity of the Reserve's ecosystems.
7. Monitor watershed function.
8. Participate in collaborative initiatives such as the Three Mountain Alliance Watershed Partnerships with other public and private forest landowners.
9. Protect important forested lands through addition to the Forest Reserve System.

It is important to protect the Reserve's native ecosystems because this forested watershed impacts the quantity and quality of water in the wells and tunnels used for the District's domestic and agricultural water supply. While many people are familiar with the water cycle and how rainfall ends up in groundwater that is used by humans, fewer people are aware of the forest's role in producing and filtering our drinking and fresh water. Forests are critical for accumulating fresh water. Fog condensing on trees is an important source of moisture and can increase measurable precipitation by 20% (Juvik and Perreira 1973; Juvik and Nullet 1995). Forests collect and filter water into the ground water and streams. A healthy native forest without soil disturbance limits aquatic pollutants (e.g. siltation, suspended solids, turbidity, nutrients, organic enrichment, toxins and pathogens) due to erosion and runoff. Forests may also reduce the impacts of flooding and erosion by slowing down water as it flows down the mountain.

Feral cattle have long been a threat to the watersheds of Ka'ū Forest Reserve, and continued work is needed to remove feral cattle from the Reserve and prevent the ingress of additional cattle from adjacent lands. Adjacent ranchers are responsible for maintaining boundary fences. DOFAW staff are planning on continuing their efforts to remove all feral cattle from the Reserve, through staff hunting and other approved animal removal methods. Additional boundary fencing may be required to prevent the ingress of cattle into Ka'ū Forest Reserve.

To protect the water resources of the Reserve and limit damage to native Hawaiian ecosystems, a combination of fencing and feral ungulate removal from fenced units is needed. Without fencing, ungulate control is not effective, due to reproduction of existing populations and continued ingress from adjacent areas. The construction of fenced management units is proposed for approximately 12,000 ac (4,856 ha) in the upper elevation (4,000 - 5,000 ft (1,219 - 1,524 m)) portions of the Reserve. We have prioritized this area because the proposed fencing and feral ungulate removal would protect a large portion of the Ka'ū Forest Reserve landscape, including important watershed and existing native species habitat, particularly habitat for the three endangered forest bird species. This area is also a priority for restoration for release of the 'Alalā. Monitoring data from forest bird transects shows this area is the portion of the Reserve that has the most feral ungulate damage. Although there is currently an intact canopy of tall native trees, in many areas much of the ground and understory layers of ferns, small plants and young tree seedlings have been damaged by feral ungulates, leaving the ground bare and exposed. Without management, the native forest will continue to decline because young trees will not be able to grow and become established to replace the older canopy trees as they die. Fencing and feral ungulate removal will benefit native ecosystems by limiting the browsing and trampling of native plants. Other benefits include reduction of soil erosion/exposed soil and subsequent invasion of non-native plants.

Three possible alternatives of about 12,000 ac (4,856 ha) are being considered for fencing, which differ in the location of fencing. These draft alternatives will be presented

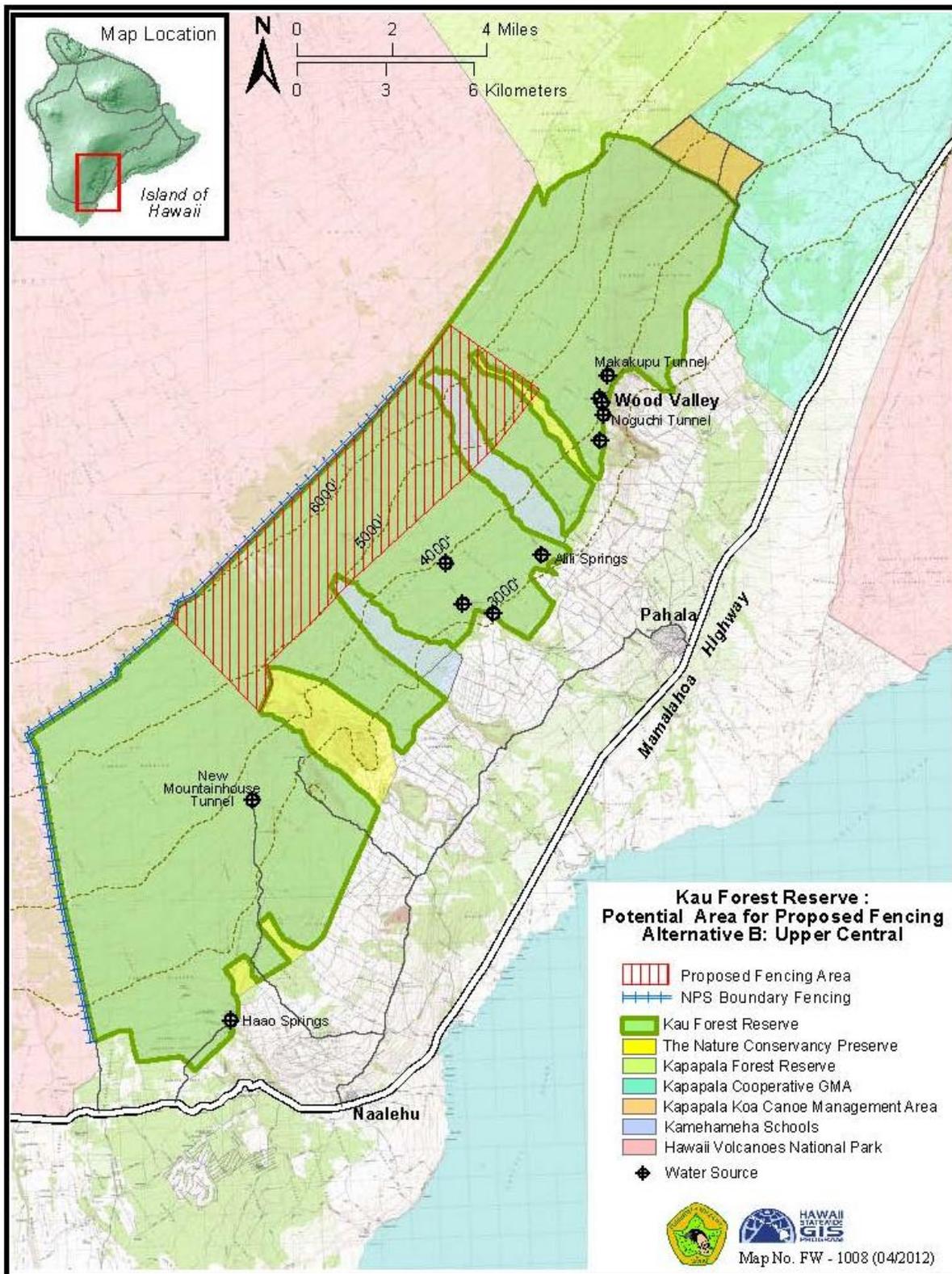
to agencies, organizations and the general public in the draft EA. DOFAW's preferred alternative for fencing in the draft EA is shown in Figure 14.

We are still determining the location, size design and number of the fenced units that would be constructed within the proposed area for fencing. The area would be subdivided into separate fenced subunits of 2,000 - 4,000 ac (809 - 1,619 ha) in size that would be fenced over time, as funding becomes available. The final configuration and number of fenced unit(s) will consider factors such as water resources, quality of native ecosystems and habitat for native species, level of damage from ungulates, public use of area, cooperation with adjacent landowners, terrain, logistics, accessibility, and feasibility for effective feral ungulate removal. Field surveys will be conducted to identify locations for the planned fence alignments, and final fence alignments will be sited to avoid any impacts to botanical, faunal, and archaeological resources. Fences are not meant to restrict public access into management units, and walkovers and gates will be installed in order for people to access fenced areas. Fencing costs are estimated at approximately \$150,000 per mile (labor, materials and helicopter), and will be completed based upon the availability of funding for labor and materials. DOFAW staff and/or contractors will need to implement construction of fenced units in phases.

As fence construction is completed, DOFAW staff will use various approved methods to remove ungulates from within the fenced units (State of Hawai'i 2007). Public hunting will be encouraged during the first phase of ungulate removal where safe, feasible and effective, but additional control methods including drives, trapping, staff control with dogs, and snaring, may be needed to remove all the ungulates.

Regular fence inspection and maintenance will be needed once fence construction is complete. Fences will also need to be replaced as they deteriorate and costs for fence replacement will need to be taken into account in future management plans.

Figure 14. Ka'ū Forest Reserve - Preferred Alternative (Fencing of Central Portion of the Reserve)



2. Invasive Species Control

Management Objective: Protect intact native forest by removing high priority non-native, invasive weeds and other invasive species.

Actions:

1. Monitor and map the distribution of high priority weeds and develop a control strategy.
2. Identify highest priority areas for intensive weed control.
3. Control weeds along invasion corridors (e.g., roads, trails, fences) and within fenced management units using approved methods.
4. Maintain procedures to prevent introduction of new weeds.
5. Monitor weeds to determine whether weed control measures are effective and to detect changes in long term distribution and abundance.
6. Monitor and map the distribution of other invasive species and develop a control strategy, as needed.

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. DOFAW staff will monitor weed control areas to evaluate the effectiveness of control efforts. Ka'ū Forest Reserve is also targeted for additional weed mapping using new mapping technologies (high resolution aerial imagery). Analysis of the aerial imagery will assist DOFAW staff in locating priority weeds for control purposes.

Weed control priorities include suppression and containment of priority weeds (night blooming jasmine, kahili ginger, bocconia, clidemia, and strawberry guava) along the lower Reserve boundaries to prevent and reduce the spread of these weeds into more intact native forest areas in the higher elevations. Regular surveys along the lower boundary and along forest bird survey transects should be continued to detect new incipient weeds and increased spread of priority weeds into the upper Reserve. DOFAW will develop cooperative weed control projects with adjacent private landowners and lessees to benefit ranching, forestry and agriculture as well as suppress priority weeds in critical native forest buffer areas.

Other weed control priorities include the following: reducing the spread of bocconia from Wood Valley into the Reserve; develop a containment strategy for night-blooming jasmine (e.g. keep Waihaka gulch population farthest to the east from spreading further east); eliminate kahili ginger from Mauna Kea Springs Hunter Trail vicinity west of Waihaka gulch; and control glory bush on Mountain House Road.

Priority areas for weed management will also include 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.

Weed control goals include early detection and preventing the establishment of incipient, habitat modifying weeds that are not currently present (e.g. miconia) or are still localized. For priority weeds already present, 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, DOFAW 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 people working in and visiting the area. DOFAW staff and volunteers will follow protocols for cleaning of boots, equipment and vehicles.

A combination of control techniques including staff control using manual, mechanical and approved herbicides will be 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. Due to widespread and heavy infestations of certain weeds and limited resources, DOFAW will use approved biocontrol agents within the Reserve, when available, and if shown to be effective.

3. Threatened and Endangered Species Management

Management Objective: Protect occurrences of threatened and endangered species and restore populations of these species in appropriate habitat to assist with the overall recovery of these species.

Actions:

1. Fencing and feral ungulate removal (discussed above in section on Watershed Values - actions #1 - 4).
2. Weed management and preventing the introduction of new habitat-modifying species are discussed above (Invasive Species Control - actions #1-5).

General actions to protect watershed values and native ecosystems discussed above (e.g. fencing, ungulate removal and weed control etc) are critical to the long-term health and recovery of native ecosystems which provides habitat for threatened and endangered plants and animals. These management actions are the most critical actions needed to protect existing native habitat, biological diversity and rare species. These actions, as well as other actions specific to individual species, are recommended in U.S. Fish and Wildlife Service Recovery Plans (Appendix C). The areas proposed for fencing and ungulate removal are a high priority because they contain existing populations of forest birds as well as rare and endangered plant species.

In some instances, the implementation of actions described above is not enough to recover certain threatened and endangered plants and animals. These species may have wild populations that are so low that the species cannot survive and recover without additional management. These species may require additional management actions to maintain the persistence of wild populations or re-establish new populations. Additional specific actions for forest birds, 'Alala and rare plants are discussed below.

a) Forest Birds

Actions:

1. Predator control
2. Continue long-term forest bird monitoring program in cooperation with the Hawai'i Forest Bird Interagency Database Project to assess changes in the population and distribution.

The native birds of Ka'ū will benefit from previously discussed management actions in all alternative areas proposed including fencing and ungulate removal and invasive species control. Although there is still a forest canopy in the areas proposed for fencing, removal of feral ungulates will allow native understory plants and trees to regenerate, providing additional areas for birds to forage for fruit and nectar resources as well as ensuring the long-term presence of the forest into the future. Further, removing pigs would reduce the number of mosquito breeding sites, which would reduce the transmission of avian diseases, and reduce the spread of non-native plants. The former is critically important as climate change increases the area over which mosquitoes and the avian malaria parasite will be able to survive reduces the overall area of disease free forest available for native forest bird habitat.

Native forest birds will benefit from management actions directed at 'Alalā described below, such as predator control of non-native mammals. Non-native mammals eat native birds and eggs as well as seeds/fruit and arthropods that are critical foods to sustain native birds. Thus any reduction in their numbers would likely benefit native birds. Small mammalian predator removal is extremely difficult and costly to implement on a large-scale using currently existing methods. DOFAW staff may implement predator removal in certain high priority areas (e.g. upper elevation, fenced management units, 'Alala release sites, 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 may be implemented if they are approved and offer a cost-effective way to remove predators.

b) 'Alalā Restoration

The restoration of 'Alalā to the wild will require significant management actions, including the construction of holding aviaries, and a constant human presence at

release sites. The following management actions are recommended by the Revised Recovery Plan for the 'Alalā (2009):

Actions:

- 1) Fencing and ungulate control - a minimum area of approximately 2,500 ac (1,012 ha) is required for initial releases.
- 2) Remove predators from the release area (all feral cats and 80% of other non-native predators (mongoose, rats).
- 3) Restore native food plants through planting, as needed
- 4) Construct release cages
- 5) Determine 'lo density and the relationship between 'lo density and the availability of rodents and game birds, and vegetation density.

Fencing a management unit of 2,500 ac (1,012 ha) is the minimum area needed for initial releases to start the restoration of a small wild population of 'Alalā. 'Alalā may use both unfenced and fenced areas in the Ka'ū Forest Reserve as well as adjoining lands. The size area needed to sustain a large wild population of 'Alalā is not known at this time. In previous releases of 'Alalā in Kona, the released birds used an area of about 10,000 ac (4,047 ha), but there were, at the most, 12 birds in the field at any one time, and none had set up breeding territories.

Holding or release aviaries will 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 will need to maintain a constant presence at the release site for an undetermined length of time to care for, feed, monitor, and track released birds. 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 'Alalā release will require additional staff. The predator control team will track the abundance of predators and trap and bait as needed. The ungulate and vegetation team will track the abundance of ungulates, remove ungulates from fenced areas, monitor 'lo abundance, restore food plants, monitor vegetation recovery, track and control invasive species and check and repair fence. The latter two teams do not need to maintain a constant presence at the site.

c) Rare Plants

Actions:

1. Survey, map and monitor existing populations and individual rare plants and collect propagation material.
2. Propagate and re-introduce certain species of rare and endangered plants in appropriate protected habitat through outplanting, in coordination with other agencies and organizations working on rare plant recovery.

3. Monitor growth and survival of reintroduced plants.
4. Protect rare plants in areas outside fenced management units through the construction of small fenced exclosures
5. Conduct other management, as required (control of damaging weeds, insects, slugs, plant disease and/or mammalian predators).

Over the past decade, numerous species of rare plants have been propagated and reintroduced into fenced, ungulate-free areas to contribute to their overall recovery in the wild. Species listed in Table 5 will be the focus for the DOFAW rare plant program in Ka'ū Forest Reserve. The goal of rare plant management is to remove threats to these species and ensure their long-term survival in secure and self-sustaining wild populations.

DOFAW staff will work cooperatively with other organizations and agencies on rare plant recovery including 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, propagation, and reintroduction through outplanting. PEPP is focused on preventing the extinction of taxa with fewer than 50 individuals in the wild. The VRPF and/or other state permitted facilities will propagate all rare plants used in the DOFAW program.

DOFAW staff will follow rare plant collection and reintroduction guidelines recommended by the Hawai'i Rare Plant Restoration Group (interagency group of rare plant experts) <http://www.hear.org/hrprg/>. DOFAW 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. small fences around wild plants that are not within fenced management units, control of damaging weeds, insects, slugs, plant disease and/or mammalian predators).

d) Rare Invertebrates

Specific management actions to protect invertebrates are not proposed at this time. Little is known about native invertebrates in Ka'ū Forest Reserve so additional surveys are needed to inventory species and identify important habitat for rare species. Previously discussed management actions to benefit watershed and native ecosystems and other rare species will also benefit rare native invertebrates, as native invertebrates are generally dependent on native plants for food and as host plants.

4. Public Activity

Management Objective: Provide for continued public use of Ka'ū Forest Reserve including hunting, recreational opportunities, cultural uses, personal gathering, educational programs and activities.

Actions:

- 1) Maintain existing public access roads.

- 2) Develop new access routes to increase access, particularly across private and state-leased lands below the Reserve.
- 3) Continue to facilitate public hunting in the Reserve.
- 4) Develop trails and recreational amenities (e.g. picnic and/or camping areas).
- 5) Hire outreach staff and work with partners to provide community outreach and education (e.g. volunteer service trips, student internships, school programs etc) to build public understanding and support for Ka'ū Forest Reserve's unique native resources.
- 6) Develop more effective and user-friendly methods to issue DOFAW permits for gathering and other activities.
- 7) Hire additional staff to implement proposed actions, establish a regular DOFAW presence in the area and continue consultation with the community.

Public activity and recreational uses of the Reserve are a high priority as long as these activities are compatible with the protection of watershed and natural resources. DOFAW Draft Management Guidelines (Appendix C) classify the Reserve as "light use" for recreation. Recreational uses will be limited to certain areas to minimize impacts on natural resources and trails would be the main recreational feature for this type of classification. DOFAW management of recreational uses of the Reserve will emphasize low-impact activities and minimal improvements that are consistent with the remote, wilderness nature of the Reserve.

The transition of lands from sugar production to numerous private landowners and state-leases has reduced public access to the Reserve. DOFAW needs to ensure continued public access for recreational uses, hunting, and traditional and cultural practices as private lands adjacent to the Reserve get sold and developed. Additional forest access routes to Ka'ū Forest Reserve are currently being assessed by DOFAW, and community input will be sought on priority access routes. DOFAW will implement increased public access to the Reserve through various methods including developing easements, land acquisition or public access agreements with adjacent landowners.

There are not currently any designated trails or camping areas within the Reserve; however, these types of recreational amenities may be appropriate for certain areas within the Reserve. DOFAW will seek community input and recommendations on the potential development of and locations for additional recreational amenities for Ka'ū Forest Reserve such as picnic and camping areas, trail development and public cabins/shelters.

DOFAW management will seek to ensure the long-term availability and sustainability of native plant resources for traditional resource gatherers in Ka'ū Forest Reserve. The current extent of use of the Reserve for traditional and cultural gathering is not currently known. DOFAW will explore more effective and user-friendly ways to issue permits to the public for gathering including potentially establishing a satellite office with a more regular staff presence in Ka'ū and/or implementing a on-line computerized permitting system. The sustainability of these resources will be enhanced by protection of native

forest ecosystems through fencing, feral ungulate control and weed control as well as a greater staff presence in the region.

NPS is currently developing a general management plan for the Kahuku section of Hawai'i Volcanoes National Park. This plan may increase access to and recreational uses of Ka'ū Forest Reserve as this section of the park surrounds Ka'ū on two sides. DOFAW will work cooperatively with NPS on the development of additional trails and access routes through the park. Trails through the Reserve could potentially connect to other trails in the park, including historic trails such as the Kahuku - Ainapo trail across the top of Ka'ū Forest Reserve as part of a larger trail system. For example, historic maps depict a trail from Mountain House through the Reserve to Kahuku (connecting with the Kahuku-Ainapo trail), which may be a good trail to reestablish for public use.

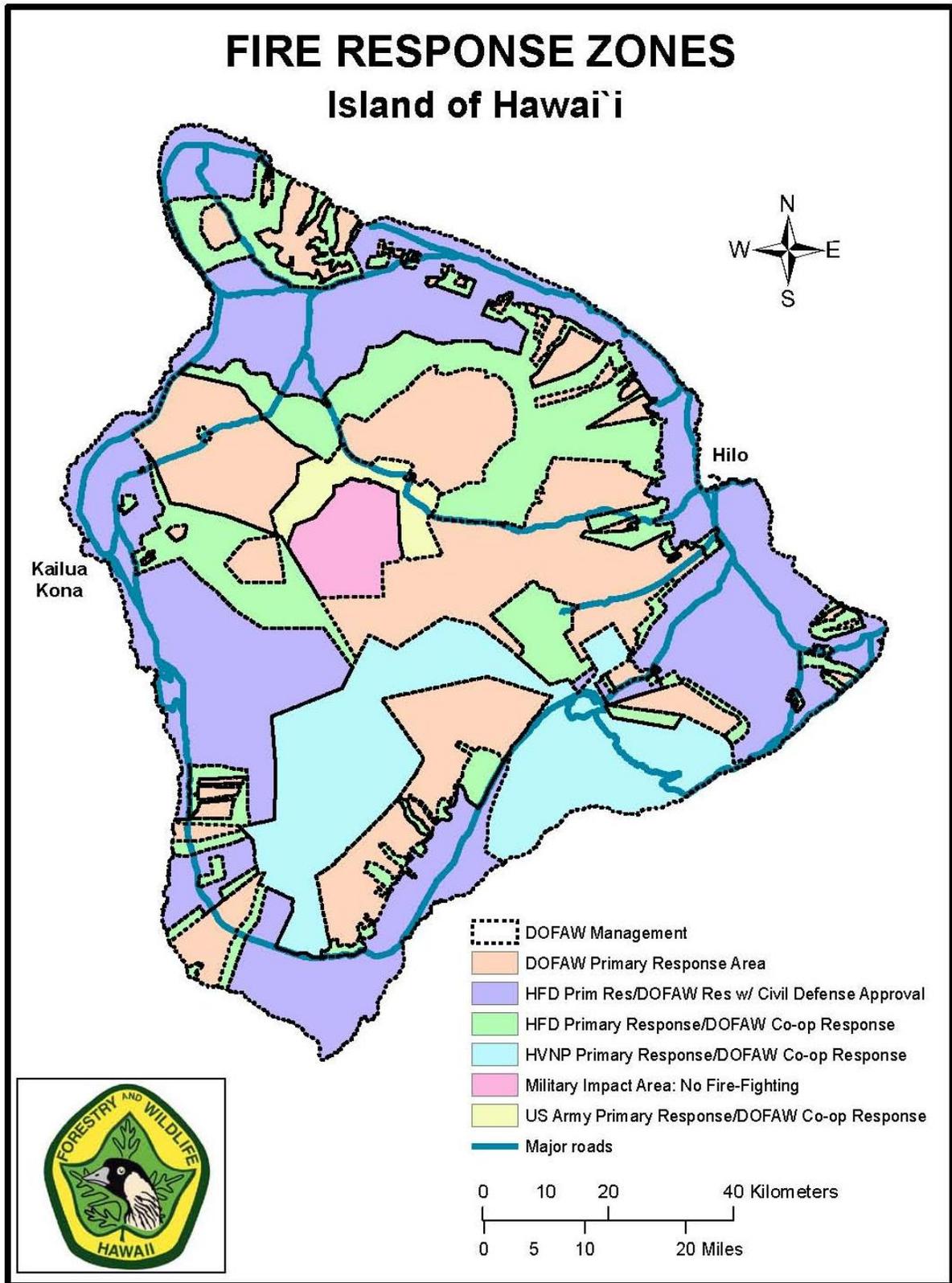
5. Resource Protection

Management Objective: Reduce the threats of fire, insects, and disease to the Ka'ū Forest Reserve.

1. Install a remote automatic weather station to monitor fire weather in the Reserve and/or adjacent areas (specific location to be determined).
2. Respond to fires, as needed.
3. Monitor forest for insects and disease.

Management actions to protect watershed values and native ecosystems will maintain the overall health of the forest, which will make the forest more resistant to threats from fire, insects and disease. DOFAW is the primary responder to fires within the Ka'ū Forest Reserve (Figure17). DOFAW is responsible for fire protection within DOFAW lands and is also required to cooperate with Hawai'i County Fire Department and fire control agencies of the Federal Government in developing plans, programs and mutual aid agreements for assistance for prevention on other lands.

Figure 17. Fire Response Zones, Island of Hawai'i



6. Game Animal Management

Management Objective: Continue to provide public hunting opportunities in Ka'ū Forest Reserve.

Actions:

- 1) Maintain existing public access roads for use by hunters.
- 2) Develop new access routes to increase hunter access, particularly across private and state-leased lands below the Reserve.
- 3) Provide opportunities for public hunters to assist with the removal of feral pig and sheep removal in fenced, management units prior to staff control.

Ka'ū Forest Reserve is currently part of Hunting Unit B, and Reserve is used by local residents for hunting, particularly for feral pigs. DOFAW seeks to balance the objective of continuing to provide public hunting opportunities in the Reserve with the protection of native ecosystems and watersheds. The Ka'ū Forest Reserve is very large (61,641 ac (24,945 ha) of public land) and will be able to accommodate both management objectives. The Reserve is not designated as an area where habitat will be manipulated to enhance game populations due to the high quality of the native ecosystems and watersheds. This plan emphasizes increasing access to lower portions of the Reserve to allow for public hunting while increasing watershed and native ecosystem protection in more remote, inaccessible upper portions of the Reserve through fencing of management units and removal of feral ungulates. Public hunting will be a priority action in the initial stages of feral ungulate removal in fenced management areas wherever safe, feasible, and effective.

7. Commercial Activity

Management Objective: Develop means to make Ka'ū Forest Reserve economically self-supporting, in whole or in part, as has been done with other forest reserves across the state.

Actions:

1. Determine environmentally compatible means for generation of revenue to support proposed management activities.

According to HRS §183.5 (5), the department shall: Devise and carry into operation, ways and means by which forests and forest reserves can, with due regard to the main objectives of title 12, be made self-supporting on whole or in part.

Commercial activity is not a priority management activity for Ka'ū Forest Reserve. DOFAW will only develop commercial activities in the Reserve that are compatible with the highest priorities - protection of watershed values and native ecosystems, and that do not interfere with public activity.

Water is one of the most important sustainable resources generated by the Reserve. One potential source of funding for watershed management is a long-term agreement with ADC for the use of water and water infrastructure in Ka'ū Forest Reserve. ADC is interested in developing such an agreement to benefit agricultural water users in Ka'ū. Funds generated from an agreement with ADC could be used for the implementation of watershed protection projects, which would improve the quantity and quality of water generated from the Reserve.

D. Management Plan Implementation

1. Management Plan Cost

The estimated costs of proposed management actions are outlined in Table 9. The management actions proposed in this plan will require a greatly increased level of funding in order to implement over the next ten or more years.

There are currently limited financial resources to manage the Forest Reserve System, and DOFAW has estimated there is approximately \$0.25/acre funding available for forest reserve management statewide. Increased funding for high cost projects outlined in this plan will be obtained through outside grants as well as funding from partners, including federal and private organizations. High profile actions such as the reintroduction of 'Alalā to the wild will provide an opportunity for increased funding for management that will provide multiple benefits (e.g. funding for fencing and ungulate removal will benefit watershed values, native ecosystems and native forest birds, including the 'Alalā). Ka'ū Forest Reserve is a high priority for increased management for conservation agencies and organizations across the state and nationwide. The completion of management planning and compliance for actions proposed in the plan will likely generate increased financial resources to manage the area.

2. Staffing

Current staffing levels are not adequate to implement the projects proposed in this plan. DOFAW anticipates obtaining outside funding through federal and private grants to increase staff levels to implement projects. Major actions such as fencing may be contracted to outside entities; however, a DOFAW team of 5-10 people (wildlife biologists and field personnel) will be needed to implement other projects proposed in this plan. Similar ongoing DOFAW and watershed management projects elsewhere in the state hire personnel through the University of Hawai'i Pacific Cooperative Studies Unit. Additional funding and staff support will also be available from partners such as the TMA.

3. Timetable

To be determined based on available funding.

E. Overall Measures of Success

Indicators that may be used to gauge the success of the various management actions proposed for Ka'ū Forest Reserve include:

- Number of cattle removed from forest
- Miles of fence, or number (acres) of fenced management units constructed
- Miles of fence, or number (acres) of fenced management units maintained
- Numbers of feral ungulates removed from fenced management units
- Area and percent of forest land with significant soil erosion
- Levels of nutrients, dissolved oxygen, suspended sediment, turbidity, siltation or temperature change in water
- Ground-water recharge rates and aquifer sustainable yields
- Level of rainfall gauging
- Improved public access by roads and trails
- Reintroduction of extirpated species
- Native forest bird populations stable or increasing
- Percent cover by forest type
- Acres of invasive plants controlled
- Miles of unpaved access road maintenance
- Number and extent of fires in the area
- Level of forest disease incidence or pest infestation
- Number of special use permits issued
- Amount of revenue generated

IV. FUTURE RECOMMENDATIONS

Forest Reserves encompass and incorporate a variety of public uses and benefits. DOFAW will continue to seek to balance these uses to accomplish overall goals for Ka'ū Forest Reserve including protecting watershed values and native ecosystems and providing public recreational opportunities. This plan is intended to cover a fifteen-year time frame and will be revised, as necessary, as actions proposed in the plan are successfully implemented.

Future plans will address management of additional areas which are currently in the process of being added to the Ka'ū Forest Reserve (Kapāpala Koa Canoe Management Area and Kamilo). These areas contain different resources (e.g. koa canoe logs, coastal ecosystems), and DOFAW will have different priorities for the management of these areas.

Ka'ū Forest Reserve will continue to be a major water resource for future generations. Watersheds services include providing humans with a fresh water supply, providing habitat for native plants and animals, allowing better flood control, mitigating climate change impacts, and providing economic, social, recreational and educational opportunities for the human communities in the area. Economic and agricultural

development in the Ka'ū District and an increasing population will require the fresh water produced and filtered by the forested watershed.

Future management will need to benefit watershed, native forest ecosystems and unique native species and people who use the area for recreation and cultural practices. Future plans may propose additional fencing and ungulate removal, particularly in areas critical to protect the watershed and native plants and animals.

Table 9. Ka'ū Forest Reserve Management Summary (15 years)

Management Goal	Management Objectives	Recommended Major Actions	Estimated Cost
Watershed Values and Native Ecosystems	<p>Maintain native forest for production of fresh water for public use, reduction of land-based pollutants and improvements in coastal water quality.</p> <p>Maintain the long-term presence of native ecosystems</p>	<p>Remove all feral cattle from within the Reserve and control livestock trespass through continued DOFAW staff cattle control and maintenance of existing fencing</p> <p>Protect forested watershed from feral ungulate damage by constructing fenced management units for approximately 12,000 acres, removing feral ungulates from within fenced management units, and inspecting and maintaining fences.</p>	<p>\$250,000</p> <p>\$3,300,000 (22 miles fencing) \$1,350,000 (ungulate control) \$ 200,000 (inspect/maintain)</p>
Invasive Species Control	Protect intact native forest from non-native, invasive weeds	<p>Monitor and map the distribution of high priority weeds and develop a control strategy.</p> <p>Control weeds and prevent the introduction of new habitat-modifying species</p> <p>Identify highest priority areas for intensive weed control.</p> <p>Control weeds along invasion corridors (e.g., roads, trails, fences) and within fenced management units.</p> <p>Monitor weeds to determine whether weed control measures are effective and to detect changes in long term distribution and abundance.</p>	<p>\$350,000 (aerial imagery)</p> <p>\$1,000,000 (control)</p> <p>\$300,000 (map/monitor)</p>
Threatened and Endangered Species Management	Assist with the recovery of threatened and endangered species by protecting occurrences of these species and restoring them in appropriate habitat	<p>Forest Birds</p> <ul style="list-style-type: none"> • Monitor to assess changes in the population and distribution. <p>'Alalā</p> <ul style="list-style-type: none"> • Predator control • Restore native food plants 	<p>\$150,000</p> <p>\$2,500,000</p>

DRAFT Ka'ū Forest Reserve Management Plan - May 2012

		<ul style="list-style-type: none"> • Construct release cages, release birds <p>Plants</p> <ul style="list-style-type: none"> • Survey, map and collect propagation material. • Propagate and re-introduce plants through outplanting. • Monitor growth/survival of reintroduced plants. • Protect rare plants outside fenced management units through the construction of small fenced exclosures 	\$100,000
Public Activity	Provide for continued public use including hunting, recreational opportunities, cultural uses, personal gathering, and educational programs.	<p>Maintain existing public access roads.</p> <p>Develop new access routes to increase access, particularly across private and state-leased lands below the Reserve.</p> <p>Continue to facilitate public hunting in the Reserve.</p> <p>Develop trails and recreational amenities</p> <p>Hire outreach staff and work with partners to provide community outreach and education</p>	<p>\$300,000</p> <p>\$500,000</p> <p>\$500,000</p> <p>\$500,000</p>
Resource Protection	Reduce the threats of fire, insects, and disease to the Ka'ū Forest Reserve	<p>Respond to fires, as needed.</p> <p>Monitor forest for invasive insects and disease.</p>	<p>100,000</p> <p>\$50,000</p>
Game Animal Management	Continue to provide public hunting opportunities in Ka'ū Forest Reserve.	<p>Maintain existing public access roads for use by hunters.</p> <p>Develop new access routes to increase access, particularly across private and state-leased lands below the Reserve.</p> <p>Provide opportunities for public hunters to</p>	<p>Costs under public activity</p> <p>Costs under public activity</p> <p>Costs under ungulate control</p>

DRAFT Ka'ū Forest Reserve Management Plan - May 2012

		assist with the removal of feral pigs and sheep in fenced, management units prior to staff control.	
Commercial Activity	Develop means to make Reserve economically self-supporting, in whole or in part, as has been done with other forest reserves across the state.	Determine environmentally compatible means for generation of revenue to support proposed management activities.	
TOTAL			\$11,450,000

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VI. APPENDICES

A. Ka'ū Forest Reserve Additions and Withdrawals

Action	Date	A/W	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key
Governor's Proclamation	August 2, 1906	A	Set aside to continue protection of the forest on the lower slope of Mauna Loa	65,850 */1	1722	397001001 (por.) 398001004 (por.) 397001022 397001007 (por.) 397001006 397001018 397001013 397001005 397001012 397001014 397001008 397001004 397001016 39700102397001020 397001015 397001003 397001017 397001002 397001019
Governor's Proclamation	February 4, 1911	A	Addition of lands at Ka'ala'ala-Makakupu, Keaīwa, Ka'auhuuula and Pālima	216.2 */2	2213	397001001 (por.) 397001007 (por.)
Governor's Proclamation	October 17, 1930	W	Modify - boundary revision/revised description of Ka'ū Forest Reserve	67,078 */3	5652	397001001 (por.) 397001022 397001007 397001006 397001018 397001013 397001005 397001012 397001014 397001008 397001004 397001016 397001021 397001020 397001015 397001003 397001017 397001002 397001019

DRAFT Ka'ū Forest Reserve Management Plan - May 2012

Governor's Proclamation	April 13, 1932	A	Addition (portion of the lands of Wai'ōhinu in the vicinity of Hā'ao Springs) as land important for the conservation of water	266.80	5842	397001001 (por.) 397001009
Executive Order 1560	May 1, 1953	W	Withdraw from Governor's proclamations of August 2, 1906, February 4, 1911, October 17, 1930 and April 13, 1932	5,955	11599	397001013 397001012 397001014 397001008 397001004 (por.) 397001016 397001021 397001020 397001015 397001003 397001017 397001002 (por.)
Executive Order 4156	April 24, 2006	A	Land set aside for public purpose, for addition to Ka'ū Forest Reserve	4,744.9 0	24187 24188 24189	396006018 396006015 396006010 396006009 397001014 397001016 397001021 397001020 397001015 397001017

*/1 Includes private lands at Kāhilipalinui (165 ac.), Hīlea Nui (2620 ac.), Hīlea Iki (37 ac.), Punalu'u (1275 ac.), Pā'au'au 2 (1675 ac.), and Keaīwa (460 ac.).

*/2 Includes private lands at Keaīwa (23 ac.).

*/3 Includes private lands at Kāhilipalinui (169 ac.), Kī'olokū (211 ac.), Hīlea Nui (2620 ac.), Hīlea Iki (37 ac.), Punalu'u (1378 ac.), Pā'au'au 2 (1598 ac.), and Keaīwa (511 ac.).

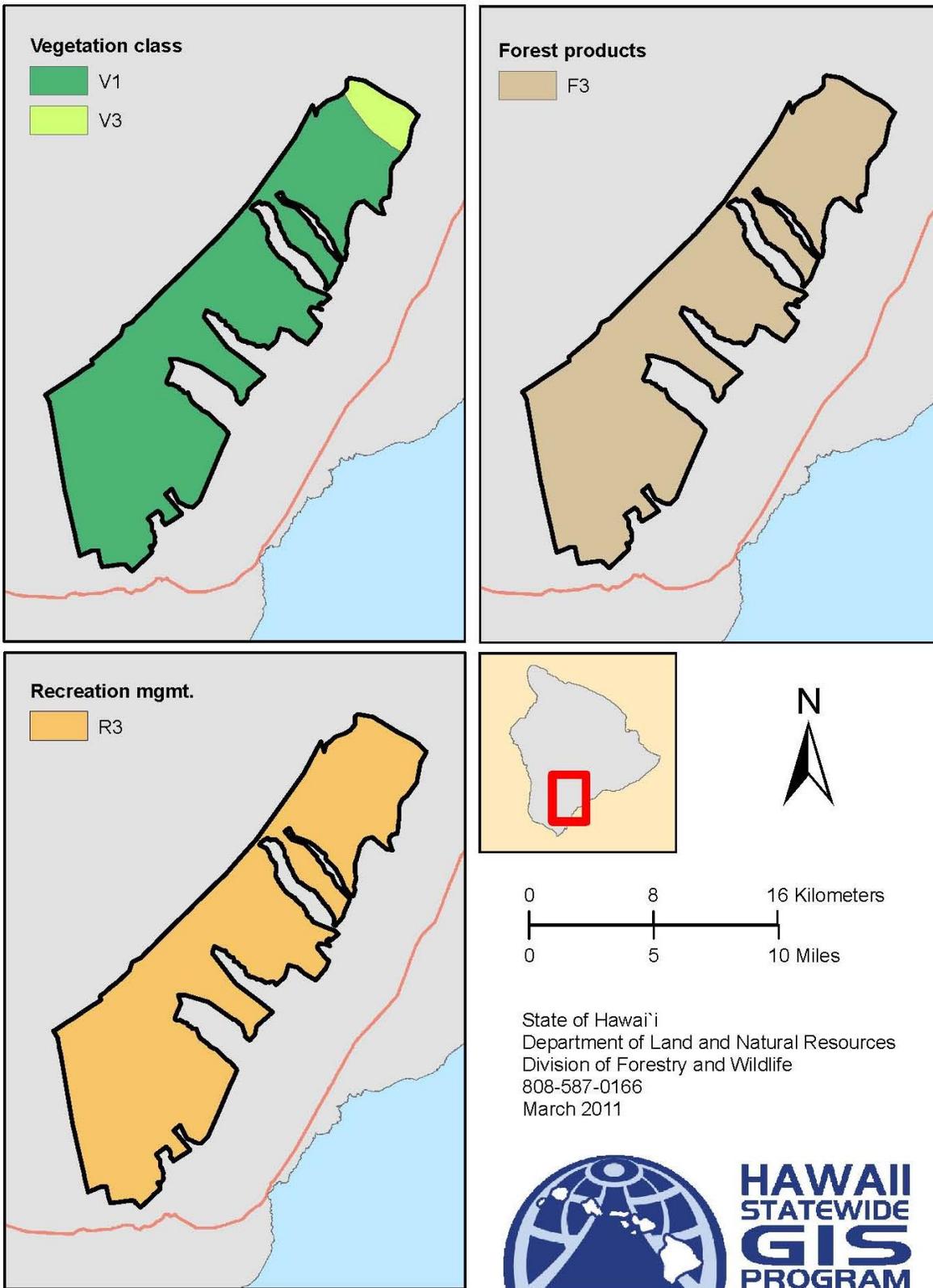
B. DOFAW DRAFT Management Guidelines for Ka'ū FR

DOFAW prepared DRAFT Management Guidelines in 2001 to balance desired levels of activities (human use) on DOFAW managed lands. DOFAW is currently in the process of updating these draft management guidelines. The guidelines emphasize three program areas with conflicting resource demands or user groups. Current management guideline maps show classification of native vegetation according to its relative intactness and habitat quality and recommended levels of human use within these vegetation classifications for the following activities: Outdoor Recreation, Forest Products, Game Management and Hunting.

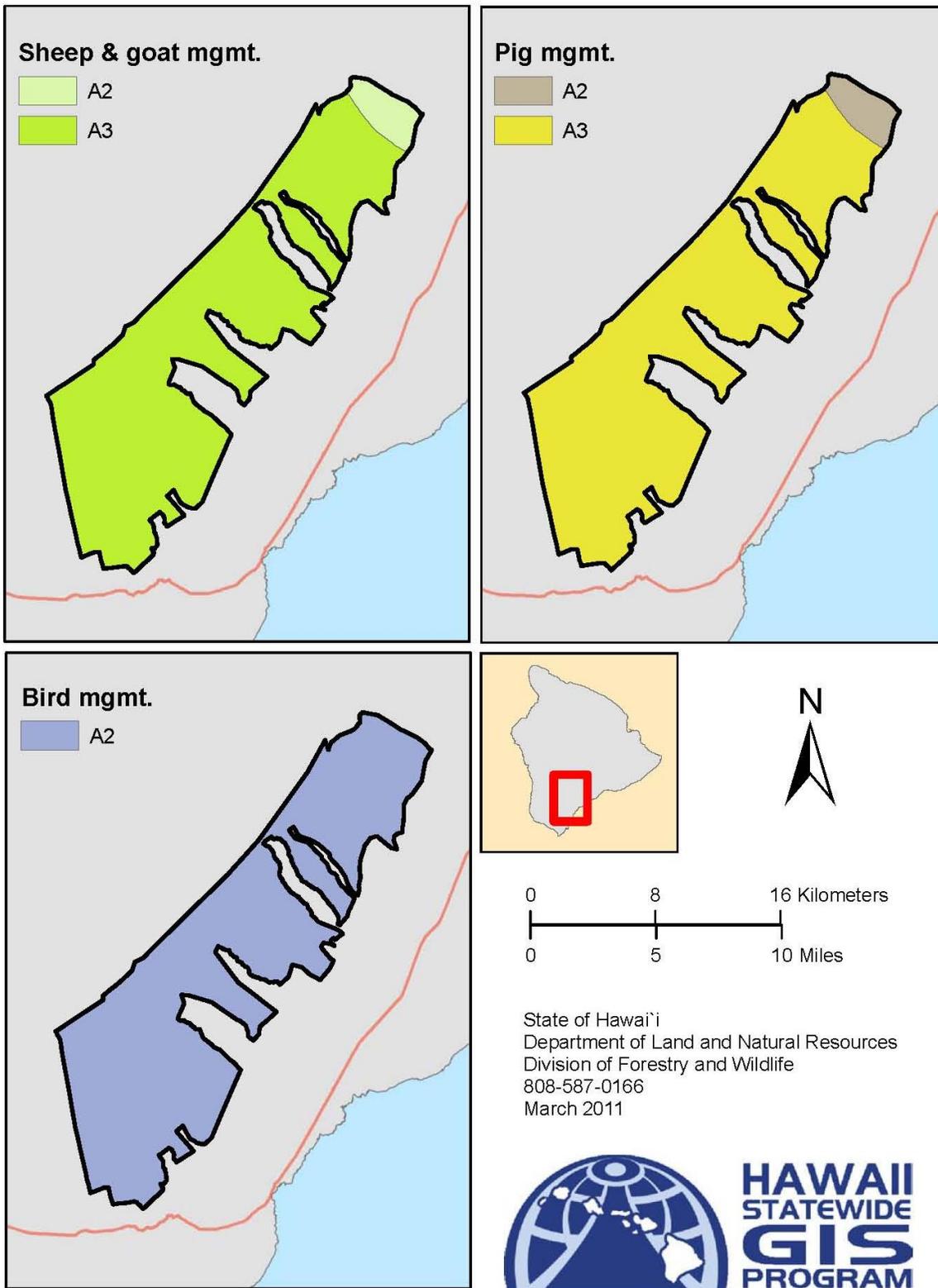
Management Guideline	Classification	Objective	Permitted activities
Vegetation	V-1 Highest Quality Native Ecosystems	Protect and perpetuate these areas, by preventing non-sustainable activities or intensities of use	Permitted activities are minimally disruptive, and would be focused on ecosystem preservation
	V-3 - Considerably Disturbed Areas*	Prevent activities or intensities of use that result in degradation of unique native species and secondary forest resources (water supply, erosion control & aesthetic values).	Permitted activities may have high levels of disturbance, as long as they don't negatively impact remaining native plant populations and have an eventual net benefit to other resources like water, or an improved vegetative cover for other activities. Native plant conservation may be focused at a species, rather than an ecosystem level.
Game Management and Hunting	A3 - Game Control (public)	Resource protection is the primary objective, with emphasis on native plant communities and watersheds.	Seasons and bag limits are designed for public hunting to reduce impacts to native resources
	A2 - Mixed Game and Other Uses	Game management is an objective integrated with other uses.	Habitat may be manipulated for game enhancement. Game populations are managed to acceptable levels using public hunting.
Outdoor Recreation	R3 Light Use	Recreation would be limited to certain areas, or occasional levels of use due to impacts on resources or programs.	Trails would be the main recreational feature, and their use may be restricted.
Forest Products	F3 Personal		Small-scale non-commercial harvesting or salvage is allowed, such as materials for cultural uses. Permit and/or license required with appropriate restrictions.

* According to DOFAW staff, Ka'ū FR areas classified as V-3 in 2001 are not currently distinctive from adjacent V-1 areas. V-3 areas may have been classified due to disturbance due to feral cattle that have since recovered due to feral cattle removal.

DOFAW DRAFT Management Guidelines for Ka'ū FR (Vegetation Class, Forest Products and Recreation Management)



DOFAW DRAFT Management Guidelines for Ka'ū FR (Vegetation Class, Forest Products and Recreation Management)



C. U.S. Fish and Wildlife Service Recovery Plans/Critical Habitat Designations for Ka'ū Species of Plants and Animals

Recovery Plan/Critical Habitat Designation	Comment
Revised Recovery Plan for the 'Alalā (<i>Corvus hawaiiensis</i>) (2009)	<p>Recommendations for management actions for the benefit and recovery of the 'Alalā.</p> <p>http://www.fws.gov/pacific/ecoservices/endangered/recovery/documents/AlalaDraftRevisedRecoveryPlan.pdf</p>
U.S. Fish and Wildlife Designation of Critical Habitat for 12 Species of Picture-Wing Flies From the Hawaiian Islands (2008)	<p>Provides recommendations for habitat management for <i>Drosophila heteroneura</i></p> <p>http://www.gpo.gov/fdsys/pkg/FR-2008-12-04/pdf/E8-27664.pdf#page=2</p>
U.S. Fish and Wildlife Revised Recovery Plan for Hawaiian Forest Birds (2006)	<p>Recommendations for management actions for the benefit and recovery of native forest birds.</p> <p>http://ecos.fws.gov/docs/recovery_plan/060922a.pdf</p>
U.S. Fish and Wildlife Final Designation and Nondesignation of Critical Habitat for 46 Plant Species From the Island of Hawai'i, HI (2003)	<p>Discusses management actions for the benefit and recovery of <i>Cyanea stictophylla</i>, <i>Melicope zahlbruckneri</i>, and <i>Phyllostegia velutina</i></p> <p>http://www.fws.gov/policy/library/2003/03-14143.pdf</p>
U.S. Fish and Wildlife Big Island II: Addendum to the Recovery Plan for the Big Island Plant Cluster (1998a)	<p>Provides recommendations for management of <i>Phyllostegia velutina</i> and <i>Melicope zahlbruckneri</i></p> <p>http://ecos.fws.gov/docs/recovery_plan/980511a.pdf</p>
U.S. Fish and Wildlife Recovery Plan for the Hawaiian Hoary Bat (1998b)	<p>Supports objective 2: protect and manage current populations and identify and manage threats</p> <p>http://ecos.fws.gov/docs/recovery_plan/980511b.pdf</p>
U.S. Fish and Wildlife Recovery Plan for Four Species of Hawaiian Ferns (1998c)	<p>Provides recommendations for management of <i>Asplenium peruvianum</i> var <i>insulare</i></p> <p>http://ecos.fws.gov/docs/recovery_plan/980410e.pdf</p>
U.S. Fish and Wildlife Recovery Plan for the Big Island Plant Cluster (1996)	<p>Provides recommendations for management of <i>Clermontia lindseyana</i>, <i>Cyanea stictophylla</i>, and <i>Nothocestrum breviflorum</i></p> <p>http://ecos.fws.gov/docs/recovery_plan/960926a.pdf</p>

ENVIRONMENTAL ASSESSMENT

Ka'ū Forest Reserve Management Plan

**State of Hawai'i
Department of Land and Natural Resources**

**APPENDIX 2
Cultural Impact Assessment**

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DRAFT–CULTURAL IMPACT ASSESSMENT FOR THE KA‘Ū FOREST RESERVE, KA‘Ū DISTRICT, ISLAND OF HAWAI‘I

TMK: (3) 9-7-001:001, 009, 013, 014, 015, 016, 017, 018, 019, 020, 021,022; (3) 9-6-006:009, 010, 015, 018; and (3) 9-5-015:003 [portion]



Prepared For:

The Department of Land and Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl St., Room 325
Honolulu, HI, 96813

May 2012

Keala Pono 

Keala Pono Archaeological Consulting, LLC • 53-412 Kamehameha Hwy., Hauula, HI 96717 • Phone 808.381.2361

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**DRAFT–CULTURAL IMPACT ASSESSMENT FOR THE KA‘Ū FOREST
RESERVE, KA‘Ū DISTRICT, ISLAND OF HAWAI‘I**

**TMK: (3) 9-7-001:001, 009, 013, 014, 015, 016, 017, 018, 019, 020, 021,022; (3) 9-6-006:009,
010, 015, 018; and (3) 9-5-015:003 [portion]**

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May 2012



ACKNOWLEDGMENTS

Mahalo piha to the Department of Forestry and Wildlife (DOFAW), particularly Tanya Rubenstein, Mililani Browning, and Nohea Ka'awa for their support and assistance throughout the course of the study. This project was truly a team effort and it was clear from the beginning that all of the different agencies and organizations involved (DOFAW, Geometrician Associates, Keala Pono, The Nature Conservancy) have the same goal in mind - to produce work that ultimately helps to understand and better steward the Ka'ū Forest Reserve so it remains healthy and vibrant for generations to come.

As the majority of our group is local, young, developing cultural resource managers, we also want to *mahalo* DOFAW for giving us this opportunity to help train the next generation of cultural resource managers who are earnestly trying to reshape and renew Hawai'i's cultural resource management process so it is more meaningful for our communities. We are grateful for this opportunity to demonstrate our deep commitment and the breadth of our professional knowledge, skills, and competence in documenting and preserving Hawai'i's natural and cultural resources. All of us who contributed to this study feel deeply honored and privileged to have worked at such a significant *wahi pana*. Each of us has learned and grown tremendously from this experience and will continue to remain interested and involved with any efforts to improve and strengthen the stewardship of the Ka'ū Forest Reserve.

And most importantly, we *mahalo* all of the individuals who shared their precious time, memories, and stories with us; we are truly grateful to each and every one of them. Without their willingness to share personal recollections and *mana'o* with us, this important study would not have been possible. The *mana'o* that was shared will keep the stories of Ka'ū alive and enable generations to come to better understand and appreciate the very special beauty and importance of this place.

MANAGEMENT SUMMARY

At the request of the Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW), Keala Pono Archaeological Consulting, LLC conducted a Cultural Impact Assessment for the Ka'ū Forest Reserve on the island of Hawai'i. The Ka'ū Forest Reserve includes TMKs (3) 9-7-001:001, 009, 013, 014, 015, 016, 017, 018, 019, 020, 021,022; (3) 9-6-006:009, 010, 015, 018; and (3) 9-5-015:003 [portion].

DOFAW has management responsibilities for the 61,641-acre Ka'ū Forest Reserve as part of the State Forest Reserve System. DOFAW is preparing the Ka'ū Forest Reserve Management Plan to develop management actions for general and specific areas that protect and restore the watershed and native species as vital natural and cultural resources. The proposed project consists of habitat management and restoration to benefit endangered forest birds including the 'alalā, or Hawaiian crow (*Corvus hawaiiensis*). Proposed management includes fencing a portion of the area to exclude ungulates (feral pigs, mouflon sheep), removal of ungulates from within fenced areas, weed control, predator control, rare and native plant restoration, monitoring, 'alalā reintroduction and management infrastructure (e.g., helicopter landing zones, campsites). Other aspects of the proposed project include outreach and education, community consultation and enhancement of public access to the Reserve (e.g., development of hunter access, trails and other recreational amenities such as cabins and/or campsites).

This project requires compliance with the State of Hawai'i environmental review process (Hawai'i Revised Statutes [HRS] Chapter 343), which requires consideration of a proposed Project's effect on cultural practices and resources. Through background research and community consultation efforts, this report provides information pertinent to the assessment of the proposed Project's impacts to cultural practices and resources (per the *Office of Environmental Quality Control's Guidelines for Assessing Cultural Impacts*) which may include Traditional Cultural Properties (TCP) of ongoing cultural significance that may be eligible for inclusion on the State Register of Historic Places, in accordance with Hawai'i State Historic Preservation Statute (Chapter 6E) guidelines for significance criteria (HAR §13-284) under Criterion E. The document is intended to support the project's environmental review and may also serve to support the project's historic preservation review under HRS Chapter 6E-42 and Hawai'i Administrative Rules (HAR) Chapter 13-284.

The Reserve is located adjacent to the Kahuku section of the Hawai'i Volcanoes National Park, on Mauna Loa Volcano. The Ka'ū Forest Reserve contains native forest ecosystems which support native forest birds (including several endangered species), rare and endangered plants, and invertebrates. The Reserve is also an important watershed area and provides recreational resources for residents. The major current threats to native biodiversity in this area include feral ungulates, avian disease and invasive plants and animals.

The Ka'ū Forest was and continues to be a special place, with an abundance and diversity of flora, fauna, and other natural resources present. Evidence of cultural (archaeological) resources is harder to come by, however, since no formal archaeological surveys have taken place in the Reserve. Future archaeological investigations may uncover historic sites within the Reserve. It can be assumed that Hawaiians visited the area most often for the utilization of numerous natural resources. Bird hunting, wood harvesting, and plant gathering for a variety of uses were likely practices of the area. It can also be presumed that the uplands of Ka'ū were occasionally visited for spiritual practices since it lies within the realm of the gods or *wao akua*. In the historic era, the Ka'ū Forest Reserve was utilized for *pulu* harvesting, hunting, and for its wealth of freshwater resources. Today the Reserve is still used for gathering of plants and *wai*, hunting, and

spiritual/ceremonial practices. The Ka‘ū community also hopes that the Reserve can serve as an outdoor classroom to teach children and adults alike about the unique resources to which the forest is home. Community participants support many of the initiatives proposed in the Ka‘ū Forest Reserve Management Plan, and hope that they can continue to be included in the planning processes so that their *mana‘o* and connection to the place is honored.

CONTENTS

Acknowledgments.....	i
Management Summary	iii
List of Figures	viii
List of Tables.....	viii
INTRODUCTION.....	1
Scope of Work.....	2
Cultural Impact Assessment Standards	3
METHODS	4
Archival Research	4
Community Consultation.....	4
Scoping and Interviewee Selection	5
Ethnographic Interviews	5
Student Intern Training.....	6
BACKGROUND	7
Project Area and Natural Landscape	7
Water Resources.....	7
Native Birds of the Ka‘ū Forest	12
Cultural Background.....	13
<i>Mo‘olelo</i> Associated with Ka‘ū.....	13
‘ <i>Ōlelo No‘eau</i> Associated with Ka‘ū	34
<i>Oli</i> and <i>Mele</i> associated with Ka‘ū	43
Traditional Land Use.....	49
Historic Period Accounts, Maps, and Land Use.....	72
Māhele.....	74
Historic Maps.....	81
The Changing Landscape.....	81
Establishment of the Ka‘ū Forest Reserve	89
Previous Archaeological Studies	90
Site Types.....	95
<i>Heiau</i> in Ka‘ū.....	96
The Ainapō Trail	101
The Kahuku-Ainapō Trail	102
Historical and Cultural Sites Associated with the Ainapō Trail.....	105
Previous Interviews	106
Freddie Rice	106
Rally and David Greenwell	109
Summary of Background Information.....	110
ETHNOGRAPHIC SURVEY	113
Pele Hanoa.....	114
Wahi Pana in Ka‘ū	114
‘ <i>Ohana</i> Homestead.....	115

Contents

Gathering Plants in the Forest	116
Sugar Plantations.....	116
Concerns and Recommendations	116
John Replogle and Shalan Crysdale, The Nature Conservancy Hawai‘i.....	117
Fencing	117
Access to the Forest.....	118
Water Resources.....	118
Pigs and Hunting	119
Collaboration and Future Management	119
Kalani Decoito and Larry Galban.....	119
Importance of Access	119
The Natural Migration of Pigs.....	119
Protecting Resources for the Community.....	120
How the Land Functions	120
Recommendations and Suggestions	121
Susan Pua.....	121
Kahuku	122
Punalu‘u	122
Suggestions and Recommendations	123
Earnest “Peewee” Breithaupt.....	123
Water Sources	123
Utilizing Natural Resources	124
Accounts of Ka‘ū.....	124
Trails and Cultural Sites	124
‘Alalā.....	125
Management Recommendations	125
Mabel Aulike Kaipo	125
Memories in Waiohinu.....	125
‘Ohana.....	125
Cultural Practices	126
Cultural Sites	126
References to Caterpillars in Ka‘ū	126
Native Birds.....	126
Management Suggestions.....	127
Kilohana Domingo.....	127
Concerns and Recommendations	127
Keola Awong, Laura Schuster, Lora Gale, and Helen Wong-Smith, Hawai‘i Volcanoes National Park.....	128
Kūpuna/Cultural Consultation Group.....	128
‘Alalā.....	128
Management Recommendations	128
Thomas Kaniho.....	129
Kama Dancil, Kamehameha Schools.....	140

Contents

Management Concerns and Recommendations.....	140
Fencing Alternatives	140
Water Resources.....	140
Iwikauikaua Joaquin, Keauhou Bird Conservation Center.....	141
Keauhou Bird Conservation Center	141
‘Alalā.....	141
Suggestions for ‘Alalā Release	143
Summary of Ethnographic Survey.....	143
CULTURAL LANDSCAPE OF THE PROJECT AREA.....	144
Hawaiian Agriculture	144
Gathering of Plant Resources	144
Fresh Water Resources	145
<i>Wahi Pana</i> and Cultural Resources	146
Trails and Access.....	147
‘Alalā	148
Hunting.....	149
Burials	150
SUMMARY AND CONCLUSION.....	151
Cultural Resources, Practices, and Beliefs Identified.....	151
Community Concerns of the Proposed Project.....	151
Lifestyle Changes.....	152
Access for Gathering and Hunting	153
Watershed Management.....	153
Planning Process	154
Recommendations/Mitigations	154
Fencing.....	154
Access	156
‘Alalā Habitat.....	156
Native Plant Restoration.....	156
Protection of Cultural, Historical, and Archaeological Sites	157
Education	157
Collaboration.....	157
Future Research.....	158
Confidential Information Withheld	158
Conflicting Information.....	158
GLOSSARY.....	159
REFERENCES	165

FIGURES

Figure 1. Location of Ka‘ū Forest Reserve on Hawai‘i Island.....	8
Figure 2. USGS map with location of Ka‘ū Forest Reserve.....	9
Figure 3. Aerial photo of the Ka‘ū Forest Reserve.....	10
Figure 4. TMK located within the Ka‘ū Forest Reserve	11
Figure 5. Traditional ecological zones identified by Handy and Pukui (1998).....	51
Figure 6. Location of <i>ahupua‘a</i> in the Ka‘ū Forest Reserve	62
Figure 7. 1928 map showing the <i>ahupua‘a</i> that make up the southern boundaries.....	63
Figure 8. 1928 map showing the <i>ahupua‘a</i> that make up the northern boundaries.....	64
Figure 9. Drawing of <i>hale</i> in Ka‘ū, during Ellis’ trip around Hawai‘i Island, 1823	75
Figure 10. Kuleana awards in Kī‘olokū and Honu‘apo Ahupua‘a, below the Forest Reserve	76
Figure 11. Kuleana awards and grants in Hi‘iona‘ā, Hōkūkano, and Ka‘alāiki Ahupua‘a	77
Figure 12. Kuleana awards in Hīlea Nui and Hīlea Iki Ahupua‘a, below the Forest Reserve.....	78
Figure 13. Kuleana awards and grants in Nīnole and Wailau Ahupua‘a.....	79
Figure 14. Kuleana awards for <i>mauka</i> Punalu‘u Ahupua‘a, below the Forest Reserve	80
Figure 15. Early map of Ka‘ū (Dodge 1894).....	82
Figure 16. Map of Ka‘ū showing early land divisions (Lyman 1879)	83
Figure 17. Map of the Ka‘ū Forest Reserve (Wall 1906).....	84
Figure 18. TMKs where previous archaeological work was conducted.....	93
Figure 19. Archaeological surveys in HAVO area.....	96
Figure 20. Location of <i>heiau</i> in Ka‘ū as documented by Stokes.....	98
Figure 21. 1928 map showing the location of the Kahuku-Ainapō Trail	103
Figure 22. 1928 Honuapo quadrangle map illustrating the Kahuku-Ainapō Trail	104
Figure 23. Aunt Pele Hanoa	115
Figure 24. Ka‘ū Forest Reserve.....	120
Figure 25. Uncle Tommy Kaniho (far right) with John Replogle and Nohea Ka‘awa.....	130
Figure 26. Iwikauikaua Joaquin at the Keauhou Bird Conservation Center	142
Figure 27. One of the <i>‘alalā</i> at the Keauhou Bird Conservation Center	142

TABLES

Table 1. <i>Ahupua‘a</i> within the Ka‘ū Forest Reserve	60
Table 2. Previous Archaeological Investigations in Ka‘ū (complete citations in references).....	91
Table 3. Site Types Potentially Found in <i>Mauka</i> Ka‘ū (Burrell et al. 2009).....	97
Table 4. <i>Heiau</i> in Ka‘ū	99
Table 5. List of Organizations and Individuals Contacted for Interviews.....	113
Table 6. Summary of Concerns and Recommendations.....	152

INTRODUCTION

At the request of the Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW), Keala Pono Archaeological Consulting, LLC conducted a Cultural Impact Assessment (CIA) for the Ka'ū Forest Reserve on the island of Hawai'i. The proposed project consists of habitat management and restoration to benefit endangered forest birds including the 'alalā, or Hawaiian crow (*Corvus hawaiiensis*). Proposed management includes fencing a portion of the area to exclude ungulates (feral pigs, mouflon sheep), removal of ungulates from within fenced areas, weed control, predator control, rare and native plant restoration, monitoring, 'alalā reintroduction and management infrastructure (e.g., helicopter landing zones, campsites). Other aspects of the proposed project include outreach and education, community consultation and enhancement of public access to the Reserve (e.g., development of hunter access, trails and other recreational amenities such as cabins and/or campsites).

This CIA is part of a larger effort that DOFAW is undertaking to help with the management of the Ka'ū Forest Reserve. At the time this CIA was being conducted, DOFAW was also working on their Ka'ū Forest Management Plan (draft 2011) to be included in the larger Environmental Assessment. Because DOFAW has already compiled a wealth of information regarding the physical description of the project area (geology, soils, climate, rainfall, water resources), native ecosystems, wildlife, land use history, and threats, the reader is referred to this document for in-depth information regarding these categories.

The primary needs for developing the Ka'ū Forest Management Plan include:

- * Need to maintain and restore a key watershed
- * Need to preserve a unique ecosystem with critically endangered plants and animals
- * Need to perpetuate natural resources vital to Hawaiian culture and practices
- * Need for a suitable site to reintroduce the 'alalā or Hawaiian crow into the wild
- * Need to provide for continued and expanded public use, especially for residents of the Ka'ū District

Based on the needs listed above, the purposes of the project include:

- * Develop management actions for general and specific areas that protect and restore the watershed and native species as vital natural and cultural resources. These actions include fencing and ungulate removal from the most critical area(s), predator control, invasive plant removal and control, and native plant restoration.
- * Reintroduce the 'alalā to the Ka'ū Forest Reserve.
- * Enhance public access to Ka'ū Forest Reserve through development and maintenance of public access roads, and other infrastructure (trails, cabins and/or campsites, etc.).
- * Conform with the purpose of the Forest Reserve System and the Ka'ū Forest Reserve, in particular, as stated in Hawai'i Revised Statutes (Chapter 183) and associated Hawai'i Administrative Rules (Chapter 104), to protect, manage, restore, and monitor the resources of forest reserves for the public benefit, particularly water resources.

Based on the purpose and needs of the project, the following management actions will be undertaken throughout or in selected parts of the Ka'ū Forest Reserve as part of a 10 to 20 year management plan for the area:

- * Fence management areas and remove feral and introduced ungulates from within fenced management areas for watershed and native ecosystem health.

- * Remove high priority non-native, invasive plants.
- * Implement non-native predator control.
- * Restore *'alalā* to the wild.
- * Continue long-term forest bird surveys to assess changes in bird population and distribution.
- * Survey and inventory rare native plants and animals (including insects and snails).
- * Improve habitat and recover rare and endangered plants by propagation and reintroduction of plants into appropriately fenced and protected habitat.
- * Maintain existing public access roads and develop new routes to increase access, particularly across private and state-leased lands below the Reserve.
- * Continue to facilitate public hunting in the Reserve by developing new access routes to increase hunter access.
- * Develop trails and recreational amenities. Public input on the location and nature of specific trails, picnic areas and camping areas is needed to determine the best location for potential users.
- * Hire outreach staff and work with partners to provide outreach and education (e.g., volunteer service trips, student internships, and school programs) for the community to enhance public understanding of the Reserve's unique native forest.
- * Respond to fires, as needed.
- * Monitor the forest for insects and disease and conduct other management as required (control of damaging insects, slugs, and/or plant disease).
- * Consider environmentally and socially appropriate ways to make Ka'ū Forest Reserve economically self-supporting to support protection and management of the Reserve.
- * Work with adjacent private landowners on cooperative management to make better use of limited funding and resources and more effectively manage interconnected landscapes.

Scope of Work

Based on the CIA guidelines created by the Office of Environmental Quality Control, Keala Pono has prepared a report for the Ka'ū Forest Reserve documenting a review of literature, maps, and archaeological studies of the area and ethnographic interviews related to traditional cultural practices and land use there. Although the proposed project will occur over a smaller portion of the Forest Reserve (exact acreage is still to be determined); the CIA addresses cultural resources in the broader Forest Reserve area. DOFAW is planning on using information from the CIA for future management planning efforts for the entire Forest Reserve. Contents of this CIA include:

1. An examination of historical documents, Land Commission Awards, Royal Patent Grants, native and foreign testimonies, and historic maps and photos
2. A review of existing archaeological information
3. A compilation of Native Hawaiian oral traditions including chants, stories, mythologies, place names, and proverbs
4. Community consultation/ethnographic interviews
5. A summary of culturally valuable native natural resources
6. An assessment of impacts and mitigation recommendations

The report begins with a description of the project area and its natural landscape. Cultural traditions such as *mo'olelo*, *'ōlelo no'eau*, *oli* and *mele* are presented next. Following this section is a summary of the traditional land uses of Ka'ū and then a historical overview of the changes in land use, which includes historical maps and visitor recollections. The next section provides details of the archaeological resources in the Reserve. Summaries of interviews are presented next, followed by the Cultural Impact Assessment. Project results are summarized and recommendations

are made in the final section. Hawaiian words are defined in a glossary, and appendices at the end of the report present more information on place names as well as documents associated with the ethnographic survey.

Cultural Impact Assessment Standards

The structure and content of this Cultural Impact Assessment is in compliance with several guiding documents including: *The Hawai'i Environmental Council's Guidelines for Assessing Cultural Impacts* (Appendix B), *A Bill for Environmental Impact Statements* (Appendix C), and *Act 50* (Appendix D). This Cultural Impact Assessment meets the standards for all of the above documents, and therefore is in accordance with Chapter 343, HRS.

METHODS

This section outlines the methods used in archival research and community consultation as well as efforts to train student interns during this project.

Archival Research

Research was conducted at relevant institutions, and personal collections of researchers and ethnographic informants were utilized as well. Sources included historic maps and photos, accounts from early visitors, Hawaiian language newspaper articles, *mele*, *oli*, *'ōlelo no'eau*, various collections of *mo'olelo*, and archaeological reports. Institutions and sources used include:

- * State Historic Preservation Division Library, Hilo – Archaeology reports, maps
- * Hawai'i Volcanoes National Park Archives and Library – Archaeology reports, maps, old photos
- * DOFAW office – Files, reports, maps
- * Bishop Museum Archives and Library – Hawaiian Ethnographic Notes including Mary K. Pukui translations of Hawaiian newspaper articles of 1800s, photos, tape recordings, interviews, maps
- * Hawaiian Mission Children's Society Library – Missionary journals and letters mentioning Ka'ū
- * UH Hilo Hawaiian Collection – Journals, books, maps, reports
- * State Archives – Photos, records, journals
- * State Survey Office – Historic maps
- * Translated Native Hawaiian Sources of 1800s – Fornander, Kamakau, 'Ī'ī, Kepelino, Malo
- * Hawaiian Language Newspapers – Land use, place names, *mo'olelo*

Although a considerable amount of research was conducted at the above repositories, it should also be emphasized that by no means does this study represent an exhaustive examination of the Ka'ū Forest Reserve and its surrounding areas. There is still a wealth of information that remains to be researched and analyzed, especially in un-translated Hawaiian language newspapers and Māhele documents (Boundary Commission testimonies) and in the memories, thoughts, and voices of our *kūpuna*. Additionally, because the project area was so large (spanning over 40 *ahupua'a*, and a land area of more than 60,000 acres) this study could not go into great detail for every *ahupua'a*, *mauka* to *makai*, located within the Ka'ū Forest Reserve. So in this regard, this study can be considered more of an overview of the *mauka* cultural and natural landscapes of Ka'ū, and a compiling of sources that are currently available for this area. Thus, the reader is encouraged to expand upon the resources and information compiled in this document to further broaden our *'ike* (knowledge) and understanding of Ka'ū. This study, it is hoped, will motivate other scholars, students, and lifelong learners to research, document, and continue to pass on the stories and memories of this most special *wahi pana*.

Community Consultation

By and large, the most important feature of a CIA study is the consultation process, which is the foremost method used to gather information on how and why communities revere certain places. Consultation with communities facilitates meaningful and effective communication and participation, and can produce constructive management and preservation recommendations.

The ethnographic survey was performed during September 2011 and January 2012. As a multi-phase process, the study consisted of conducting oral history interviews, transcribing the digitally recorded interviews, analyzing the oral history data, and preparing of the report. Personnel included Kelley Uyeoka, MA, lead ethnographer, Li‘ula Mahi, BA, ethnographer, U‘ilani Macabio, BA, ethnographer, and Aoloa Santos, ethnographer.

Scoping and Interviewee Selection

Scoping for this project began by contacting knowledgeable individuals, agencies, and groups that are recognized as having a cultural, historical, genealogical, or managerial connection to the project area in Ka‘ū. Our initial scoping methods included emailing and mailing out letters and figures, contacting individuals on the phone, or meeting with people in person to inform them of the project (see Appendix E).

Knowledgeable consultants were selected because they met one or more of the following criteria: 1) was referred by Keala Pono Archaeological Consulting, LLC or DOFAW; 2) had/has ties to the project area or vicinity; 3) is a known Hawaiian cultural resource person; 4) is a known Hawaiian traditional practitioner; or 5) was referred by other cultural resource people. Consultants were selected because they are knowledgeable about the project area. All of the participants agreed that many of the *kūpuna* who knew about Ka‘ū have passed away, thus resulting in the increased reliance on literature and other sources of information. A list of organizations and individuals were contacted and 16 interviewees were identified and consulted.

Ethnographic Interviews

Keala Pono’s ethnographers have an intimate knowledge of Hawai‘i’s history, culture, and “local ways” to better interact with the community in culturally appropriate ways. As always, interviews were conducted in a respectful and professional manner to the highest current oral history standards. Standardized ethnographic instruments were used to document the interview process, generate content, and secure authorization to use collected material. With the informant’s permission, we: 1) recorded the interviews, 2) transcribed and/or summarized them, 3) presented them to the informant for editing/concurrence, and 4) included these interviews and summary analyses in the final report.

Semi-structured interviews were the preferred interview technique for this project because they are open-ended, but follow a general script that covers a list of topics. Information gathered during the initial phases of archival research and scoping for this project was utilized to construct the open-ended questions for the semi-structured interviews. The interview questions were derived from the main themes that the researcher felt were the most important to attain a comprehensive understanding of the past, present, and future knowledge of the project area. The main themes that guided our consultation efforts included:

- * *Mo‘okū‘auhau* – genealogy and family history
- * *‘Ohana* and individual ties to the land
- * *Mo‘olelo* and traditional accounts – including place names, *mele*, *oli*, *hula*
- * Cultural practices – in the past and in the present
- * Natural resources – gathering of plants, water resources
- * Cultural and historical sites – in the immediate site and the surrounding areas
- * Historical information – historical events, people
- * Knowledge sources
- * Impacts and mitigation recommendations
- * Preservation and management concerns and recommendations

Interviews were taped using a digital MP3 recorder. During the interviews, consultants were provided with the Agreement to Participate/Informed Consent Form (Appendix F) and briefed on the purpose of the ethno-historical study. Research categories were addressed in the form of open questions (Appendix G), which allowed the consultant to answer in the manner that he/she was most comfortable. Follow-up questions were asked based on the consultant's responses or to clarify what was said.

Interview transcriptions and summaries were completed by reviewing the audio recordings and interview notes, then typing up interview summaries. A copy of the interview summaries were sent to each participant for review and participants were asked if they had any corrections, additions, or deletions to their interview summaries, as well as if they had any objections to the release of the document. When the interview summaries were returned, they were corrected to reflect any changes made by the participant. The ethnographic analysis process consisted of examining each interview summary and organizing information into research themes, or categories.

Student Intern Training

As an additional component of this project, DOFAW and Keala Pono supported three student/young professional interns who were mentored and trained to conduct portions of the background research, ethnographic interviews, and report writing phases of the project. The purpose and goal of incorporating an intern training component was to increase the number of Native Hawaiians and *kama'āina* in the cultural resource management field through scientific and cultural mentoring, education, and field experiences.

Interns worked closely with our experienced staff and were exposed to the scientific and technical side of studying and documenting cultural landscapes while at the same time experiencing how to conduct cultural resource management projects in a *pono* manner. They gained leadership, practical, professional, and academic experience and knowledge by working with a wide range of resource management professionals during the project. Additionally, this hands-on, project-based research experience provided them with the resources and motivation to continue their academic and professional training within the anthropology and archaeology disciplines.

BACKGROUND

This chapter presents information on the natural and cultural landscapes of the project area. Summaries of previous archaeological work and ethnographic interviews are included as well.

Project Area and Natural Landscape

Located in the district of Ka‘ū on the southeastern side of Hawai‘i Island (Figures 1–3), the Ka‘ū Forest Reserve lies adjacent to the Kahuku section of the Hawai‘i Volcanoes National Park, on the Mauna Loa Volcano. The nearest towns are Pāhala, Nā‘ālehu and Wai‘ōhinu. The project area consists of approximately 61,641 acres within TMKs (3) 9-7-001:001, 009, 013, 014, 015, 016, 017, 018, 019, 020, 021,022; (3) 9-6-006:009, 010, 015, 018; and (3) 9-5-015:003 [portion], situated between 2,000 and 7,000 feet (610–2,134 m) in elevation (Figure 4). The average temperature ranges from 55° to 75° Fahrenheit (13–24° C), and rainfall ranges from 60 to 120 inches (1,500–3,000 mm) per year (Juvik and Juvik 1998).

The Ka‘ū Forest Reserve consists almost entirely of native ecosystems and is the largest expanse of intact native forest remaining in the Hawaiian Islands. According to DOFAW’s Ka‘ū Forest Reserve Management Plan (2011 Draft), most of the Reserve falls into the highest quality native ecosystem vegetation classification, with minimal disturbance and low levels (less than 10%) of non-native plants.

Water Resources

The water sources in the Reserve are considered one of its most vital resources. The watershed of the Ka‘ū Forest was recognized early on as a resource that needed to be protected and managed. The following is a description of the importance of the Ka‘ū watershed:

The Reserve was originally established in 1906 to protect the water supply of the district, and the forest continues to provide important watershed services for the community. Native Hawaiians recognized the importance of forests in water production and water quality, as reflected in the Hawaiian proverb, “Haihai ka ua i ka ulu la au” (The rain follows after the forests). Early foresters also recognized the importance of Hawaiian forests as watershed. Ralph Hosmer, First Territorial Forester stated “In Hawai‘i, the most valuable product of the forest is water, rather than wood.”

Despite the large amount of rain in the upland forests of Ka‘ū, there are no perennial streams because the water is absorbed quickly into the highly permeable lava flows (Davis and Yamanaga 1966). Surface water reaches the sea only after periods of heavy rainfall and flooding. The water absorbed into the lava sinks rapidly to the basal water table where it either floats on salt water or is perched on impermeable ash beds and becomes ground water. Some basal water seeps out at springs at or near sea level along the coast (Stearns and MacDonald 1946 in DOFAW 2011).

There are eight watershed basins in the Ka‘ū Forest Reserve. The following list provides the names of the watershed basins and the streams that stem from these basins (DOFAW 2011):

- * Hi‘onamoa Gulch
Streams – Hi‘onamoa, Mo‘a‘ula, Uwēwale, Ka‘ala‘ala, Pā‘au‘au, Waiakaloo, Kauhuhuula, Peleli‘ili‘i, Waihaka, Keāiwa, Pi‘ikea, Waloala, Makakupu, Punalu‘u

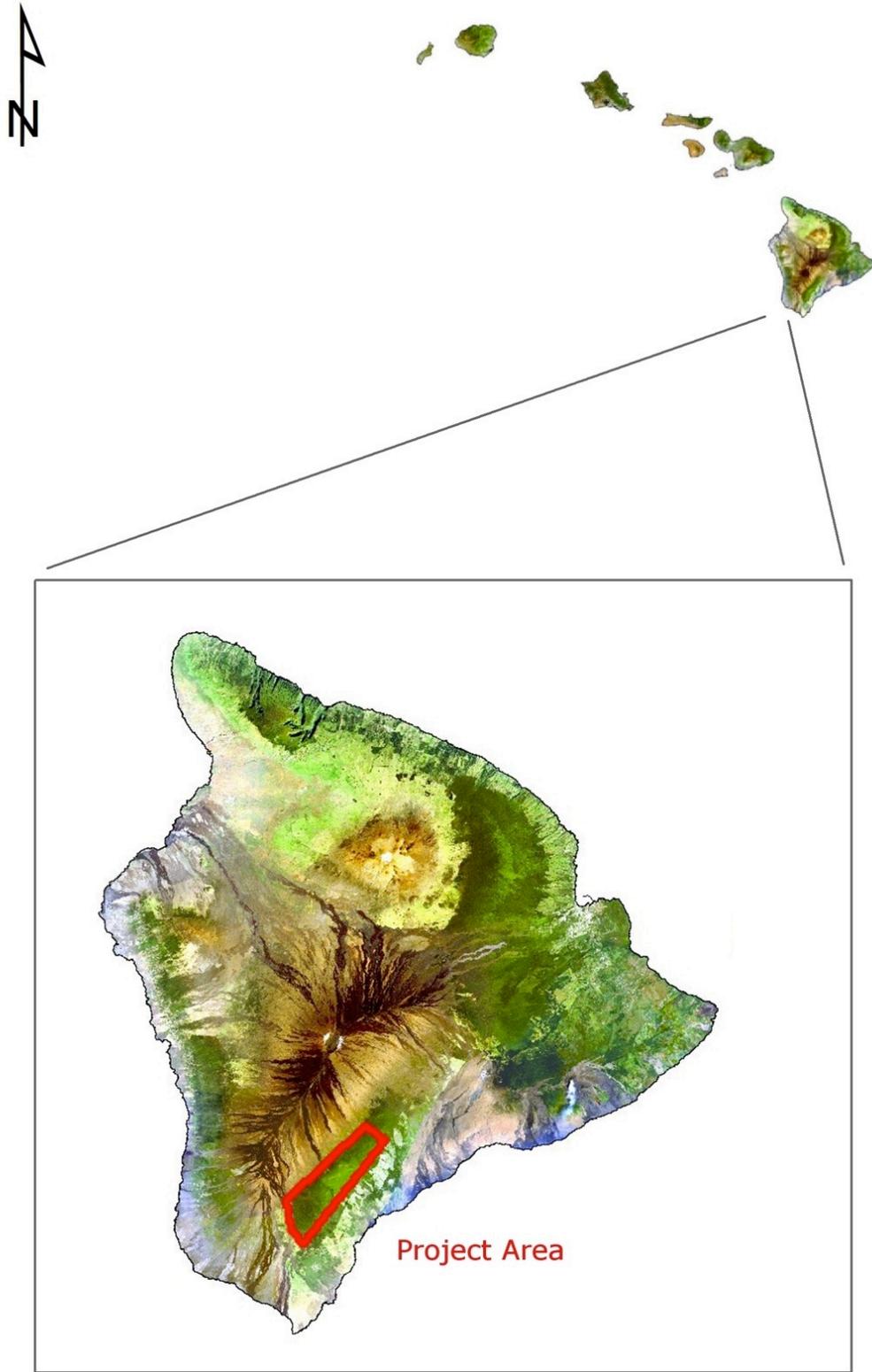


Figure 1. Location of Ka‘ū Forest Reserve on Hawai‘i Island.

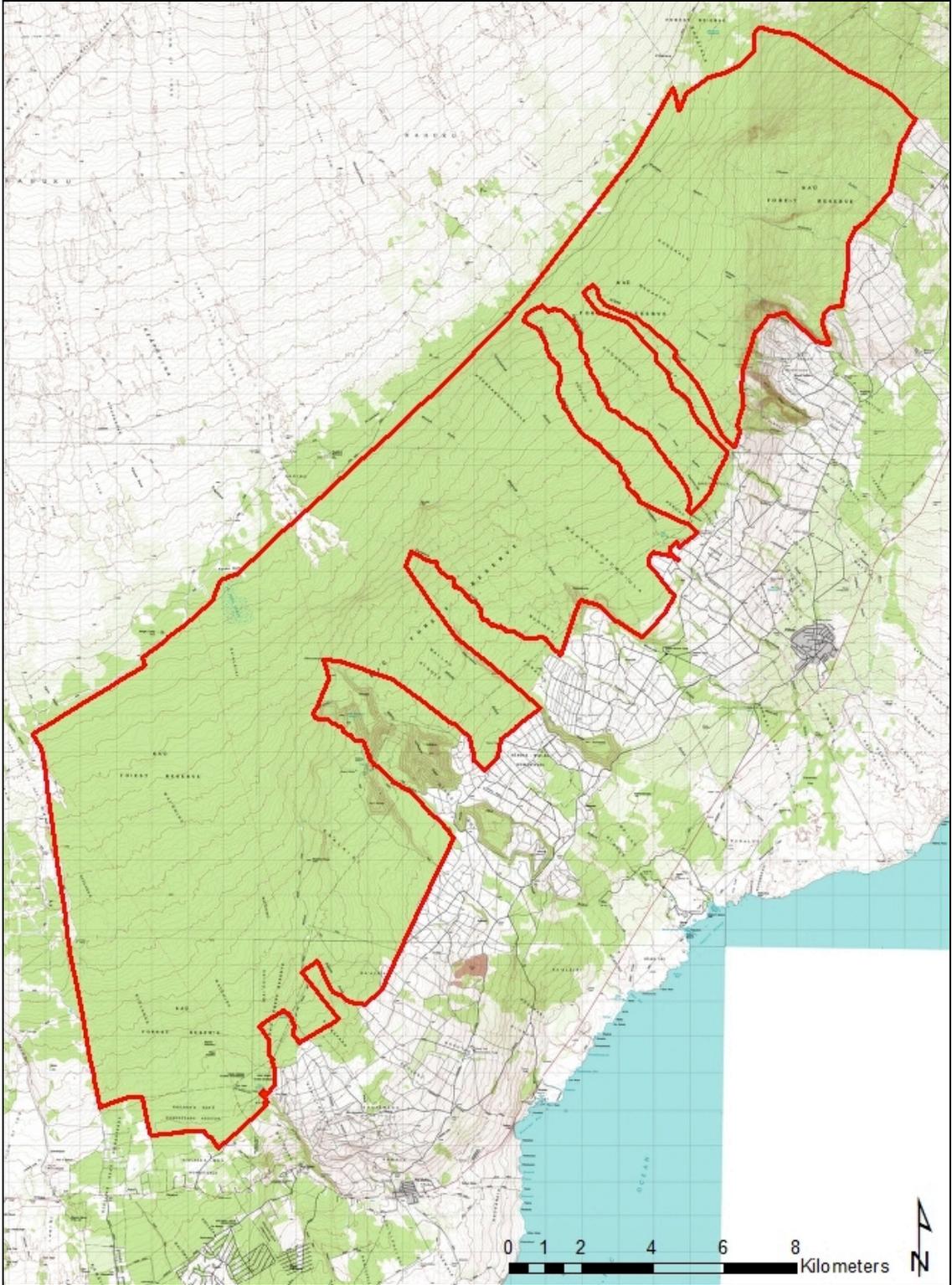


Figure 2. USGS map with location of Ka'ū Forest Reserve.

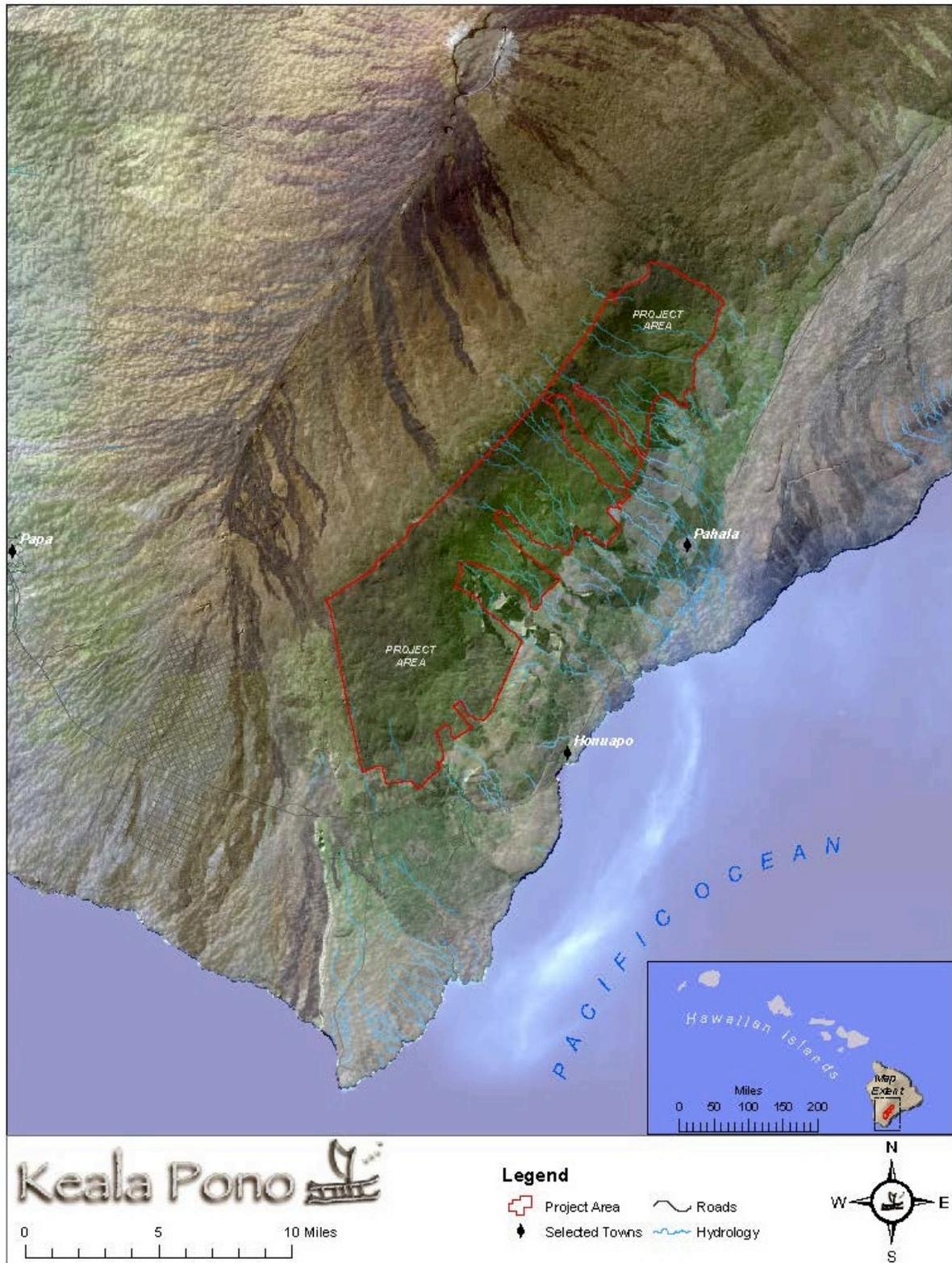


Figure 3. Aerial photo of the Ka'ū Forest Reserve.



Figure 4. TMK located within the Ka'ū Forest Reserve.

- * Ninole Gulch
Streams – Nīnole
- * Hīlea Gulch
Streams – Hīlea
- * Honuapo
Streams – Honuapo
- * Kaunāmano
Streams – Kaunāmano
- * Nā‘ālehu
Streams – Alapai Gulch
- * Wai‘ōhinu
Streams – Kaluapuhi, Wai‘ōhinu
- * Kawela
Streams – Kaalualu

Native Birds of the Ka‘ū Forest

Honeycreepers and ‘*alalā* are important native birds that inhabit the Ka‘ū Forest Reserve. They are briefly described below.

Honeycreepers and Other Birds

The Ka‘ū Forest Reserve provides habitat for six honeycreepers (*Subfamily Drepanidinae*) endemic to the Hawaiian Islands. These include three federally listed endangered species: ‘*akiapōlā‘au* (*Hemignathus munroi*), Hawai‘i creeper (*Oreomystis mana*), and Hawai‘i ‘*ākepa* (*Loxops coccineus*). The non-endangered honeycreepers found in the area include: Hawai‘i ‘*amakihi* (*Hemignathus virens*), ‘*i‘iwi* (*Vestiaria coccinea*) and ‘*apapane* (*Himatione sanguinea*). Other native birds reported from the project area include the federally endangered ‘*io* or Hawaiian hawk (*Buteo solitarius*), the Hawai‘i ‘*elepaio* (*Chasiempis sandwichensis*), and the ‘*ōma‘o* or Hawaiian thrush (*Phaeornis obscurus*). Native forest birds are primarily found in the upper elevations of the Forest Reserve (above 4,000 ft. (1,219 m) in elevation, where lower numbers of mosquitoes reduce the incidence of diseases such as avian malaria and pox.

‘Alalā

The Ka‘ū Forest Reserve also provided habitat for the ‘*alalā*, or Hawaiian crow. The ‘*alalā* is endemic to the island of Hawai‘i, and was restricted to the dry and mesic forests in the western and southern portions of Hawai‘i Island. The species is associated with ‘*ōhi‘a* (*Metrosideros polymorpha*) and ‘*ōhi‘a-koa* (*Acacia koa*) forests with an understory of native fruit-bearing trees and shrubs.

A review was undertaken to look for references to the ‘*alalā*. Of the *mele*, *mo‘olelo*, and historical references that were reviewed, the ‘*alalā* was only mentioned three times. The earliest mention was in the Hawaiian language newspaper, *Ka Nūpepa Kū‘oko‘a*, Puke 15, Helu 39, on September 23, 1876:

Ua hoi mai nei ke Kanikela Farani mai kana huakai imi i na mea kaulana o Hawaii nei no ka hoikeike ana aku. He eono paha ona mau hebedoma i noho pu aku nei me ke Kauka Farani ma na kualapa o Hualalai. A iloko o ia manawa, ua ohi mai oia he elua haneri ano ili manu, mailoko mai o na manu Iiwi, Amakihi, Omao, Palila, Apapani, Elepaio, Ou, Oo, Akialoha, Kolea, Alala, Io a me ka Nene. Ua makemake nui oia e loaia ona Mamo, aohe nae hoi he loaia iki.

Consul Farani just returned from his trip to search for the famous things of Hawaii for the purpose of showcasing them. He has about six hebedoma that lived with him and the Doctor Farani at the ridges of Hualalai. And within that time, he collected two hundred kinds of bird skin from the birds Iiwi, Amakihi, Omao, Palila, Apapani, Elepaio, Ou, Oo, Akialoha, Kolea, Alala, Io, and the Nene. He really wanted to get the Mamo but he didn't get it at all.

Historian David Malo also briefly mentions the 'alalā. According to Malo, "The *alala* (*Corvus hawaiiensis*) is another species, with a smaller body, about the size perhaps of the female of the domestic fowl. Its feathers are black, its beak large, its body is used for food. This bird will sometimes break open the shell of the water-gourd (huewai). Its feathers are used in *kahili* making. This bird is captured by means of the pole or snare." (1951:38)

Lastly, David Kalākaua writes about the 'alalā in his book, *The Legends and Myths of Hawaii: the Fables and Folk-lore of a Strange People*:

The *kahu* of the king first met the princess and her companion, and, when requested by him to favor his royal master with a visit, the princess informed him that she might possibly comply with his request the night following. "If I come," she said, "I will give you warning." "Now, listen and heed," she continued. "If you hear the voice of the 'a'o I am not in its notes, and when you hear the caw of the 'alalā I am not in its voice. When the notes of the 'elepaio are heard I am getting ready to descend. When you hear the song of the 'apapane I shall have come out of my house. Listen, then, and if you hear the 'i'iwipōlena singing I am outside of your house. Come forth and meet me.

And so it came to pass. In the *kihi*, or first watch of the evening, resounded the cry of the 'a'o, in the second watch the caw of the 'alalā, at midnight the chirruping of the 'elepaio, in the *pili* of the morning the song of the 'apapane, and at daybreak the voice of the 'i'iwipōlena. Then a shadow fell on the door, "and we were enveloped," said the king, "in the thick fog, and when it cleared away the princess was seen in her glorious beauty, borne on the wings of birds." The name of the divine being, he said, was Laieikawai." (Kalakaua 1990:459–460)

Additional information on traditional practices regarding native birds is further discussed in the Traditional Land Use section of this report.

Cultural Background

To fully understand Hawaiian epistemology or the native worldview, one must take a step back into the mindset of the *kūpuna*. This mindset is one that has evolved and developed over centuries of being intimately in tune with the natural environment from the heavens above to the depths below. In contemporary times, we must now try to decode and decipher the environment around us to get a glimpse of how *nā po'e kahiko* understood their universe. One piece of evidence that provides insight into how they saw the Hawaiian landscape is through the *mo'olelo*, *ōlelo no'eau*, *oli*, *mele* and place names that we still have a record of today. Every place, feature, resource, and atmospheric element in the Hawaiian universe was either utilized or recognized by *nā po'e kahiko*, and described and recorded in the place names, *mele*, and *oli* they composed. By carefully and systematically weaving them all together, the traditions and history serve as clues of the past.

***Mo'olelo* Associated with Ka'ū**

Mo'olelo have long been valuable sources for transferring cultural knowledge through generations. According to Mary Kawena Pukui (1995), "Storytelling served as a principal source of

entertainment while simultaneously providing instruction in the many aspects of life - ancestry, history, religion, human relations, crafts, and the natural world.” Bush (1994) explains that, “The stories provide the younger generation with the reason to uphold our intimate and fond attachment to our revered land, notable sites and prominent heroic deeds of our ancestors.” Overall, Pukui states that the information and values that are found in *mo‘olelo* “remain meaningful and necessary for people in Hawai‘i today, whether of Polynesian ancestry or not” (Pukui and Green 1995:XII). The following *mo‘olelo* introduce many prominent people, places, features, and traditions of the Ka‘ū district.

Nī‘auepo‘o

Pukui (1933:179–185) documented the following Ka‘ū legend of the origin of the coconut and Ka‘ū place name, Māniana. This legend involves Kū and Hina who are deities identified with fishing, as well as the coconut and eel which are *kinolau* (body forms) of Kū (Tangarō 2005). The legend of Nī‘auepo‘o takes us on a journey from the district of Ka‘ū to the distant land known as Kahikinui‘āle‘ale‘a. With the guidance of his ancestor, Nī‘auepo‘o travels to Kahikinui‘āle‘ale‘a to reunite with his father. While living there, Nī‘auepo‘o is misidentified by his father and killed as a result. In his spirit form, he is eventually recognized as the son of Kūalakai and through ritual is restored to life. The legend of Nī‘auepo‘o is as follows:

Hina was the mother of Nī‘auepo‘o, Kūalakai the father. Kū came from Kahikinui‘āle‘ale‘a to Māniana in Ka‘ū and lived with Hina. At length he said to his wife, “I am going back to Kahikinui‘āle‘ale‘a from whence I came. When our child is born, if he asks for me, give him these tokens by which I may know him - my red helmet, my red feather cape, and my canoe with red sails. Send him to me in this canoe and in this only.”

Hina’s son was born and named Nī‘auepo‘o. As he grew up, he noticed that the other boys had fathers, and he asked Hina where his own father might be. “Alas! He is dead; only we two are left,” she told him. He persisted in asking, and at length she told him of his father in Kahiki and showed him the tokens. When he refused to go in his father’s canoe, she went to consult her parents about the boy’s wish to travel to the land of his father. They advised her to call upon their ancestor Nuiolahiki to conduct the boy and gave him two gifts, an arrow and a bow, to take with him to Kahiki. In the morning at daybreak Hina called upon her divine ancestor.

E Niuolakahiki	O life-giving coconut
I kupu i Kahiki	That budded in Kahiki
I mole i Kahiki	That rooted in Kahiki
I kumu i Kahiki	That formed a trunk in Kahiki
I lau i Kahiki	That bore leaves in Kahiki
I hua i Kahiki	That bore fruit in Kahiki
I o‘o i Kahiki ē!	That ripened in Kahiki!

Instantly, a coconut spouted from the ground in front of her door and grew into a tree with two coconuts upon it, in which she recognized her ancestor. Waking her son, she told him to sit among the leaves of the tree and hold on tight and not to fear. The boy took his bow and arrow, seated himself among the leaves, and held tight. Higher and higher grew the tree until the leaves looked like a mere dot in the sky. The boy was frightened and called to his mother, “O Hina! Hina! My hands and feet are numb with fear!”

Hina called back, "O life-giving coconut, hold your grandchild fast!" Then the boy lost his fear through the *mana* of the divine ancestor. There was now no land in sight. Higher and higher grew the tree, and again fear gripped the boy. He called, "O Hina! Hina! My hands and feet are numb with fear!" Hina, anxiously listening, heard the voice of her son faintly and called back, "O life-giving coconut, hold fast to your grandchild!" Up and up they went; then at last the tree bent over toward Kahiki'āle'ale'a. In alarm the boy cried out, "O Hina! Hina! My hands and feet are numb with fear. I am losing my grip and shall fall!" Very faintly came the words to Hina's ears, and she called back, "O life-giving coconut, take care of my son!" Ever downward bent the tree until its leaves rested on the land of Kahikinui'āle'ale'a. Then, assuming human form, the ancestor said to the boy, "Guard well your grandparents' gifts; the arrow will lead you where ever you wish to go."

Nī'auapo'o walked along the shore until he came upon a group of boys who were playing and shouting. "Who are you and where do you come from?" they cried. I am Nī'auapo'o and I live in this neighborhood," he replied. "No, you do not," a few retorted. "We live hereabouts ourselves, and we have never seen you before." "Come and join us in our play," invited others. So Nī'auapo'o became one of the merry, shouting boys.

Someone proposed a contest of skill, and they fell to work to make a large mound of sand to mark a course for surfing. They paddled out on their boards to meet the surf and turned shoreward, each trying to keep in line with the mound they had built. Those who kept in line surfed again and again. Those who missed went ashore to watch the others. The game continued until Nī'auapo'o alone was left the victor. So it was with every game proposed - boxing, spear-throwing, footraces, *'ulu maika* (bowling) - Nī'auapo'o excelled in all.

One of the boys in the group, named Uhu'ula, admired his skill and asked Nī'auapo'o to become his friend, and the two boys strolled away together. Nī'auapo'o now remembered his arrow, and he sent it flying, along with words, "Cry 'nē!' over the bald-head, 'nē!' over the drooping-lidded, 'nē!' over the one eyed, 'nē!' over the hunchback, and lead me to the place where I belong!"

The arrow sped on, whistling over the baldhead, the drooping-lidded, the one-eyed, and flying over the head of the hunched backed woman who stood outside of a large grass house. It entered the door of the house, where a young girl caught it quickly, rolled it in a piece of fine *kapa*, and held it firmly in her hand. She looked up as the shadow of the two boys in the doorway fell across the mats.

"Have you seen my arrow?"

"No, I have not seen it."

"I saw it come in here."

"Perhaps you are mistaken; there is no arrow here."

"Let me call it, and it will answer."

"Call it, then."

So, Nī'auapo'o called, "O arrow of my grandfather, where are you?"

"Here!" answered the arrow.

"Come to me!"

The arrow moved to obey, but the girl held on tight, hoping that the boys would enter the house after the arrow, and finally she invited them to do so. As soon as they were inside, the hunchback, at a sign from her mistress, closed the door, and the girl took Nī'auapo'o for her husband.

Now, the girl was the daughter of Kūalakai by another wife, one who lived here in Kahikikū, and the chief had promised himself that when his son came from Hawai‘i, this girl was to become his son’s wife, and he had set two old men to watch at the beach for the coming of the canoe with the red sail. When he heard that the girl had already taken a husband, he was very angry, and proceeding to the house of the girl and addressing Nī‘auepo‘o, he asked, “Who are you?”

“I am Nī‘auepo‘o, son of Hina and Kūalakai.”

“If you are indeed Nī‘auepo‘o, where are the red helmet, the red feather cape for your shoulders, the canoe with the red sail, and my sacred canoe?”

“Those I left with my mother in Hawai‘i.”

“You are an imposter and shall die, both you and your friend here!” The two boys were seized and bound, and when the *imu* was prepared, they were killed and baked therein.

That night a great rainstorm swept over the land, washing away leaves, stones, charcoal, bodies, and all, washing them out of the *imu* into the sea. There Niuolahiki in this eel form took charge of the bodies of the boys and carried them to the gods of the sea, where they came to life again, Nī‘auepo‘o in human form and Uhu‘ula in the form of a red fish.

Three nights later, the two guards watching at the shore for Nī‘auepo‘o to arrive by canoe saw a handsome youth rise out of the sea and come to the shore. Observing a fine paved walk leading to a well-built house by the shore, he called, “O Kahikiloa! O Kahikipoko! For whom was this walk made?” And they both answered, “For Nī‘auepo‘o.”

“First they kill Nī‘auepo‘o, and then they say that the walk is made for him!” And stepping boldly upon the walk, he went toward them.

Seeing the bathing pool beside the house, he said, “O Kahikiloa! O Kahikipoko! Whose bathing pool is this?”

“It is Nī‘auepo‘o.”

“They have killed Nī‘auepo‘o, and yet they say that this is his bathing pool!” Plunging into the water, the youth bathed into the pool. Pointing then to a loincloth suspended from the overhanging bough of a tree, he said, “O Kahikiloa! O Kahikipoko! Whose loincloth is this?”

“It is for Nī‘auepo‘o.”

“They have killed Nī‘auepo‘o and yet they say that this is his loincloth!” And he wound the cloth about his loins.

At the door of the house, he paused and said, “O Kahikiloa! O Kahikipoko! Whose water gourd is this?”

“It is for Nī‘auepo‘o.”

“They have killed Nī‘auepo‘o, and yet they say that this is his water gourd!” And he drank from the gourd.

“O Kahikiloa! O Kahikipoko! Whose drum is this?”

“It is for Nī‘auepo‘o.”

“They have killed Nī‘auepo‘o, and yet they say the drum is for Nī‘auepo‘o!” And he sat and continued drumming upon it until it grew late.

“O Kahikiloa! O Kahikipoko! Whose sleeping mats are these?”

“They are for Nī‘auepo‘o.”

“They have killed Nī‘auepo‘o, and yet they say that these mats are for Nī‘auepo‘o!” And he lay down on the mats.

“O Kahikiloa! O Kahikipoko! Whose sleeping *kapa* are these?”

“They are for Nī‘auepo‘o.”

“They have killed Nī‘auepo‘o, and yet they say that these *kapa* are for him!” And he drew the *kapa* over himself.

“Wake me early, O Kahikiloa and Kahikipoko, that I may depart before the sun is warm.” In the morning they wakened him early, and he went away into the sea.

For four nights, the father of Nī‘auepo‘o heard the sound of his son’s drum and was uneasy. He called the watch keepers and heard the story from them. Then he summoned two prophets and asked them to see what being it was who came up each night out of the sea and beat upon his son’s drum, drank from his son’s gourd, slept upon his son’s sleeping mats, and covered himself with his son’s sleeping *kapa*.

The prophets prayed and declared to him that it was no other than his own son, who had come on the back of his ancestor Niuolahiki to seek his father. In order first to appease the ancestor, he must prepare gifts of a pure black pig a fathom in length, black ‘*awa* drink, a red and white fish, and take them to the sea and call upon Niuolahiki. If he was willing to forgive the chief, he would arise in his eel body and eat the offering; then he would not fight against him when the chief endeavored to catch his son. Next, instructed the prophets, when his son had come up into the house, he should take ten long nets and surround the house and then offer to him exactly the same food which had been given to his ancestor, without varying it a bit. If he varied it, there would be trouble.

The chief sent men to carry out the prophets’ charge. The ancestor rose from the sea and ate the offering. At night the nets were laid, and the chief and his men hid in the sand before the youth appeared.

After the sun was set, the boy came up out of the sea, and his feet touched the land, he called, “O Kahikiloa! O Kahikipoko! I see eyes, bright eyes, staring at me out of the sand!”

“Those are crabs, just sand crabs! Only we two are here.”

“O Kahikiloa! O Kahikipoko! Whose paved walk is this?”

“It is for Nī‘auepo‘o.”

“First they kill Nī‘auepo‘o, and now they say it is for Nī‘auepo‘o!”

The father listened and heard the questions and answers repeated for the bathing pool, the loincloth, the water gourd, the drum, the sleeping mats, and the sleeping *kapa*. The two old men then questioned the youth, and he told them all he knew about his parentage, his journey to Kahiki, and what had happened since his coming. In the meantime, the chief drew near and listened to the story and knew that this was indeed his son Nī'auēpo'o.

The sun was high the next day before the men awakened Nī'auēpo'o. The youth dashed out of the house and found himself caught in a net. He tore through it and felt another net about him. As he neared the last net, they brought the girl whom Nī'auēpo'o had made his wife and placed her within it. She held him with her arms until the men had succeeded in covering both with the net and taking them into the house, where the food was laid before Nī'auēpo'o with prayer. He ate and became as he was before he was killed. All desire to fling himself into the sea left him, and on the sixth day, he and his half-sister went away to her home to live together. The chief, however, had observed that the red fish had by some mistake been omitted in the offering and knew that trouble was in store for him.

In the meantime, in Ka'ū, Hina knew that evil had befallen her son, and in answer to her prayer, her shark guardian appeared and carried her over the sea to Kahiki'āle'ale'a. There she fought her son's father for killing her son and threw him into the sea, where the gods of the sea in pity turned him into the first *kūalakai* fish.

Hina then returned to Ka'ū and married again, and her first child, a daughter, she named Māniana, Numb, in memory of the brother's sensations when he went over the sea with his ancestor Niuolahiki. The place where Hina lived in Ka'ū district is still called Māniana, after her daughter who was born to her there. (Handy et al. 1972:1-7)

The Bitter Gourd

The following legend involves twin sisters that were born from a bitter gourd in Kama'oa, Ka'ū. This gourd grew from the navel of their deceased mother and continued to increase across the land. The legend of the bitter gourd presents many facets of symbolism. According to Handy and Pukui (1998:38-39), "The gourd is a symbol of Lono, god of agriculture. As a very close relative was often referred to as one's "navel", this, we believe, implied that the people of Kamao'a Plain claimed very close relationship, through his priesthood, to Lono. The miraculous growth of the vine refers to the rapid spread of the population in this area, extending across seven *ahupua'a* from Kamao'a to the Kona boundary, and so arose the saying of that 'ohana: "We are the people of the seven *ahupua'a*", referring to their descent from the woman out of whose navel the gourd vine grew. It is also noted that since the birth of the gourd sisters, twins have been a common occurrence from generation to generation in this 'ohana (Handy and Pukui 1998:38-39). The legend of the bitter gourd is as follows:

Among the distant legendary ancestors of one Ka-'u 'ohana were twin sisters who were said to have been born from a bitter gourd that grew out of their dead mother's navel. A young couple, because of parental disapproval of their marriage, eloped and made their home on Kamao'a plain. Many who loved them followed, and thus began the peopling of that plain. When the young wife was about to become a mother she died and was borne to a cave where she was lovingly laid to rest. Unknown to her people, a vine sprouted from her navel and grew very rapidly. It traveled far, crossing seven *ahupua'a* (land sections) before it fruited, back of a fisherman's home, close to the boundary between Ka-'u and Kona. The fisherman was pleased at finding such a fine gourd growing beside his house, and would frequently thump and pinch it to see if it was ready to pick. The spirit of the dead woman visited her husband in a dream and complained of soreness from being

thumped and pinched. When the husband wakened he went to look at her body and found the vine growing out of her navel. This vine he traced to its fruiting end beside the fisherman's house. An argument ensued over the ownership of the gourd, which was settled by establishing the vine's source, and the husband took the gourd home, where he kept it carefully on a bundle of dry *kapa*. In time the gourd cracked open and out fell two seeds which developed into identical twin girls, who became famous in later life as robust and powerful fighters as well as prolific mothers.

Because of the gourd relationship, it became *kapu* amongst this large 'ohana of Kamao'a plain to burn any fragment of gourd, since "to burn the bones of an ancestor" was an insult. Midwives placed a gourd at the head of a woman in difficult labor, with a request for ancestral help in delivering the child. (Handy and Pukui 1998:38–39)

Another account of this *mo'olelo* was collected from Keliihue Kamali in 1935 and is as follows:

The people of Kamaoa cultivated gourds as well as sweet potatoes. When the gourds were broken the pieces were never burned but were buried. The people of this place claim descent from a gourd. Long ago, a chief and his wife went to Kamaoa to live. The wife became pregnant and died. Her husband laid her body away in a cave. Out of her navel sprung a vine that grew and grew across a wide stretch, about seven ahupua'a, and there it fruited near a man's house. The man was curious about his strange thing and often pinched it to see whether it was ripening. The wife appeared to her husband in a dream and told him to seek the gourd and to carry it home. The chief found the gourd, explained to the man near whose house it grew and carried it back to Kamaoa. The next day the gourd cracked and out fell two seeds. These seeds were kept with the intention of planting them when the rainy seasons came but instead of that these seeds became girls. These twins grew up, married and became the ancestors of thousands (*mau lau*) of the natives of Kamaoa. The natives of Kamaoa were all of chiefly blood. These chiefs served their own chiefs who were the children of the oldest line. When visiting chiefs came to other parts of Kau these natives of Kamaoa never bothered to go and see them. They remained at home and went about their own business. Visitors to Kamaoa were very welcome but never encouraged to settle among them.

The gourd was used by these people to help in childbirth when delivery was delayed. A gourd was placed at the head of the mother-to-be. This gourd was believed to hasten delivery. (Kamali 1935)

Kauila

In association with Punalu'u is the *honu* deity Kauila, who is known to be a protector of the children in that area. According to Tangarō (2005:23), "The *honu* is a *kinolau*, physical manifestation, of the god Kanaloa. And as the springs are fed from mountain sources, here we speak of the older established gods of Ka'ū, Kāne and Kanaloa whose primary function was to establish freshwater sources." This *mo'olelo* commemorates the arrival and life of Kauila at Punalu'u, in addition to the establishment of the freshwater spring called, Ka wai hū o Kauila. Furthermore, this *mo'olelo* acknowledges Punalu'u as a long time nesting place for *honu* that is still evident today. The *mo'olelo* of Kauila is as follows:

A legend relates that there was a time when stormy weather prevented the men from diving for water. There were two supernatural turtles who had come out of the ocean to Punalu'u. Honupo'okea (Turtle-with-white-head), the mother; and Honu'ea (Turtle-with-reddish-brown-shell), the father. The mother gave birth to an object resembling a piece of *kauila* wood, which she buried in the sand to be hatched out by the sun. Then they dug into the earth and made a spring, then returned to the sea. When it was time for her "egg"

to hatch, Honupo‘okea returned. When the thing she had laid did hatch it was a turtle the color of polished *kauila* wood. Mother and daughter lived in the spring until the baby turtle grew up. The young turtle was named Kauila. The spring came to be named “The-rising-water-of-Kauila.” The turtle girl was able to assume human form and play with the young folk, but would become a turtle again when she went back into the spring. When bubbles came up in the spring, people knew the turtle girl was asleep in her home. Children used to catch fish and shrimps in the spring, and Kauila watched lest the little ones fall in. The people loved Kauila for this and because her spring gave them drinking water. They never used her water for any other purposes. (Handy et al. 1972:608–609)

Nīnole

The following *mo‘olelo* involves a beautiful woman by the name Nīnole and her reputation for trickery. Due to her actions, a spring in the Nīnole area was named in commemoration of those that she tricked. The *mo‘olelo* of Nīnole is as follows:

A legend relates that Nīnole was the name of a beautiful woman who was the daughter of the cannibal woman Kaikapu. Nīnole was beautiful but cruel. While she and her mother lived by the pools, the people of Punalu‘u were afraid to go there for water. The spring on the east side of the Nīnole ponds was named Kau-wale, meaning “useless lading”. Here is why it was so named. Nīnole the ogress used to go to the beach near this spring, where she could be seen by men passing in canoes. She would beckon to them and they would come ashore. She invited them to eat, and led them to the cave in which her mother lived. When they entered, the cave mouth would close. The men were trapped; some were eaten, some were tormented and starved. (Handy et al. 1972:606–608)

Wai‘ōhinu

The following legends provide insight about the place name Wai‘ōhinu. The first suggests the name was given to a stream that washed down grease from dead bodies and had the appearance of shiny water. The second refers to the name Wai‘ōhinu as belonging to a female *kupua* from Kahiki who resided in Ka‘ū. The *mo‘olelo* are as follows:

A cruel *kupua*, or nature spirit, came from Kahiki and dwelt just below the Ha‘ao springs. He married a Ka‘u woman, who bore him a son named Kupa. They inflicted all sorts of suffering on men who went to the spring; they killed many and hid the bodies among the tall weeds around the spring. A cloudburst brought down in the stream the grease (*hinu*) from these corpses and so the stream was called Wai-o-hinu. By a ruse the ogre and his son were caught in a net, and were burnt in an *imu*.

Another story is that the name of Waiohinu belonged to one of two *kupua* who were stones which had come from Kahiki. The male stone was named Ka‘uloa and was black. Waiohinu was the female stone, which was red. These stones stood in a *kukui* grove, sinking deeper and deeper into the earth in the course of time. They were often heard conversing with each other. Ka‘uloa, the name of the male stone, was given to the whole land, now called Ka‘ū. (Handy et al. 1972:586)

Kumuhea

The following *mo‘olelo* involves a *kupua* (demi-god) by the name Kumuhea who had the ability to change forms into a caterpillar. Kumuhea is known to be an ‘*aumakua* to some in the Ka‘ū district and is symbolized through the caterpillars that frequent the area.

Another Ka‘ū *‘aumakua* was Kumuhea, a son of Kū, who came from “Kahiki” first to Molokai and thence to Ka-‘u on the island of Hawai‘i. He fell in love with a girl there who returned his affection, and when he became her husband he took her to the top of a hill, now called Pu‘u ‘Enuhe (Caterpillar Hill) to make their home. He has never visited her or her relatives except at night, and now after marriage he always vanished in the daytime, returning at evening bringing sweet-potato greens for their provender. An exclusive diet of greens soon reduced his wife to skin and bones, and when her brothers came to see her they were shocked at her appearance and went to a relative who was a *kahuna* to discuss the matter. It was revealed to the *kahuna* that the young man was a *kupua* (nature spirit) whose other form was the caterpillar that feeds on sweet potato foliage. The god Kū, whose son it was, was called upon for help, and Kū came and put an end to his son’s assuming human form.

Nevertheless Ka-‘u remained the permanent home of Kumuhea, and because of the marriage relationship that had existed no native of the place would deliberately destroy a caterpillar. It is still remembered, from the childhood of a living person, that the precautions were taken to avoid stepping on them when the roads were covered with them during unusual and pestilential visitations. When natives planted their sweet potatoes they called upon Kumuhea to help himself to the leaves but not to destroy the plant or harm the tubers, and the plants were left unharmed; but should newcomers or careless natives set about to kill off the “pests”, more and more would appear until his vines would be utterly consumed. Kumuhea could be a friend, but he could also be a bitter enemy. (Handy and Pukui 1998:37)

Kawelohea, Kawelo the Shouter

The following legend is about a beautiful woman named Kawelo. After her death she was placed in a blowhole that is known today as the spouting horn. Her spirit would call out and her voice of warning could be heard throughout Ka‘ū. The expression “Ke hea mai nei ‘o Kawelohea, Kawelohea calls” is associated with this legend and commonly used in poems of Ka‘ū.

Kawelo was a woman famed for her beauty from one end of Ka‘ū district to the other. She was so beautiful that her husband was dreadfully jealous whenever she spoke to other men.

One day, her husband saw her talking to one of their friends, and he was so angry that he killed Kawelo and placed her body in a cave situated on a point which jutted out into the ocean. Every day, when her husband went to fish, Kawelo’s voice could be heard calling:

E Ku‘u Kāne ē,	O my husband, listen!
Aloha ‘ole ‘oe ia‘u!	You do not love me
‘A‘ohe kā ;oe e ki‘i mai ia‘u	Or you would come to get me
E hele pū nō kāua i ka lawai‘a!	That we might go out fishing together.
Ku‘u kāne aloha ‘ole ē!	O my loveless husband, listen!

The man’s fishing expeditions proved fruitless. So harassed and exasperated did he become because of her constant shouting that he took his wife’s bones to the side of a blowhole on the seashore and pounded them to dust, muttering as he did so, “You have been able to call to me because your bones were not yet dust! Now there you are!” After powdering the bones, he left them lying where they had been crushed, and the sun scorched them until they were bleached. When the tide rose through the blowhole, they were washed inside the hole and lost in its depths. But still could her voice be heard from the depths calling,

Ku‘u kāne aloha ‘ole ē! O my husband, listen! You do not love me
E ki‘i mai ‘oe ia‘u e hele pū me ‘oe! Or you would come and take me fishing with you!

Her husband could not possibly do as she wished, for it meant certain death to plunge into the blowhole. The only thing he could do was to stifle his wrath. The woman continued to call in this manner until her husband’s death. After that time, her voice predicted strange events that were to befall the land and thus foretold to the natives of that locality what events were to be expected. When Kamehameha became the ruling monarch, Kawelo’s voice was heard from within the blowhole calling, “Another country shall possess the land! Another country shall possess the land!”

The men who heard her thus shouting answered, “O Kawelo! Kamehameha possesses the land, one of our own sons of Hawai‘i here.” But the voice answered, “Not so! The land shall not be for Pai‘ea, it shall belong to the sea. Another country will possess the land!”

Her cry was heard from Paepae, where the blowhole lies, below the precipice of Pōhina, to the village of Pāhala and of Kahuku, so that it became the chief subject of conversation among the people of that vicinity.

Her cry did not cease until after the annexation treaty of this fine land with the United States. After the death of Kamehameha, the cry continued: “Another country shall possess the land!” Dwellers in that part of the island have said that when the arrangements were being made to take Hawai‘i as part of the United States of America, the prophecy of Kawelo was heard, “E ku‘u lāhui ē! Ho‘ohui ‘āina! Ho‘ohui ‘āina! No ka ‘āina ē ka ‘āina!” (“O my nation, listen! Annexation! Annexation! Another country shall possess the land”).

Since that time, some mischievous visitors to the spot have broken away the mouth of the blowhole, leaving a great gap. Kawelo still calls, but the opening is so large that her words cannot be plainly understood. Only those who are near can hear what is said; people at a distance hear the voice, but the words are lost. (Pukui and Green 1995:100–101, 155–156)

Makanikeoe (Makanikau), The God of Love

The following legend from Ka‘ū tells of how Makanikau helped a young man that was cast out by his wife’s family. According to Beckwith (1970:93), “the wind god Makani-keoe (Makani-kau), one of the many gods of love named in Hawaiian lore, has control over plants and can himself take the form of a tree or cause plants to grow. A branch from his transformation form will serve as a love charm, but only a brave person can secure such an amulet because of the voices and visions which will pursue him.” In this legend Makanikau provides a young man with food when the land experiences famine. As a result, the young man is accepted by his wife’s family and reunited with his loved one. Today, when there is a family quarrel in Ka‘ū people say, “Makani-keoe is gone from home,” or “Makani-keoe has come back” when the quarrel is resolved.

In folk belief the wind god Makani-keoe (Makani-kau), one of the many gods of love named in Hawaiian lore, has control over plants and can himself take the form of a tree or cause plants to grow. A branch from his transformation form will serve as a love charm, but only a brave person can secure such an amulet because of the voices and visions which will pursue him. A folktale from Kau district on Hawaii tells how Makani-kau takes pity on a young husband turned out of the house by his wife’s family because of his indolence, and reconciles the couple by conjuring up food for his protégé when all the land suffers from famine. Today in Kau when there is a family quarrel folk say, “Makani-

keoe is gone from home,” or “has come back” when the quarrel is patched up. (Beckwith 1970:93)

The *mo'olelo* is as follows:

It is said that Makanikeoe and his sister Lauka'ie'ie came to the district of Puna from foreign lands. Upon their arrival, they said to each other, “You go your way and I will go mine.” Makanikeoe spied the mouth of a certain cave, and entering, followed along a secret passage and came out on the side of a mountain, where he found a man weeping. Through his power as a god, he recognized the man as Kānekoa and asked him, “What are you doing here?” “I am here because my father and my mother-in-law have cast me out and taken away my wife,” answered Kānekoa. The god could not help laughing. “What caused all this trouble?” he inquired. “My mother-in-law thinks me an idle, worthless person,” said Kānekoa. “She is not satisfied unless I am always working. If I rest while I am cultivating the land, she calls it laziness; if I stop awhile when out fishing, that is idleness also. She wants me to work without ceasing.” The god invited Kānekoa to share his cave, saying, “You are to become a good friend of mine and you must give attention to all that I teach you.”

As they approached the cave, there appeared spontaneously bananas, *'awa*, taro, sweet potatoes, and yams through the power of the god. Then the god told Kānekoa, “Pound an abundant supply of taro root, then go to the side of the road and invite wayfarers to partake.” Kānekoa did as he was told; he pounded the taro root for food and called to the travelers, “Come and eat! Come and eat!” Those who were hungry followed him to the cave and ate, and they took back to Ka'ū this strange news about Kānekoa.

About this time, Kānekoa's father and mother-in-law began to enter into negotiations with another man who wanted to marry their daughter. When they heard the news about Kānekoa, they were so indignant that they immediately set out for 'Ōla'a with the man whom they had chosen for their new son-in-law, intending to kill Kānekoa.

The god, who knew of their plan, warned his friend. “I am going to change myself into a tree and stand at the mouth of the cave,” he said. “When your wife's relatives come to do you harm, step on my body.” This was the first intimation Kānekoa had of his friend's divinity. Kānekoa went to the roadside as usual, and presently he saw his wife's relatives approaching. While his mother-in-law scolded him, his rival ran forward with a wooden club intending to kill him.

Kānekoa ran to the entrance of the cave and climbed upon a limb of the tree. Instantly, he felt himself being gently lowered. The trunk of the tree became like the body of a man, and a loud voice cried, “Hearken, O tree ferns!” and the ferns cried, “Here we are! Here we are!” He called to the bird's-nests fern and the fiber-bearing vine and to every wild plant of the mountain, to other ferns, also to the mountain-apple tree and the *maile* vine, and each responded, “Here we are! Here we are!” The terror-stricken intruders threw down their clubs and fled, imagining that they had heard the voices of the innumerable gods of the wilderness.

Soon after this, the god, knowing that a famine was to come upon the district of Ka'ū, directed his friend, “If your wife comes to ask for food, feed her, but drive off her relative and friends; surely, since they have called you an idle, worthless fellow, they cannot eat your food!” “If they come weeping, I may pity them,” said Kānekoa. “Drive them away and see what will happen,” insisted the god.

When the famine came as had been predicted, many came to Kānekoa for food and, returning, reported to the people of Ka‘ū, “Kānekoa has an abundance of food.” His wife went weeping to her mother and said, “It is because you have driven away my husband, the only one who was a food supply, and because you want me to take this new husband - that is why we now feel the pangs of hunger. So the family set out for the cave. Kānekoa, fearing to disobey the god, allowed only his wife to enter; the others waited without. When they tried to enter, the magic tree hit them with its branches and drove them away.

After a little, the wife said to her mother, “I have a vision of the feast of Kānekoa. Let me go away to the seashore day by day to seek black crabs for food.” “Go child, for we are weak with hunger,” replied the mother. Then the wife flew to her husband, and when her appetite was appeased, she returned to her mother, saying, “There were no black crabs at all on the shore!” This she did day after day until she grew quite plump and pretty, while her parents were starving with hunger.

At last the parents could endure it no longer. They begged Kānekoa to take pity on them, calling him “our good son and provider of parents.” The god forgave them and promised them food, only they must return Kānekoa his wife and banish the new husband, and then go home to their own home and leave the wife to live with her husband. Kānekoa pitied his starving rival and gave him sweet potatoes before he went, but the father and mother-in-law stoned him out of the district and he took refuge in Kona.

After this, the god bequeathed to his friend the cave and all its provisions and went forward on his mission of love. Once, according to the story, he found a woman with a broken leg and carried her back to the cave and gave her to his friend to care for, bidding him treat her kindly as he himself had been treated.

To this day, when there is quarreling in the family, old Hawaiians in Ka‘ū remark, “Makanikeoe is gone from home,” and when peace is restored they say, “Makanikeoe has returned.” (Pukui and Green 1995:27–29)

Kūmauna, Kū of the Mountain

In the book titled, *Hawaiian Mythology*, Beckwith (1970:17) writes, “Ku-mauna (Ku of the mountain) is one of the forest gods banished by Pele for refusing to destroy Lohiau at her bidding. He is said to have lived as a banana planter in the valley above Hi‘ilea in Ka-u district on Hawaii, which bears his name. There he incurred the wrath of Pele and was overwhelmed in her fire. Today the huge boulder of lava which retains his shape in the bed of the valley is worshiped as a rain god. As late as 1914 a keeper escorted visitors to the sacred valley to see that the god was properly respected and his influence upon the weather restrained within bounds for the benefit of the district.”

Tangarō (2005:21) further explains:

Kūmauna is the local deity of rain in the Hīlea vicinity. In his mineral form of a huge rock, Kūmauna (an extension of the great god Kū) continues to play a heavy role in the psyche of the Ka‘ū people. Kūmauna is credited for growing the iholena variety of banana. At the base of Pu‘u Kaiholena are the remains of what obviously could have been an extensive plantation of the iholena variety banana, perhaps the remains of Kūmauna’s plantation.

A short *mo'olelo* of Kūmauna in Ka'ū is as follows:

A tall foreigner comes from Kahiki and cultivates bananas of the iholena variety in a marshy spot of the valley. Pele comes to him in the shape of an old woman and he refuses to share his bananas with her. She first sends cold, then, as he sits doubled up with his hands pressed against his face trying to keep warm, she overwhelms him with a stream of molten lava. In this shape he is to be seen today encrusted in lava.

Sick people are sometimes brought to a cave near the place where stands Kūmauna and left there overnight for healing. In case of drought an opelu fish is brought from the sea and struck against the rock in order to call the rain god's attention to the needs of his worshipers. In case a fish of the proper variety is lacking, a rare plant growing in the vicinity, which has leaves mottled like the sides of the opelu, may be used as a substitute. But all this must be done with the greatest reverence. Visitors to the valley are warned to be quiet and respectful lest a violent rainstorm mar their trip to the mountains. The story told of Johnny Searle has become a legend of the valley and a warning to irreverent foreigners. About the year 1896, while Johnny Searle was manager of Hi'ilea sugar plantation, there occurred a prolonged drought and one evening as he was riding home down the valley with a party of Hawaiian goat hunters he raised his gun and shot at the Kūmauna boulder, exclaiming, "There, Kūmauna! Show your power!" The shot broke off a piece from a projecting elbow, which some say he took home and threw into the fire. His companions fled. That night (as the story runs) a cloud-burst rushed down the valley and flung great stones all over the back yard of the plantation house, where they may be seen today as proof of the truth of Kūmauna's power. (Beckwith 1970:18–19)

Kalākolohe, The Mischievous Sun

The following is a short account of Kalākolohe who was a *kahuna* of Ka'ū. He could read the signs of the clouds and was asked by sugar plantation owner, Mr. Hutchinson to pray for rain when it was needed. The account of Kalākolohe is as follows:

Kalākolohe, the mischievous sun, was a famous *kahuna* of Ka'ū. He was not a priest who took life but one who understood healing, a reader of the signs in the clouds. The sun was one of his gods. At Honokāne gulch was a *heiau* which had been kept by his ancestors up to the time when such things were abolished.

Mr. Hutchinson, of the Hutchinson Sugar plantation company, was the head of the sugar plantation adjoining the place where Kalākolohe lived...Mr. Hutchinson often heard of Kalākolohe's power and of his ability always to obtain what he prayed for, so when the land got too dry, he went to the *kahuna* and asked him to be so kind as to pray for rain. The *kahuna* prayed, rain fell, and everything grew well...

The *heiau* at Honokāne is destroyed, all but the foundations. It is said that in this gulch the tumult of joyful chanting and confused shouting may be heard, although no one is to be seen there. Within this gulch the *kukui* tree, *noni* apple, mango, orange, *hau* tree, coconut, pandanus, and fig flourish, with many other kinds of trees besides. From ancient times to the time of Kalākolohe, a strict taboo protected this fruit, but since this death, the people all go and help themselves to it. (Pukui and Green 1995:103–104)

Nā Ali'i Ho'oluhi o Ka'ū, The Despotie Chiefs of Ka'ū

The *mo'olelo* of Nā Ali'i Ho'oluhi o Ka'ū provides insight into the strength of Ka'ū people. According to Tangarō (2005:11) the following *mo'olelo* "will provide evidence that the Ka'ū intolerance for despots is based on the misuse of natural and human resources. This analysis will

provide an opportunity to see Ka‘ū not just as ‘rugged individualists’ but a people who understood that mistreatment of natural and human resources risked general life and living.” These legends also provide place names and proverbs that arose from the following events. For instance, the east current at Kalae was named after the chief Hala‘ea. The famous saying Ka‘ū Makaha (Ka‘ū the destroyers) came from the *mo‘olelo* Kohāikalani. In addition, the proverb “*Kau ‘ino auwa‘a o Ka‘alu‘alu*” originated from the *mo‘olelo* of Koihala. The chiefs in these *mo‘olelo* disregarded the health of their land and people and were killed as a result. The *mo‘olelo* of Ka‘ū chiefs Hala‘ea, Kohāikalani, and Koihala are as follows:

Hala‘ea

“A greedy chief was Hala‘ea. Every day he visited the fleet of fishing canoes and took for himself and his retainers all the fish he could find. Then he held a feast, carousing and often wantonly wasting the food that remained. As for the fishermen, they were obliged to catch the fish without ever having any to take home to their families. Day after day, they ate herbs for food. This conduct of the chief greatly vexed the people, and they sought a means to rid themselves of his oppression. Never did they go out upon the ocean without hearing on their return the voice of their chief crying, “The fish is mine! Give me the fish!”

At last came the season for ‘ahi, the tuna, and a proclamation was made, summoning the head fishermen to accompany their chief to the fishing grounds. So they gathered together and prepared their canoes, looking after the nets, the bait, and whatever else was required for the expedition. Also, they held a council at which it was agreed to deposit all their fish in the chief’s canoe and themselves return to the shore without even a backward glance. At the day appointed, everything was in readiness from Wai‘ahukini to Keauhou.

When the first canoe-load was conveyed to the chief’s canoe, even then the voice of the chief could be heard protesting, “Bring me the fish! Bring me the fish!” But when the second, third, fourth, fifth, and succeeding canoes had deposited their loads into the chief’s canoe and he saw there was danger of swamping the canoe with their weight, he called out, “The chief has fish enough!”

“Not so!” cried the men. “Here is all the fish that the chief desires!” They piled in the last load, and the canoe began to sink rapidly. The chief looked about for help, but there was no canoe at hand and no man to show compassion; all had gone back to land. So perished Hala‘ea in the sea, surrounded by objects of his greed. (Pukui and Green 1995:74–75)

Kohāikalani

An evil man was the chief, laying heavy burdens upon his people whenever an opportunity offered. When he built a temple for himself on the hill Ka‘ulakalani, he commanded the men of the place to bring large, smooth stones from Kāwā, many miles distant. Patiently, the heavy loads slung on poles over their shoulders, they bore the rock from the seashore to the hill where the foundation of the temple was to be laid. When much stone had been collected, two priests (*kahuna*) arrived to supervise the erection of the structure, and upon seeing the quantity of stone brought from Kāwā, they turned to the men and exclaimed, “Look you! There was stone enough already without you exerting yourselves to bring more from Kāwā! It is clear that your chief intends when this temple is completed to offer your bodies as sacrifice. Hence, when he commands you to bring an ‘*ōhi‘a* tree to be used in the building, you must tell him to select one for himself and that you will then help him pull it up here. In this way you may save your lives.”

The people heeded the priests' warning, and when they were commanded to descend the cliff after a tree, they replied, "O heavenly one, listen! It is better for you to choose the tree to your liking and uproot it, and we will haul it up hither." The chief consented. He was so strong that with one pull he uprooted a great tree. He looped the branches and then proposed to ascend the cliff and pull the tree up from the top while the men pushed from below. This, however, they refused to do; they wanted to pull while the chief pushed from below, and to this the chief acquiesced. The men pulled at the tree until it was half the distance up the cliff, then released the rope. The great tree rolled over on top of the chief, and death came to the oppressor.

Since the rule of these despotic chiefs, Ka'ū has become noted as a land where people look out for themselves and their own family. The rulers fear to say "We are great chiefs" lest a reckoning come from the people. In the old days, Ka'ū was a despotic district; a chief would command and be instantly obeyed – one would give orders which were at once fulfilled. Thus did they live. But these days of civilization have overturned all those customs. (Pukui and Green 1995:75–76)

The following story provides another account of Kohāikalani and the building of a *heiau* on Makaanau Hill. This account was written by Z.P. Kalokuokamaile and translated by M.K. Pukui.

Hilea, in Ka'ū was the birthplace of Koha-i-ka-lani. As it was the custom in the olden days to worship fishes, birds, stones or wood, Koha wished to have a wooden god to worship. Koha was living in the upland of Hilea. There were many houses in this place and life there, in olden times, was pleasant.

The houses stood on ground composed only of earth. The chief desired much to have (his god) made of a big log and have it erected on Makaanau hill, close to the village of upper Hilea. He ordered his kahuna to ascend with the men to cut the wood and the size of log that he desired was four fathoms in length and girded by three men. Because the kahuna heard his words, they replied, "O Chief, if that is your wish here is a large tree nearby that only requires cutting. It has a hardwood like the kauila which would not rot when buried in the earth." Koha asked, "What kind of a tree is it?"

"Here is a breadfruit tree with the size desired by the chief." The chief approved of this, "Yes, that is good." Then a large breadfruit tree, five fathoms long and could be girded by three men, was cut down, a tree the size desired by the chief.

The breadfruit log was hauled up to the foot of Makaanau hill and there it was left. There was one thing that needed doing and that was to carve one end of the breadfruit into an image of a man. Orders were given to the wood carvers and they made it look like a man. After the carvers had finished their work, then it was ready to pull up to the top of Makaanau hill where it was to be erected. Many men climbed to the top of the hill to pull it upward.

Many of the men struggled to lift up the lower end of the log, the chief was among them. This they did all day long and all week. It took a very long time, but it did not budge to move upward. The people were tired and bored with the needless task of the chief's. They had no time to do their own work, for they were occupied with this wearisome useless work. Therefore, the men who worked below at lifting the log and some of those on the hill met and plotted to put an end to this wearisome task. "Tomorrow we shall tell the chief to go directly below the log so that he could plead with his image." This was agreed to by those at the foot and at the top of the hill. "When you pull the image upward till it gets above the heads of all of those who are lifting, just as it does every day as we work, then you let go. We will tell the chief to get directly under the log." In the morning

the men gathered where the wooden image was. Those at the top of the hill assembled there and those at the bottom of the hill went there. Then the man who gave the orders to pull, called out to pull the log upward.

The men on the hill pulled and those below lifted, but it did not rise any higher; it was just as it was before. Some of the men at the foot of the hill said, "O chief, today you go directly under the other end of your god and lift it up. It is strange that it would not move. What do you think of this idea?" "It is good." The chief went under the end of the log. The people above pulled and those below lifted. Every person below was eager to have the log higher than their heads. Then the call came, "*Moku ke kaula*" (cut the rope). This was the signal to pull the log up and let it go. The log was pulled up and then it was released. So it was that Koha met his death. This deed of the men of Ka'ū earned for them the name of Makaha (destroyers). This district, Ka'ū, became renowned as Ka'ū Makaha. (Kalokuokamaile and Pukui:147-148)

A third account of the building of this *heiau* was translated for the Maile Wreath and included in the Treasurers Report under the title, "Traditions from the province of Kau." This account is titled, "The story of Kahookalani."

He was, according to tradition, the greatest chief of the island, and reigned King at Hīlea. It was he who built the heiau, situated on the great plateau of Makaanau. There are still to be seen the sea-worn pebbles which Kohookalani caused to be brought upon the heights about two leagues from the shore. The pebbles were intended for the inner pavement of the temple. The people, crushed by the enormous difficulty of transporting them, weary of the yoke of royal power, and excited by disloyal priests, began to show their discontent. A conspiracy was soon laid by these two classes leagued against the chief. They took advantage of a religious ceremony in order to rid themselves of the despot. The temple was finished, and the only question was how to carry a god to it. This divinity was nothing but an ohia tree of enormous size which they had felled in the forests above Ninole. On the appointed day the chief, the priests and the people set about the task of drawing the god to his residence. In order to reach the height of Makaanau, there was a very steep pali to be ascended. They had to carry up the god by the side of Ninole, which was best adapted for the execution of their plan. On arriving at the foot of the declivity all pulled at the rope, but the god, either by the trick of the people and priests or from the obstacles which the inequality of the rock presented, only ascended with great difficulty. "The god," said the kahuna, "will never reach the summit of the pali if the chief continues to walk before him. The god ought to go first, by right of power, and the chief below, behind him, to push at the lower end, otherwise we will never succeed in overcoming his resistance." The great chief, Kohookalani, submitted to the advice of the priests, placed himself under the god and pushed him from below. Instantly, at a given signal, people and priests dropped the rope, and the huge idol, rolling upon the chief, crushed him in a moment. (Treasurer's Report n.d.:62-64)

Koihala

An irresolute chief was Koihala. When the chief was visiting in Kona, he dispatched a messenger to Ka'ū with the order for food to be prepared and taken to Wai'ahukini to meet him. When all was ready, the servants bore it to Wai'ahukini. As they sat awaiting his appearance, they saw the chief's canoe heading for Kā'iliki'i, so they took up the food again and went on to the place where they expected him to land. But when they got to Kā'iliki'i, he was heading for Kapu'a.

Again the men shouldered the food and followed toward the mountain, but as they reached Kapu'a, they perceived the chief heading for Ka'alu'alu, and they immediately

proceeded thither. By this time they were hungry and tired, and they therefore agreed to watch and, if the chief did not arrive shortly, to eat the food themselves. The chief delayed landing, simply sitting idly in the canoe and gazing at the men. So the servants ate the food that had been prepared and then they put stones in the ti-leaf packets in which the fish had been wrapped and in the empty calabashes of vegetable food. The chief, seeing these things, paddled furiously until he reached Ka'alu'alu. Hence has arisen the proverb, "Kau 'ino 'au wa'a o Ka'alu'alu," that is, "The canoes arrive hurriedly at Ka'alu'alu." Hastening up the beach to the spot where the men sat, he cried, "Say! Let us eat! Let the chief eat!" "Yes, indeed!" answered the servants. "Here is vegetable food and fish!" Whereupon they stoned the despotic chief to death. (Pukui et al. 1995:75)

Another account of Koihala was translated for the Maile Wreath and included in the Treasurer's Report under the section titled, "Traditions from the Province of Kau." The account goes as follows:

Koihala reigned at Kau. He was a great chief, and perhaps the whole island recognized his authority. An abuse of power hastened his death. He had commanded the people of Kau to carry him food upon the plateau of Punaluu, at a place called Puuonuhe. A band of men set out with pounded taro (*poi*), enveloped in ki leaves, called *la'i*. Arriving at the top of the table-land, which is very lofty, they learn that the chief had set out for Koolikii, thirty miles from Puuonuhe, and that he has ordered them to carry provisions to this remote place. As soon as they have arrived there, orders are sent them to go as far as Waiohukini, a half hour's walk further in the same direction and under the great pali of Malilele on the beach. They depart. On arriving at Waiohukini they receive orders to go to join the chief at Kalae. There was the great pali to be climbed again, and two leagues more to go. When they reached the cape of Kalae, which is the southernmost point of the Hawaiian group, they were sent to find the chief at the village of Mahana. But he had departed from it for Paihaa, a village situated near Kaalualu, a little bay where coasting vessels sometimes anchor. There they were at last to find the tyrant. Exasperated, dying of hunger, indignant at the cruel manner in which the chief made sport of their toils, the carriers sat down on the grass and deliberated. At once they decide that they will consume the provisions without leaving anything for a chief who amuses himself so strangely in fatiguing his people (*hooluhi hewa*.) They also resolve to carry him bundles of stone instead of taro. The doom of Koihala is pronounced –his insupportable yoke is to fall. The conspirators, after having appeased their hunger, depart and soon arrive, with a dejected air, in the presence of the chief. "Prince," said they, "here are thy servants with thy provisions." They humbly deposit at his feet their loads enveloped in *la'i*. The bundles are opened and the scene changes. These people, apparently half dead, suddenly become like furious lions who prepare to devour their prey. They arm themselves with stones, and make them hail upon Koihala, and his suite, who perished at the same time.

Two other great chiefs of the island were slain by the people of Kau. The one was killed at Kalae by fisherman with their paddles, the other was stoned to death at Aukukano. (Treasurer's Report n.d.:63–64)

Nu'uanupa'ahu, Chief of Ka'u

In February 1867, the Hawaiian newspaper *Kū'oko'a* printed a story written by historian Samuel Manaiakalani Kamakau about a chief of Ka'u named Nu'uanupa'ahu. In 1985, this story was included in the book titled *Beaches of Hawai'i* written by John Clark. The story of Nu'uanupa'ahu is as follows:

Nu‘uanupa‘ahu had journeyed to the district of Kohala where Kalani‘ōpu‘u, high chief of the island, was relaxing with other chiefs and members of his court. Kalani‘ōpu‘u, suspicious that the chief of Ka‘ū was conspiring to usurp his power, decided to kill him. Kalani‘ōpu‘u and his chiefs, knowing Nu‘uanupa‘ahu to be an excellent surfer, agreed they would take him surfing at Kauhola in Hala‘ula where they knew he would be attacked and killed by sharks. Nu‘uanupa‘ahu, however, battled his way successfully through the sharks, earning the admiration of both chiefs and commoners, who watched him fight his way to shore. Later he died of his wounds at Pololū, where he was buried.

In the story Kamakau describes Nu‘uanupa‘ahu as “The cut-worm tearing son of Nā‘ālehu,” a direct reference to the famous legend of Pu‘u ‘Enuhe, the large caterpillar-shaped hill inland of Punalu‘u, and also notes that the Ka‘ū chief gained his skill in surfing from riding waves at Kāwā. In former times, Ka‘ū boasted three famous surfing breaks, Punalu‘u, Paiaha‘a, and Kāwā. The waves at Kāwā are still surfed regularly, but present day surfers know the break as Windmills, named for the small windmill onshore in a cattle pasture. (Clark 1985:64)

Nānaele, Chiefess of Ka‘alāiki

The following story involves a chiefess of Ka‘alāiki named Nānaele and her husband Nāliko. Nāliko is a promiscuous chief that neglects Nānaele until she falls sick. Upon hearing of her health, the people of Ka‘alāiki and Kāwā come together to retaliate against Nāliko. This story revisits their relationship and the escape through Ka‘ū that saved Nāliko’s life.

Nānaele was a high chiefess of Ka‘alāiki in Ka‘ū district on the island of Hawai‘i. She was kindly, fair to look upon, and a general favorite with her people. One day, a company of travelers from Kohala district visited Ka‘ū and, seeing Nānaele, coveted her as a wife for their young chief, Nāliko. When this proposition was made to Nānaele, she consented, since they reported him a pleasant man, handsome, modest, industrious, and with other good qualities. On returning to Kohala, the men told Nāliko about the comeliness of Nānaele and begged him to become the husband of so beautiful a woman. Nāliko was delighted that such an excellent wife had been secured for him and readily assented to the arrangement. A few short months later, the two young people were married at Ka‘alāiki. Friends and relatives attended the great feast prepared for them. Soon after, Nānaele returned with Nāliko to Kohala.

It was not long before Nāliko returned to his old ways – to the *hula* and the company of young women of the district, leaving Nānaele at home with neither vegetables nor fish. She could do nothing. She could only wait until his affection brought him back to her again, when he would perhaps bring her food she needed; meanwhile, her body wasted away until she was nothing but bone.

When finally her unfaithful husband returned home, Nānaele turned to him and said, “O Nāliko, listen! A new life for me; I shall never see you. You have provoked me too much with your unkindness!” “Ugh! If you should live, so should Milu!” responded her husband, and he went off at once to his pleasures.

When her husband was gone, Nānaele crept out in search of food. She crawled along until she came to a place where some farmers raised pigs; there she fell to the ground in her weakness. A man who was passing, seeing that something was causing excitement among the herd of pigs, came to look and found the exhausted woman. He carried her across his shoulders to his hut, where Nānaele was cared for by his wife.

By the time that Nānaele had recovered her strength a little, the rumor had reached the Ka‘ū district that she was almost dead. This news brought heaviness of heart to the people of Ka‘alāiki and Kāwā, and they decided to go and fetch home their chiefs. Some went from Kahuku, some from Kona, still others from Kohala. Two of them went to the place where Nānaele was staying, taking a *mānele* in which she was placed and then borne with care some distance to a place where other men were waiting to relieve the weary bearers of their burden. Thus was she taken by relays until she reached Ka‘alāiki.

After a year had passed, Nāliko heard that Nānaele had recovered her health, that she was twice as beautiful as before, and that many suitors from the mountains to the sea were seeking her favor. So this neglectful husband arose and started out to take his wife back to Kohala. Some of the retainers of Nānaele, perceiving his movements, ran to report them to her parents. Nānaele was removed to Kāwā and there concealed. Meanwhile, a great feast was prepared at Ka‘alāiki for Nāliko. When he arrived there, he was welcomed by his parents-in-laws and informed that his wife and her woman attendants had gone bathing in the sea and would return late that evening.

During the feast, Nāliko was greatly entertained by watching the women dancing and chanting this *mele*, or song:

No‘u, no Nānaele	For myself, for Nānaele,
Na ka wahine a Nāliko	For the wife of Nāliko.
No‘u ke ola a‘e,	For me, a new life-
‘A‘ole au i ‘ike hou iā ‘oe	I shall see you no more.

To which other women answered,

‘Ē! Ola ‘oe, ola ‘o Milu	Ugh! If you should live, so should Milu,
Kēlā mea i lalo lilo loa!	Who dwells down below!

Nāliko never stopped to consider that this song was meant as a reproach to himself. The men of Ka‘alāiki were planning, when Nāliko was in a tranquil frame of mind and night brought partial darkness over the land, to slay him and hide his body in a secret cave. But an old man was moved to pity in his behalf and whispered secretly to Nāliko, “They mean to kill you! Here! Delay is perilous! I will guide you to a place where you can hide. Come with me!” So when Nāliko saw that the people of the place were not watching, he and the old man fled secretly. They traversed an underground cave, going on and resting, going on and resting, until they reached a spot back of the Kapāpala stock ranch where they ran along between the mountains Hualālai and Maunaloa until Nāliko could go on alone to his own district while the old man turned back toward Ka‘ū lest suspicion fall upon him of having aided the escape. As he went, he saw many men out searching for Nāliko and discreetly joined himself to their number, and they scoured the country from Kahuku to the crater of Pele at Kīlauea.

Nāliko now realized that never again would he possess Nānaele, and love for his patient wife gushed up within him. He recalled how she had said, “You are an unloving husband! A new life for me; I shall never see you again.” He knew that he would have been killed without compunction by the men of Ka‘alāiki. As for Nānaele, she was happy to be again with her loving parents and to bring rejoicing to the hearts of her own people. (Pukui and Green 1995:77–79)

Nā Makapō o Moa‘ula, The Blind Men of Moa‘ula

The following *mo‘olelo* involves two blind men from Moa‘ula that traveled to Punalu‘u and were met with misfortune. This *mo‘olelo* was documented in the book *Folktales of Hawai‘i* and is as follows:

In Moa‘ula, Ka‘ū, there were two men, one of whom was totally blind and the other of whom could only see things held close to his eyes. One day they started to go down to Punalu‘u, the man who could see a little leading his totally blind companion. They went along slowly to the edge of the Punalu‘u stream, and the blind man asked, “How is it? Is there water below?”

His companion answered, “Yes, there is water.”

“Much water?”

“Yes, there is much water below.”

“Then let us jump in and swim to the other side.”

“Yes, let us jump in.”

They jumped down and broke their legs. There was indeed water but not much.

Even this did not end their traveling together. One day the blind men went again to Punalu‘u, but this time they approached the stream on the side toward the mountain. When they came to the stream, the completely blind man said to his guide, “What do you see? Is the water low?”

“Yes, very low.”

“Is that true? Is there no water below?”

“It is true, there is no water.”

“Then let us go down and wade across.”

They went down, found the stream full of water, and were swept away. They were seen struggling in the water, dragged out, and taken home. Never again did they want to go to Punalu‘u without someone who had good eyesight. (Pukui and Green 1995:93)

Nā Pua o Pā‘ula, The Blossoms of Pā‘ula

The following *mo‘olelo* takes place in Pā‘ula, Ka‘ū. Nāpuaopā‘ula was a pretty girl who was envied because of her beauty. She was killed by a shark *‘aumakua* that frequented the waters between Pā‘ula beach and Kahaoa. A shark hole remains in this area and is believed to be the home of this man-eating shark. The *mo‘olelo* of Nāpuaopā‘ula is as follows:

Nāpuaopā‘ula, Blossoms of Pā‘ula, was a pretty girl of Pā‘ula in Ka‘ū district. Many praised her beauty, and she became a great favorite with her family. Close to her home lived a household that was jealous of her because she was praised for her beauty, and their own child was homely.

Between Pā‘ula Beach and Kahaoa lived a shark *‘aumakua* of these jealous people. Every day they went with *‘awa*, bananas, and other good things to feed the shark. They first poured the *‘awa* into the shark’s hole, and when the shark’s head appeared, they fed it the food they had brought. Because of their jealousy of Nāpuaopā‘ula, they commanded the shark to take her life.

Nāpuaopā‘ula was returning with her parents from planting, and as she went close to the beach, they saw a swelling wave shaped like a white chicken rise and dash over the girl. The parents heard a wailing cry and saw their daughter being cruelly handled by the

shark. He dragged her from Kahaoa to Kawanui and from Kawanui back to Kahaoa. The girl cried to her parents, “O my parents! I am dying. Love to you!”

The broken-hearted parents consulted a *kahuna* as to the reason their beloved child had met with this misfortune. The *kahuna* told them that the shark was the ‘*aumakua* of the people living close to them and said that if they loved their daughter, they would bring him a black pig, a white cock, and black ‘*awa*. All these commands they fulfilled. Not long after, the mother became pregnant and bore a daughter. They named her Nāpuaopā‘ula. She was the exact image of her sister.

As for those evil-minded people, they contracted a swelling disease and died. First the father contracted the disease and died, and then the wife died. Thus all the members of the family died; there was no one left. Nāpuaopā‘ula the younger and her parents moved away from the place. No one fed the evil shark any more, and it was neglected in every way. For this reason, the shark hole was greatly feared because it was known that a man-eating shark lived there. (Pukui and Green 1995:42–43)

Pā‘ula

The story of Pā‘ula was told by Mrs. Wiggin and takes place in Kalaeokimo, Ka‘ū. Pā‘ula was a beautiful girl who played the game of *kimo* with a lover of the goddess Pele. When Pele saw them playing, she retaliated with vengeance and turned them to stone. Some say that the pebbles used to play the game of *kimo* can still be found at Kalaeokimo. The *mo‘olelo* of Pā‘ula is as follows:

Pā‘ula was a beautiful woman who lived on the beach of Pā‘ula. She had two friends almost as beautiful as she. All were fond of the game of *kimo*, and the spot where they loved to play was called Kalaeokimo, that is, the Cape of Kimo.

Pele has a lover whom she adored and endeavored to keep entertained with music, but he soon wearied of that and wandered off one afternoon bent on pleasure. He met Pā‘ula tossing her pebbles and counting them while her companions were swimming in the sea. He sat down before her and challenged her to a game, and for three days and nights they played, pausing only long enough to eat.

But Pele missed and sought him. When she found him with Pā‘ula absorbed in a game of *kimo*, in rage she smote them both and turned them into two headless masses of rock. There they are still to be seen, sitting facing each other with the pebbles between.

Down at the point of the cape, two friends of Pā‘ula were found playing *kimo* and they were smitten. But no trace of them remains – only the pebbles they were tossing. (Pukui and Green 1995:22)

Ka Mōhai ‘Ulu, The Breadfruit Offering

The following *mo‘olelo* honors the goddess Pele and respect for the gods in Hawai‘i. Pele is revered by many who visit the islands and is considered a family god to some in Ka‘ū. The *mo‘olelo* of Ka Mōhai ‘Ulu reminds us that Pele can be both benevolent and revengeful in nature.

Two girls who were roasting breadfruit in the upland plain boasted of their gods.

“Laka is my god, a beneficent god!” said one.

“Kapo is my god, an amiable god!” said her companion.

While they were thus praising their gods, an old woman appeared.

She said to the first girl, “Give me some of your breadfruit.”

“No,” answered the girl, “my breadfruit belongs to Laka.”

“Is Laka a powerful god?”
“Yes, a powerful god indeed!”
“Give me some water from your gourd.”
“No, indeed! This water belongs to Laka.”

The old woman turned to the second girl and asked her for breadfruit. Knowing that she had not vowed the breadfruit to her favorite god, she gave it gladly. When the old woman had eaten, she asked for water from her gourd and received it. When she rose to go, before leaving she said to the girl who had treated her kindly, “Go home and tell your parents to store food in their house and to hang up flags for ten days at the corners of the house.”

When the girl told her family what the old woman had said, they knew that it was no old woman, but Pele herself. They were glad that the girl had been kind to her. They obeyed all her commands, and when ten days had passed, fire from the volcano appeared above Moku‘āweoweo. The lava flowed over Ka‘ū district and destroyed many homes but spared the house and family of the kind-hearted girl.

Parents and grandparents teach their offspring not to be stingy, not to answer strangers rudely, that they might not offend Pele someday and have evil befall them. (Pukui and Green 1995:114)

These *mo‘olelo* continue to perpetuate the rich cultural history of Ka‘ū. The land tells a story, like the place names that commemorate significant people and events. From *mauka* to *makai*, these *mo‘olelo* celebrate the great respect that Ka‘ū people uphold for the land and entities that reside there. Generations of Ka‘ū continue to stand for what they believe in and persevere, hence the associated saying, “*He ‘a‘ali‘i kū makani mai au; ‘a‘ohe makani nāna e kula‘i*” (“*I am a wind-resisting ‘a‘ali‘i; no gale can push me over*”). Ka‘ū is a special place that has inspired many to continue sharing their *mo‘olelo*. As these *mo‘olelo* live on, so does the strength of the people, and the spiritual essence of the land, Ka‘ū.

‘Ōlelo No‘eau Associated with Ka‘ū

The following *‘ōlelo no‘eau* were gathered by Mary Kawena Pukui and published in her book titled *‘Ōlelo No‘eau Hawaiian Proverbs and Poetical Sayings*. These *‘ōlelo no‘eau* serve as a source of traditional knowledge associated with the district of Ka‘ū. According to Pukui, “The sayings may be appreciated individually and collectively for their aesthetic, historic, and educational values” (1983:VII). The following *‘ōlelo no‘eau* were included to gain an understanding of the places, the people, the commemorative events, and traditions that continue to be embraced throughout Ka‘ū.

Ahuwale na pali kahakai o Kamilo.
Exposed are the sea cliffs at Kamilo beach.
Said of a woman who sits carelessly and exposes herself. Kamilo is a beach in Ka‘ū.

Aia aku lā paha i Kiolaka‘ā.
Perhaps it is gone to Kiolaka‘ā.
Gone to the place of thrown-away things. Used when something is thrown away and later wanted. A play on *kiola*, to throw away. Kiolaka‘ā is a place in Ka‘ū.

Aia i Ka‘ū i Ka‘alu‘alu.
There in Ka‘ū is a place named Ka‘alu‘alu.
When seen from the ocean, Ka‘alu‘alu appears creased. This saying is applied jokingly to the wrinkles of a person, or to wrinkled clothing.

Aia i Kea'ā.

He is in Kea'ā.

A Ka'ū saying applied to a willfully inattentive person who hears no more than a deaf-mute. A play on *a'ā*.

Akāka wale no o Kaumaila'ohu.

Very clear appears Kaumaika'ohu.

One can very well see what the whole matter is about. Kaumaika'ohu is a hill in Punalu'u, Ka'ū.

'A'ohē 'alawa wale iho ia Mali'o.

Not even a glance at Mali'o.

Said of a haughty person. Pele was once so annoyed with Mali'o and her brother Halaaniani that she turned them both into stone and let them lie in the sea in Puna, Hawai'i. It was at the bay named after Halaaniani that clusters of pandanus were tossed into the sea with tokens to loved ones. These were borne by the current to Kamilo in Ka'ū.

E 'ai ana 'o i ka poi paua o Keaiwa.

Now you are eating the poi made from the paua taro of Keaiwa.

A boast from the district of Ka'ū. "Now you are seeing the very best that we have." Also used to say, "Now you will find out how fine a girl (or boy) can be in making love." The paua was the best taro in Ka'ū and the only variety that grew on the plains.

E ala e Ka'ū, kahiko o Mākaha; e ala e Puna, Puna Kumākaha; e ala e Hilo na'au ke!

Arise, o Ka'ū of ancient descent; arise, o Puna of the Kumākaha group; arise o Hilo of the water soaked foundation!

A rallying call. These names are found in Ka'ū and Puna chants of the chiefs. The Mākaha and Kumākaha (Like-the-Mākaha) were originally one. Some moved to Puna and took the name Kumākaha.

E loa'a ana iā 'oe ka mea a Pa'ahao.

You'll get what Pa'ahao has.

Pa'ahao, a native of Ka'ū, was often teased by his neighbors because when he was annoyed he would snap, "Naiō!" ("Pinworms!") This amused his tormentors. When annoyed, one might say, "You'll get what Pa'ahao has." Pa'ahao lived in Waiōhinu, Ka'ū, during the late 1800s and early 1900s.

Hahai no ka ua i ka ululā'au.

Rains always follow the forest.

The rains are attracted to forest trees. Knowing this, Hawaiians hewed only the trees that were needed.

He hā'awe pili.

Carriers of bundles of pili grass.

A derogatory saying by the followers of Kamehameha for the people of Ka'ū, who covered the road of Kapaukua with *pili* grass for their chief Keaouakuahu'ula.

Hele aku nei e 'imi i ka 'ili'ili hānau o Kōloa.

Went to seek the pebbles that give birth at Kōloa.

Said of one who goes and forgets to come home. These pebbles were found at a small beach called Kōloa, in Punalu'u, Ka'ū.

He lono ma mua, he kulina mahope; kulikuli wale ka makani o Ka'ū!
Report went first, heedlessness followed; what a din the wind of Ka'ū raised!
From a chant for Kaumuali'i of Kaua'i.

He moku 'āleuleu.
District of ragamuffins.
Said by Kamehameha's followers of Ka'ū and Puna because the people there, being hard-working farmers, lived most of the time in old clothes.

Hilina'i Puna, kālele iā Ka'ū.
Puna leans and reclines on Ka'ū.
Said of one who leans or depends on another. The ancestors of these two districts were originally of one extended family. The time came when those of each district decided to have a name of their own, without breaking the link entirely. Those in Ka'ū referred to themselves as the Mākaha and those in Puna as the Kumākaha. These names are mentioned in the chants of the chiefs of Ka'ū.

Hiohio ka makani i luna o Kapaliwai'ole.
The wind whistles on Kapaliwai'ole.
How ignorance speaks! Kapaliwai'ole is in Ka'ū.

Ho'i i Hīlea i kalo 'eka'eka.
Go to Hīlea of the dirty taro.
Said of a careless person. Once, Kohāikalani, a chief of Ka'ū, was living at Punalu'u. *Poi* was brought for him from various parts of the district, and a tiny speck of taro peeling was found in the *poi* from Hīlea. The makers of the *poi* were put to death. To say that someone hails from Hīlea is to say that he is unclean.

Kau 'ino na wa'a o Ka'alu'alu.
The canoes hasten ashore at Ka'alu'alu.
Said of those who hurry away from the scene of trouble. Ka'alu'alu is a beach in Ka'ū, Hawai'i, where fishermen hastened away from Hala'ea after unloading their fish onto his canoe.

I puni iā 'oe o Ka'ū a i 'ike 'ole 'oe iā Ka'ūloa, 'a'ohe nō 'oe i 'ike iā Ka'ū.
If you have been around Ka'ū and have not seen Ka'ūloa, you have not seen the whole of the district.
Ka'ūloa and Waiōhinu were two stones, wife and husband, that stood on a *kukui* grove on the upper side of the road between Na'alehu and Waiōhinu. With the passing of time, these stones gradually sank until they vanished completely into the earth. After Ka'ūloa was no longer seen, Palahemo was substituted as the chief point of interest.

Ka hālau a 'Ī
The house of 'Ī
The descendants of 'Ī, who extended through Hāmākua, Hilo, Puna and Ka'ū. One of these was 'Īmakakoloa, who was condemned to death by Kamehameha. According to the historian Kamakau, 'Īmakakoloa was put to death in Kama'oa. But according to the people of Ka'ū, a junior kinsman of similar appearance was substituted at the execution.

Kahilihili lau 'ilima.
A brushing off with 'ilima leaves.
After leaping into the dirt at Kaumaea, Ka'ū, the players wiped off the dust that

adhered to their skin with *'ilima* branches before going to Paiaha'a to surf. Later applied to one who takes a sketchy bath.

Kahuku kau 'ao'ao.

One-sided Kahuku.

Refers to Kahuku, Ka'ū. At one time, Kamehameha I made a bargain with some farmers to exchange *poi* for fish. A *konohiki* of Kahuku named Kaholowaho took huge calabashes of *poi* to the chief, who gave him one small fish in return. Kaholowaho tied the fish to one end of a carrying stick to show his neighbors what the chief had done. After several such exchanges, Kaholowaho brought Kamehameha a small taro in a big container. When the chief saw the taro he laughed, and from then on played fair. The fish tied to one end of the carrying stick produced the saying, "One-sided Kahuku."

Ka 'ili'ili hānau o Kōloa; ka nalu ha'i o Kāwā.

The reproducing pebbles of Kōloa; the breaking surf of Kāwā.

In Punalu'u, Ka'ū, is a small beach called Kōloa. The pebbles found here were believed to reproduce—the smooth ones being males and the porous ones, females. These were considered the best on the island of Hawai'i for *hula 'ili'ili*. Kāwā is just beyond Kōloa toward Honu'apo.

Ka 'ili'ili o Kalaekimo.

The pebbles of Kalaekimo.

Kalaekimo is where the chiefs of Ka'ū played the game of *kimo*. The pebbles there were much liked for the purpose. The place is now called Kalaeokimo.

Ka lua kupapa'u o nā ali'i.

The burial place of the chiefs.

Ka'ū, Hawai'i, where the bones of many noted ones are hidden in secret caves.

Ka makani ho'olapa o Kaumaea.

The playful wind of Kaumaea.

Kaumaea is in Ka'ū, Hawai'i.

Ka makani kuehu lepo o Na'alehu.

The dust scattering wind of Na'alehu.

Kamilo pae ali'i; Kamilo pae kanaka.

Kamilo where chiefs land; Kamilo where commoners land.

Refers to the beach in Ka'ū called Kamilo. It is partly rocky and partly sandy. When a person died at sea between Halaaniani, Puna, and Kamilo, the current would wash up the body at this beach. If the drowned person was a chief, his body would wash up on the rough side, but if he was a commoner he would float to the smooth side where anyone could come and remove him.

Ka nui e pa'a ai i ka huewai.

The size that enables one to carry a water bottle.

Said of a child about two years old. In Ka'ū, where fresh water was scarce and had to be obtained from upland springs, every person who went helped to carry home water. When a child was about two, he was given a small gourd bottle for carrying water.

Ka pali walowalo hea kanaka o Mōlīlele.

The eerie man-calling cliff of Mōlīlele.

Mōlī-lele (Mōlī's Leap), in Ka'ū, is the place where an unhappy girl named Mōlī once

leaped over the cliff in suicide. On each anniversary of her death the gale there blows a little harder than usual, and a person standing at the point from which she jumped can hear a rushing sound, as of a tapa-clad person running by.

Ka ua Hā'ao o Waiōhinu.

The Hā'ao rain of Waiōhinu.

A poetical expression in reference to Waiōhinu in Ka'ū Hawai'i. The Hā'ao rain comes down from the mountain in columns to Waiōhinu. It is mentioned in songs and chants of Ka'ū.

Ka'ū 'ai kō'ala'ala.

Ka'ū of the hasty repast.

Some of the natives of Ka'ū had a reputation for not being very hospitable. Hasty eating on the part of the host did not encourage guests to linger.

Ka'ū 'āina kipi.

Ka'ū, land of rebels.

The people of Ka'ū were known to rebel against oppression, even killing their own oppressive chiefs.

Ka'ū, 'āina kua makani.

Ka'ū, a land over whose back the wind blows.

Ka'ū is a windy land

Ka ua kau lā'au o Pāhala.

The tree-resting rain of Pāhala.

The rain of Pāhala in Ka'ū, Hawai'i, seems to rest on the tree tops.

Ka ua kūnihi a Ka'upena.

The rain of Ka'upena that turns aside.

Ka'upena was a seeress of Kama'oa Plain, in Ka'ū. Whenever rain approached, she called it to come to her home and to leave the homes of her neighbors alone so that their crops would not be ruined by a too-early rain. The rain obeyed.

Ka'ū hiehie i ka makani.

Ka'ū, regal in the gales.

An expression of admiration for the district of Ka'ū, Hawai'i, or for a stately or outstanding person of that district.

Kau 'ino nā wa'a o Ka'alu'alu.

The canoes hasten ashore at Ka'alu'alu.

Said of those who hurry away from the scene of trouble. Ka'alu'alu is a beach in Ka'ū. Hawai'i, where fishermen hastened away from Hala'ea after unloading their fish onto his canoe.

Ka'ū, i Palahemo.

In Ka'ū, at Palahemo.

Palahemo is a pool near Kalae in Ka'ū. Salt water is found under the fresh water, and any disturbance, like the dropping of a heavy stone, reverses the water, so that the salt water rises to the top. This place is famed in songs and chants.

Ka'ū lepo 'ula'ula.

Ka'ū of the red earth.

Said of the natives of old Ka'ū, who were one vast family. Because of pride in their

own people and homeland, Ka'ū people intermarried until they were of one blood and as one with their homeland. The *kauwā* were the only exceptions to this rule—they were despised and considered a people apart.

Ka'ū mai 'Oki'oki aho a Mawae.

Ka'ū from 'Oki'oki aho to Mawae.

The district of Ka'ū, from 'Oki'okiaho at the boundary of Puna, to Mawae at the boundary of Kona.

Ka'ū mākaha.

Ka'ū of the fierce fighters.

The district of Ka'ū, Hawai'i, was known for its fierce and independent warriors. Kohāikalani, Koihala, and Hala'ea, selfish and oppressive chiefs, were each destroyed by rebellious subjects.

Ka'ū malo 'eka, kua wehi.

Ka'ū of the dirty loincloth and black back.

The soil of Ka'ū is not easy to till. The farmers there squatted on their haunches and worked the soil with short digging sticks. The sun darkened the backs of the workers.

Ka'ū nui kua makani.

Great Ka'ū of the windblown back.

The wind always blows in Ka'ū.

Ka'ū nui maka lepo.

Great Ka'ū of dirty faces.

An expression of ridicule. Ka'ū, Hawai'i, is a dry, wind-swept district where clouds of dust rise into the air.

Ka wahine alualu pū hala o Kamilo.

The hala-pursuing woman of Kamilo.

A current comes to Kamilo in Ka'ū from Halaaniani in Puna; whatever is tossed in the sea at Halaaniani floats into Kamilo. Kapua once left her husband in Puna and went to Ka'ū. He missed her so badly that he decided to send her a pretty loincloth she had made him. This might make her think of him and come back. He wrapped the *malo* around the stem of a *hala* cluster, tied it securely in place with a cord, and tossed it into the sea. A few days later some women went fishing at Kamilo and noticed a *hala* cluster bobbing in the water. Kapua was among them. Eagerly they tried to seize it until one of the women succeeded. Kapua watched as the string was untied and the *malo* unfolded. She knew that it was her husband's plea to come home, so she returned to Puna.

Ka wai nā'uke po'o o Kahā.

The water of Kahā that removed head lice.

The water of Kahā is in Waiōhinu, Ka'ū. The chief Keouakuahu'ula once discovered that he had lice on his head. Not wanting others to know, he went to Kahā where he washed his head and had the pests removed.

Ke 'ā makauli o Kamilo.

The dark-faced lava rocks of Kamilo.

The dark stones of Kamilo beach in Ka'ū, Hawai'i.

Keauhou, kai nehe 'ili'ili.

Keauhou, where the sea murmurs to the pebbles.

Keauhou, Puna, Hawai'i

Ke hea mai nei o Kawelohea.

Kawelohea calls.

An expression much used in poems of Ka'ū, Hawai'i. Kawelo was a woman murdered by her husband. Her spirit entered a blowhole at Honu'apo, where her remains had been tossed. Out of this hole she warned of impending trouble, and the people grew fond of this voice from the depths.

Ke hele mai la ko Ka'ū; he iho mai la ko Palahemo; he hōkake a'e la i Manukā; haele loa aku la i Kaleinapueo.

There come those of Ka'ū; those of Palahemo descend; those of Manukā push this way and that; and away they all go to Kaleinapueo.

Said when one tries to find out something about another and meets with failure at every turn. A play on place names: 'ū (a grunt of contempt) in Ka'ū; *hemo* (to get away) in Palahemo; *kā* (to run along like a vine) in Manukā; and *leinapueo* (owl's leaping place) in Kaleinapueo.

Keiki haehae poko o Na'alehu.

The lad of Na'alehu who tears into bits.

Said in admiration of a strong warrior of Na'alehu who fearlessly attacks his foes. Later said of a Na'alehu-born person who shows no fear in any situation.

Keiki uha'i koai'e o 'Ohaikea.

Lad of 'Ohaikea who breaks koai'e logs.

An expression of admiration for any youth of 'Ohaikea in Ka'ū. A handsome young man of that locality was said to have been so strong that he could break a log in two with his bare hands.

Ke kawa lele 'opu o Kaumaea.

The diving place of Kaumaea (where skill is shown).

Kaumaea, Ka'ū, Hawai'i, is famed in old chants because it was there that a unique game was played. Instead of leaping off into the water, the players leaped off into a heap of dirt in a pit. Then they tried to slide down the mound with the least raising of dust. This game was usually followed by riding the surf of Kua'ana at Paiaha'a, thus washing off the dirt that clung to the perspiring skins of the players.

Keke'e ka waha, ua nahu i ka makani.

His mouth is wry after biting the wind.

Said of one who has found that what he said of others is true of himself.

Ke kini mahi'ai o Ka'ū.

The farming multitude of Ka'ū

A derogatory remark by Keāulumoku, author of the chant "Hauī ka lani," that the people of Ka'ū, who were mostly farmers, were insignificant people.

Ke kula wai 'ole o Kama'oa.

The waterless plain of Kama'oa.

The plain of Kama'oa, in Ka'ū, was well populated, but its people had to go upland for their watery supply.

Kō ke au ia Hala'ea.

The current carried Hala'ea away.

Said of one who goes out and forgets to return. Hala'ea was a chief of Ka'ū who was

so selfish that he demanded every fish caught by the fishermen. After years of going without fish, the fishermen rebelled. One day, the whole fleet went to the fishing grounds outside of Kalae and did not return. The chief wanted the catch and ordered a servant to go and ask for it. The servant refused, and in anger the chief went himself. When he asked for the fish the whole fleet turned the prows of their canoes shoreward. One by one the fishermen unloaded their fish into the chief's canoe. The canoe began to sink under the weight of the fish, and the chief cried out to the men to stop. They refused. The chief, his canoe, and his fish were swept out on the current and never seen again. This current, which comes from the east and flows out to sea at Kalae, is known as *Ke au o Hala'ea*.

Kōkō 'iole ka ua i ke kula.

Like the rat (-gnawed) net is the rain over the plains.

A Ka'ū saying, Makali'i, an ancient chief, once gathered all the food plants in a huge net and hung it up in the sky. The result was famine. A rat volunteered to go up to see what he could do about it. He ascended a rainbow and found the net, which he chewed. Down fell the contents, everywhere. So when the rain pours over the land and plants sprout everywhere, it is compared to the gnawed net that scattered food from the hills to the sea, bringing life to all.

Ku ka hale i Punalu'u, i Ka-wi-hū-o-Kauila.

The house stands at Punalu'u, at the gushing water of Kauila.

Said of one who has found peace and comfort at last. Ka-wai-hū-o-Kauila is a spring, the gift of a turtle goddess to the people of Punalu'u, Ka'ū.

Kumuhea Kupu 'ino.

Kumuhea, an evil demigod.

Said of anything destructive to the health. Kumuhea was a caterpillar god who ruined the health of his human wife and almost caused her death by keeping her on a diet of sweet potato leaves. Her father called to his father, the god Kū, who deprived Kumuhea of his human form, thus making it impossible for him to live with her anymore. Kumuhea lived on Pu'u'enuhe in Ka'ū.

Lele kōheoheo I ka pali o Kapaheo.

Plummeting from the cliff of Kapaheo.

A Ka'ū saying and a play on *heo* (quickly gone).

Mai ka uka a ke kai, mai kāhi pae a kāhi pae o Ka'ū, he ho'okāhi no 'ohana.

From the upland to the sea, from end to end of Ka'ū, there is only one family.

The inhabitants of old Ka'ū were of one family.

Maka'ala ke kanaka kāhea manu.

A man who calls birds should always be alert.

One who wishes to succeed should be alert to every opportunity, like one who catches birds by imitating their cries.

(Extra Explanation: The Hawaiian *ali'i* (chiefs) wore beautiful capes and headdresses crafted by weaving in thousands of tiny feathers. The Kanaka kahea manu, the bird-catcher, would imitate bird-calls to attract the birds to catch them, pluck out a small number of tiny feathers and let them go. Once he had called the birds, he had to stay alert and be prepared to catch them quickly when they came near. The saying advises one who wishes to succeed to be alert to any opportunity that should arise.)

Na kai haele lua o Kalae, o Kāwili lāua o Hala‘ea.
The two sea currents of Kalae - Kāwili and Hala‘ea.
The Hala‘ea current, named for an evil chief who was swept away, comes from the east to Kalae and sweeps out to sea. The Kāwili (Hit-and-twist) comes from the west and flows out alongside the Hala‘ea. Woe betide anyone caught between.

Na kūmau palapa‘a o Na‘alehu, oia mau no ka papa‘a.
The thick-walled calabashes of Na‘alehu are always crusted (with dried poi).
A Ka‘ū saying- the thick-headed natives of Na‘alehu are strict adherents to principles.

Na mamo a ke kipi.
Descendants of rebels.
Said of the people of Ka‘ū, who rebelled against oppression.

Nā mamo i ka halo o Kūa.
The descendants of the gill fins of Kua.
The people of Ka‘ū, Hawai‘i, are related to Kūa, the great shark god and protector of the district, by descent from his human sister.

Na mamo piha‘ā i kai o Ka‘alu‘alu.
The driftwood descendants at the sea of Ka‘alu‘alu.
Said of the innumerable children of large families, who are like the driftwood that litters the beach of Ka‘alu‘alu, Ka‘ū.

No Ka‘alu‘alu no la ho‘i kūpuna.
Naturally, when the ancestors hailed from Ka‘alu‘alu.
A play on ‘alu‘alu (baggy or loose fitting). Said of any person whose clothes do not fit properly or whose bundles are not secure. Ka‘alu‘alu is a place in Ka‘ū, Hawai‘i.

No Kalae no la ho‘i ke keiki.
The lad is from Kalae after all.
A boast: “He is a smart lad.” A play on *lae* (forehead). Refers to Kalae, Ka‘ū, Hawai‘i.

‘O Honu‘apo aku nō ia o Kahī o ka ‘ahu‘awa.
This is Honu‘apo where the ahu‘awa grows.
A Ka‘ū saying about disappointment. The *ahu‘awa* was much used as a fiber for straining ‘awa. A play on *hoka* (to strain, to be disappointed).

‘Ohu‘ohu Punalu‘u i Ka-wai-hū-o-Kauila.
Punalu‘u is adorned by the rushing water of Kauila.
Refers to Punalu‘u, Ka‘ū.

O Kua‘ana ka nalu; o Paiaha‘a ka ‘āina.
Kua‘ana is the surf; Paiaha‘a the land.
Proud were the people of Ka‘ū of the surf of Kua‘ana, where chiefs used to ride the waves to the shore of Paiaha‘a.

O Paiaha‘a ka ‘āina, o Kua‘ana ka nalu.
Paiaha‘a was the land, Kua‘ana the surf.
Paiaha‘a was a beach near Kaumaea, Ka‘ū, Hawai‘i. Here the dust that clung to the skin at Kaumaea was washed off by the surf of Kua‘ana. The inner surf, Kaina (Little Brother), was the place for children to surf, and the outer surf, Kua‘ana (Big Brother), was for grown-ups.

O Waiōhinu aku iā kahi o ka mai‘a pala.

That is Waiōhinu, where ripe bananas are.

A Ka‘ū saying meaning that one is in for bad luck. To see bananas while on a fishing or business trip was an omen of failure. From the story of twin brothers who were climbing a hill. The stronger brother climbed on while the weaker one sat and cried. The older looked down and said “Cry, baby, cry! Go to Waiōhinu to eat ripe bananas.”

Pāhala, ka ‘āina lepo ha‘aheo i ka maka.

Pāhala, land (of those who are) proud of the dust in the faces.

The people of Pāhala, Ka‘ū, like others of that district, are proud of their home, even though the wind-blown dust keeps their faces dirty.

Pala uluhe.

Ripened in uluhe fern leaves.

A term of derision applied by the shore dwellers of Ka‘ū, Hawai‘i, to the uplanders, who were poor farmers. They ripened their bananas in pits lined and covered with *uluhe* fern leaves, instead of allowing the bananas to ripen in the field.

Punalu‘u, i ke kai kau ha‘a a ka malihini.

Punalu‘u, where the sea dances for the visitors.

Punalu‘u, Ka‘ū, Hawai‘i, is said to be the place where the sea dances to delight visitors.

Uhiuhi lau māmane ka wai o Kapāpala.

Covered with māmane leaves is the water of Kapāpala.

The stream in Kapapala, Ka‘ū, often becomes very muddy. The people used to place *māmane* branches in the water to help the mud settle so that drinking water could be obtained. This saying applies to a person who tries to cover up the wrongdoings of another.

Wili ke au wili o Kāwili.

Swirled about by the swirling Kāwili.

Said of a confusing, bewildering situation. Kā-wili (Hit-and-twist) is a current at Kalae, Ka‘ū, Hawai‘i, that comes from the Kona side and flows out to the ocean. It is the rougher of the two currents that meet off at Kalae.

Oli and Mele associated with Ka‘ū

Oli (chants) and *mele* (songs) have long been a means of perpetuating tradition through artistic expression. Pukui explains, “Hawaiians were lovers of poetry and keen observers of nature. Every phase of nature was noted and expressions of this love and observation woven into poems of praise, of satire, of resentment, of love and of celebration for any occasion that may arise” (1949:247). There are two things to consider when looking at a composition: the literal translation and the *kaona*, or “inner meaning.” The *kaona* was sometimes so veiled that only the people to whom the chant belonged understood it, and sometimes so obvious that anyone who knew the figurative speech of old Hawai‘i could see it very plainly (Pukui 1949:247). The following compositions illustrate different *kaona* through the description of different features, place names, winds, rains, and important events associated with the Ka‘ū District.

Nā oli o Ka'ū

This section showcases *oli*, or chants, of Ka'ū. They tell of wind names, rain names, and places in the district.

Ku'u haku i ka ua Ha'ao e

The following chant was documented by Samuel Manaiakalani Kamakau on May 11, 1867 in the Hawaiian Language Newspaper *Ka Nūpepa Kū'oko'a*. The Ha'ao rain that is spoken of in this chant is the name of the rain that falls at Wai'ōhinu, Ka'ū. Ha'ao is also the name of a fresh water spring at Wai'ōhinu that was named after the grand-daughter of Kūmauna. Kamakau notes that this *oli* was for the Ka'ū chief, Keouakū'ahu'ula during the time that he was to be sacrificed at Pu'ukoholā. He further states that “the chant is still chanted by the old people of Ka'ū who retain their love of Keoua and hatred for Kamehameha” (1992:158). In *Ka Nūpepa Kū'oko'a*, it is written, “I ko Kaihekioi 'ike 'ana aku iā Keoua Kū'ahu'ula e amo 'ia ana i luna o Pu'ukoholā, puana akula 'oia i kēia mau hua mele aloha penei:” (When Kaihekioi saw Keoua Kū'ahu'ula being carried onto Pu'ukoholā, he uttered these loving words as follows:).

Ku'u haku i ka ua Ha'ao e	My lord of the rain of Ha'ao
Ke lele a'e la ka ua	The rain flies fast
Ma uka o 'Au'aulele	Flies over the upland of 'Au'aulele
Lele ka ua, lele pu no me ka makani	The rain flies driven by the wind
E lele po'o ana ka wai o ka ha	The rain drives down from the cliffs above
Ku'u haku mai ka wai	The tears for my chief
Ha'ule po'o e	Drop down on the heads of the people

Nā Makani o Hawai'i

The following chant was collected from the *mo'olelo* of Kuapaka'a, during the time of Keawenuiaumi (Fornander 1919:92–95). When Kuapaka'a was told by his father to call out to the winds of Hawai'i, he chanted forth...

Nā Makani o Hawai'i	The Winds of Hawai'i
Aia la! aia la! aia la!	There they are! There they are! There they are!
He apaapaa ko Kohala,	The apaapaa is of Kohala,
He naulu ko Kawaihae;	The naulu is of Kawaihae,
He kipuupuu ko Waimea,	The kipuupuu is of Waimea,
He olauniu ko Kekaha,	The olauniu is of Kekaha,
He pili-a ko Kaniku,	The pili-a is of Kaniku,
He ae ko Kiholo,	The ae is of Kiholo,
He pohu ko Kona,	The pohu is of Kona,
He maaakualapu ko Kahaluu,	The maaakualapu is of Kahaluu,
He pihala ko Kaawaloa,	The pihala is of Kaawaloa,
He kehau ko Kapalilua,	The kehau is of Kapalilua,
He puahiohio ko Kau,	The puahiohio of Kau
He ho'olapa ko Kamaoa,	The hoolapa is of Kamaoa,
He kuehu lepo ko Naalehu,	The kuehulepo is of Naalehu,
He uwahi a pele ko Kilauea,	The uwahipele is of Kilauea,
He awa ko Leleiwi,	The awa is of Leleiwi
He puulena ko Waiakea,	The puulena is of Waiakea,
He uluau ko Hilo paliku,	The uluau is of the cliffs of Hilo,
He koholalele ko Hamakua,	The koholalele is of Hamakua,

He holopoopoo ko Waipio,
 O ka welelau o kela makani,
 O ka welelau o keia makani,
 Puili puahiohio.
 Haawe ka opeope ma ke kua,
 Loaa ka ukana a ka waa make.
 No ka waa iki ka make,
 Pau pu me ka waa nui.
 Make ke 'lii, make ke kahuna,

 Make ka pulewa, ka hailawa,

 Ka lawa uli, ka lawa kea.
 O ka huli, o ka noonoo,
 E ike i ka hoku o ka lani.
 O hoku ula, o hoku lei,
 O auau pakakahi,
 O auau paka lua,
 E Keawenuiaumi, e pae.
 I nehinei ka la malie,
 E holo ia mai, ina la ua pae,

 He la ino keia la.

The holopoopoo is of Waipio,
 The end of that wind,
 The end of this wind,
 Join and cause a whirlwind
 Place the burden on the back,
 Thus a load is given to the swamped canoe,
 Because the small canoe is swamped,
 The large canoe will meet the same fate,
 Troubles will overtake the king, troubles will
 overtake the priest
 Troubles will overtake the unstable ones,
 the followers of the king
 The different officers of the king
 They will search out, they will study out
 To locate the stars in the heaven
 The red star, the string of stars
 They hasten singly,
 They hasten by twos,
 Say, Keawenuiaumi, come ashore
 Yesterday was the calm day
 Had you come yesterday, you would have reached
 your destination
 This is a stormy day.

Ki'eki'e Ka'ū Kua Makani

The following *oli* was documented by Mary Kawena Pukui and published in the Journal of American Folklore (Pukui 1949:258). This chant mentions the names of winds and places in the Ka'ū district.

Ki'eki'e Kau kua makani,
 He umauma i pa ia e ke 'A'eloā,
 I ka Unulau pa a ka Unulau,

 Ina aku la paha i Nunu-weuweu,
 Ka wahine ka'ili pua o Paiaha'a,
 Alualu pua hala o Kamilo-pae-kanaka,

 He kanaka ka ia no ke ano ahiahi,

 O wau nei la no ke ano kakahiaka,
 I o ai ka inoa o na kupuna e.

Majestic Kau of the wind-blown back,
 Whose chest is lifted to the A'eloā breeze,
 The Unulau breezes blow one after the
 other,
 Perhaps she is gone to Nunu-weuweu,
 My lady who gathers flowers at Paiaha'a,
 She is gone to seek the hala cluster at
 Kamilo-pae-kanaka.
 The other person is perhaps a child of
 evening hours
 But I am a child of the morning hours,
 This I chant that my ancestors may be
 honored.

Nā Mele o Ka'ū

Several *mele*, or songs, feature Ka'ū. These *mele* range from traditional to modern and in general they show how cherished the district was and still is.

Hele Ho'i ke Ala Mauka o Ka'ū

The following *mele* was documented in a report written by Kepā Maly, titled He Wahi Mo'olelo No Keauhou a Me Nā Wahi Pana Ma Laila. A Collection of Traditions, Historical Accounts and Kama'āina Recollections of Keauhou and its Storied Places; With Notes From Adjoining Land in Ka'ū and Puna, Island of Hawai'i. In this report, Maly shares this *mele* that was taught to him by Kupuna Ho'ohila Kawelo in 1974 (Maly and Maly 2005:16). This *mele* commemorates the landscape of Keauhou and tells of the trails, sacred places, and wind found in the area. The uplands of Ka'ū are mentioned.

Hele ho'i ke ala mauka o Ka'ū Hele ho'i ke ala makai o Puna	The path traveled has led to the uplands of Ka'ū The same path also takes one to the lowlands of Puna
'O ka ma'ema'e lā o ka pua lei Aloha ka pi'ina i Kukalā'ula Ho'opuka akula ka Pu'ulena 'āina a ke akua i noho ai Kau makana ia o ka leo 'o ka leo wale nō e	Clean and fresh like a flower garland One loves the ascent at Kukalā'ula Where the Pu'ulena breeze flows From the land where the goddess dwells The only gift I have to offer you is my voice Simply the voice

'A'ole au i Makemake iā Kona

The following is a portion of a *mele inoa* (name chant) for an *ali'i* of Ka'ū named Kupake'e. Mary Kawena Pukui also included this *mele* in the Journal of American Folklore (Pukui 1949:252).

'Aole au i makemake ia Kona O Kau ka'u O ka wai o Kalae e kahe ana i ka po a 'ao,	I do not care for Kona For Kau is mine The water from Kalae is carried all night long,
I ke kapa, i ka 'upi kekahi wai,	(Wrung) from tapas and some from sponges,
Kulia i lohe ai he 'aina wai 'ole, I Mana, i Unulau ka wai kali,	This land is heard of as having no water, Except for the water that is waited for at Mana and Unulau,
I ka pona maka o ka I'a ka wai aloha e,	The much prized water is found in the eye socket of the fish
Aloha i ka wai malama a kane, E hi'i ana ke keiki i ke hokeo,	The water prized and cared for by the man, The child carries a gourd container in his arms
E hano ana, e kani 'ouo ana,	It whistles, whistles as the wind blows into it,
Ka leo o ka huiwai i ka makani,	The voice of the water gourd is produced by the wind,
Me he hano pui ala i ke aumoe, Ka hoene lua a ka ipu e o nei,	Sounding like a nose flute at midnight, This long-drawn whistling of the gourd we hear,
E lono i kou pomaika'i, Eia! Mamuli o kou hope 'ole, okoa ka ho'i,	Hearken, how fortunate you are! There is no going back, (our) ways are different,
A ma ka wa kamalii nei, mihi malu, 'U wale iho no, Aloha 'ino no ka ho'i ke kau mamua,	In childhood only does one regret in secret, Grieving alone, (Look) forward with love for the seasons ahead of us,
'U'ina 'ino noho'i ke kau i hala aku nei.	Let pass the season that is gone.

Ka 'Iwalani

Mary Kawena Pukui also documented this chant in the *Journal of American Folklore*. *Ka 'Iwalani* is a composition in which people are referred to as ferns, a tree, wind, and a ship. Furthermore, this chant plays on different place names in *Ka'ū*.

<i>Ka 'Iwalani</i>	<i>The Iwalani</i>
Kaulana e ka holo a ka 'Iwalani Ke ka'upu hehi 'ale a o ka moana 'Aole i ana iho ko'u makemake, I na 'iwa'iwa o ka uka o Ha'ao, I ahona Honu'apo i ka lau niu,	Well liked is the sailing of the Iwalani, Moving like a sea eagle over the waves, Endless indeed is my admiration, For the maiden hair ferns of Haaao, Honuapo is made pleasant by the coconut leaves
I ka holu i kea he a ka makani, Aia i Punalu'u, ka'u aloha la, I ke kai kauha'a a ka malihini,	That sway with the wafting of the breeze, Over at Punalu'u is the one I love Beside the dancing sea, the delight of visitors
Ke huli ho'i nei, o ka 'Iwalani, E'ike i ke kai malino a o Kona, No Kona ka makani, he kuala'i pau, Kiki'i kapakahi o ka 'Iwalani.	Now the Iwalani is on its homeward way, To the smooth sea of Kona, To Kona belongs the gusty wind That heels the Iwalani over to its side.

'Tho ka Palau a 'Eku i Lalo

Also included in the *Journal of American Folklore* is the following poem that expresses the disgust of a *Ka'ū* man for the unfaithfulness of his wife. Pukui writes, "Although it refers to some modern implements, it is over three quarters of a century old" (1949:253).

'Tho ka palau a 'eku ilalo,	The plow digs down to root into the earth
Pi'i ke puna a me ke 'o hala kau i luna, Huhulu-i'i ka hulu o na manu I ka ua kakahiaka, Akaka wale no kau mai ka 'ohu, 'Ohu'ohu Punalu'u i ka Wai-hu-o-Kauila,	The spoon and the fork go up, The feathers of the bird are ruffled In the morning rain, The mist above is clearly seen, Punaluu is adorned by the gushing spring of Kauila
I ho'owali 'anapau ia e ke kai o Kamehame, 'Aohe hemahema o ka pali o Pohina,	Which is stirred up by the sea of Kamehame, There is nothing that the cliff of Pohina lacks
E kahiko ia nei e Waiohinu.	It is bedecked by Waiohinu.

Mai Poina i Punalu'u

The following *mele* titled, "*Mai Poina i Punalu'u*" was written by Susan Pua and published in the book *Beaches of the Big Island*. Aunty Susan would often frequent Punalu'u with her family and one day while she was playing *'ukulele* at Punalu'u Beach, this song came to her.

Mai Poina i Punalu'u	Don't forget Punalu'u
Mai poina, mai poina, Ka nani a'o Punalu'u	Don't forget, don't forget The beauty of Punalu'u

He beauty maoli nō	It's everlasting beauty
Pu'umoa, Pu'umoa	Pu'umoa, Pu'umoa
Ke kai hāwanawana	The whispering sea,
He beauty maoli nō	Its everlasting beauty
Kauwila, Kauwila	Kauwila, Kauwila
Ka wai onaona,	The sweet water,
He beauty maoli nō	Its everlasting beauty
Hānau ia, hānau ia	Laboring, laboring,
'Ili'ili hānau kēia	These pebbles are born
Kanani a'ō Kōloa	The beauty of Kōloa
Hā'ina, mai poina	Tell the refrain, don't forget
Ka nani a'ō Punalu'u	The beauty of Punalu'u
He beauty maoli nō	Its everlasting beauty

Punalu'u

The following *mele* titled, "Punalu'u" was written by George Kealoha Iopa, Sr. who lived in Punalu'u, Ka'ū. In 1972, C. Brewer published this song under the name of George and Alice Iopa. In 1973, it was the theme song for the restaurant at Punalu'u. This *mele* provides insight into the environment, traditional names, and special features of this beautiful place.

Punalu'u

Aloha Punalu'u, i ka 'ehu kai	This love of Punalu'u with the mist of the sea-spray
Ke kai kokolo a'ō Pu'umoa	And the creeping waves at Pu'umoa
Me ka wai kaulana, a'ō Punalu'u	Then by the water place at Punalu'u
Ka wai punapuna a'ō Kauwila	The spring water spurting like fountains at Kauwila
He u'i nā moku, a'e kau mai nei	The beauty part of the reef awaits
Kaulana kou inoa i ka po'opa'a	Which is the famous place where po'opa'a fishing is good
Mai poina iā Koloa, a'e kou inoa	This unforgettable and famous place, Koloa
Ka homehānau o ka 'ili'ili	The home and birthplace of the pebbles
Ho'i aku wau iā Nīnole	As I enter at Nīnole,
I ka wai hu'ihu'i mai ke kuahiwi	There the cool water from the mountain
Hā'ina 'ia mai ana ka puana	This is the end of my version about
Aloha Punalu'u i ka 'ehu kai	This love of Punalu'u with the mist of the sea-spray

Ka nani a'ō Ka'ū

This *mele* titled, "Ka Nani A'ō Ka'ū" was written by George Lanakilakeikiahiali'i Naope. It tells of the beauty of the district.

Ka Nani A'ō Ka'ū

Ke 'ike aku wau	Behold and see
Ka nani a'ō Ka'ū	All this beauty here in Ka'ū
Me ka beauty a'ō wai 'ō Palahemo	The beauty of the water of Palahemo
Aloha nō 'ō Ka'ū	With love an affection for Ka'ū
Nanea i ka ho'olohe	Relax and listen to
Ka nalu nui e holu ana	The waves that break at the beach
A he shua Kaulana Bay	I am sure the bay is Kaulana
Aloha nō 'ō Ka'ū	With love and affection for Ka'ū
Kaulana 'ō Kalae	Famous is Kalae
E kū nei e	And there stands

Ka hale ipu kukui mālamalama	The light house that shines
Aloha nō 'o Ka'ū	With love and affection for Ka'ū
'Ike 'ia mākou	Everyone was able to see
Wai 'ahukini	The currents of Ahukini
Me ke one wai kaulana	This water current makes this point famous
Aloha nō 'o Ka'ū	With love and affection for Ka'ū
Puana ka inoa	This is the end of my song
Ka nani a'o Ka'ū	The beauty of Ka'ū
Ua piha me ka hau'oli	I am filled with happiness and
Aloha nō 'o Ka'ū	With love and affection for Ka'ū

Ha'alulu Luna o Kaiholena

The following *mele* was documented by King Kalākaua I in the book *Na Mele Aimoku, Na Mele Kupuna, a Me Na Mele Ponoī O Ka Moi Kalakaua I: Dynastic Chants, Ancestral Chants, and Personal Chants of King Kalākaua I* (Kalākaua I 2001). Taupōuri Tanagrō provides a translation for this *mele* (Tangarō 2005:13).

Ha'alulu luna o Kaiholena	The sky above Kaiholena quivers (with rain)
Ka papa o kau mai ka 'ohu...	The foundation for the mist to mount
Hele piha a'o Ka'ū	Ka'ū becomes stocked (with resources)
O ka ipu o Kapāpala...	The food gourd of Kapāpala
Ua wali wale, 'a'ohē nao	The rain has made the soil soft, nothing left to do
I ke kū'ai nā i'a	But to exchange for fish
'O ka po'e nāna i kia'i	The people whose job it is to steward this
'O Ka'ū nui kua makani	Are those whose backs are accustomed to the wind
'O ka hū o ka maka'ainana	The overflowing of residence
'O ka maka'ainana nui po'o kua kea	The citizens whose heads are whiten with wisdom
Ka pē mahi'ai o Ka'ū...	The dew-anointed farmers of Ka'ū

Traditional Land Use

The Native Hawaiian relationship with the *'āina* is spiritually guided by reverence and a deep seeded respect. This connection is depicted in the *Kumulipo*, a highly detailed genealogical creation chant, where *kānaka* descend from Papahānaumoku, Earth Mother, and Wākea, Sky Father. Therefore, to disrespect the land is to disregard one's *'ohana*. So sustaining a *pono* connection to the *'āina*, or that which feeds, is essential to the balance of all life and to the well being of our society.

The following section discusses traditional ecological zones, land divisions, and place names of the region, as well as traditional land management and cultural practices that occurred within and around the Ka'ū Forest Reserve. Further information on place names can be found in Appendix A.

Traditional Ecological Zones

Hawaiians generally did not inhabit the mountainous upland areas of the Hawaiian Islands. These areas were cold, wet and not as hospitable as lower elevations. The mountain regions did, however, supply important raw materials and were visited to exploit these resources. Trees growing in the

mountains were cut for wood used to make canoes, bowls, tools, weapons, musical instruments and god images; birds were caught for their feathers, which were used in capes, helmets, *kahili* and *lei*; ferns and foliage were gathered for decoration and other purposes; the 'ie'ie vine (*Freycinetia arborea*), was used to make fish traps, feather helmets, god images, musical instruments, twined baskets and other such things (Krauss 1993).

The extent to which people in Ka'ū visited the area of the present day Ka'ū Forest Reserve, and the circumstances surrounding these visits, is not known and can only be inferred. However, the area is rich in natural resources, and it was undoubtedly a place where Hawaiians came for bird catching, wood harvesting, gathering of plants, and as a thoroughfare into the *mauka* portions of the island. Additionally, from sources such as Pukui, we get a glimpse of the types of activities that occurred at different elevation zones in Ka'ū (Figure 5). The traditional ecological zones that Handy and Pukui (1998) list include:

- Piko** - (13,000 ft.) Moku Aweoweo Crater, Summit
- Kua lono** - (11,000–10,000 ft.)
- Ma'u kele** or **Wao kele** - (8,000–7,000 ft.)
- Wao akua** - (6,000–5,000 ft.)
- Wao nahele** or **Wao lā'au** - (5,000–4,000 ft.)
- Wao 'ama'u** or **Wao kānaka** - (3,000 ft.)
- Wao 'ilima** - (2,000 ft.)
- Kula uka** - (1,000 ft.)
- Kula kai** - (1,000–500 ft.)

The wealth of resources that Ka'ū possessed from *mauka* to *makai* was what intrigued the first settlers to this area. The passage below describes those resources, such as various animals, fish, and plants, which defined their subsistence economy from the forested areas down to the ocean regions. This description also highlights the limitations of certain resources due to Ka'ū's unique landscape and location:

The plains and the lower forested hills of Manukā, Kahuku, Pakini and Kamao'a, and the lush sheltered valley of Waiohinu must have looked like a veritable land of promise to the keen-eye early Polynesian colonists who were skilled horticulturalists, accustomed to appraise an Oceanic landscape from the sea in terms of its habitability. The great current called Ke Au a Halali'i, sweeping southwestward from Ka Lae like the wake of a ship, made plain to these men, who sharply watched every sign of ocean and air, the fact that here the flow (au moana) of ocean around the island came together from east and west alongshore, pushed by whatsoever wind—trade winds (ko'olau), southerlies (kona), north-westerlies (kiu). And they knew that here ran the big fish they treasured most for subsistence 'ahi (tuna), aku (bonito), 'a'u (swordfish), ulua (Caranx) and mahimahi (dolphin fish), and the smaller but much-relished 'opelu (mackerel).

There were serious drawbacks, of which they were aware at first glance. There was no reef; there were but tiny coves, few beaches; and this meant few squid, mullet, goatfish, parrotfish and the like along and offshore in shallows; few shellfish and crustaceans, a dearth of limu (seaweed)—all food items of prime importance for these tropical Oceanic islanders, undoubtedly well acquainted with the dietary wealth of the lagoons of reef-rimmed high volcanic islands and coral atolls. Yet the land was both a challenge and a promise. They settled; they spread "like a gourd vine" over the plain. They cleared their plots and planted all that they had carefully transported from the old homeland. (Handy and Pukui 1998:222–223)

This would mean that it was less windy; and undoubtedly, with such cover, there was much more rainfall, mist fall and dew, in comparison with the modern desiccation of bare, windswept, sun baked plain flanked now to east and west and north by recent black lava which condenses the sun's heat and dries the air above it. The winds come in off the sea over the flank of the mountain, and in trade wind season (March to November) would normally have been saturated with moisture from spray, when not desiccated in passing over arid land as now. The winter storms from the south still bring heavy rains.

Peculiar to this region even today is the cold mist-laden breeze (kehau) that pours down from the wet or snow-clad heights of Mauna Loa. A hundred and twenty-five years ago, and later, travelers described snows on Mauna Loa in July and August. (In modern times the snowcap is less constant.) Even as recently as fifty years ago, after severe deforestation both on the seaward slopes and in the upland had taken place, dewfall was a recognized source of moisture, where it condensed off vegetation and cool rocks and dripped into low-lying holes to be collected in gourds for drinking and for watering nearby plants.

Furthermore, it is not to be doubted that there was anciently more flow in underground streams and more percolation into and from lava tubes, which fed springs like that of Wai-o-Ahukini and deep rock pools like the famous waterhole Wai-a-Palahemo near South Point. Old timers today point out that earthquakes are known to have shut off some underground streams in historic times, and that introduced trees such as the eucalyptus may have clogged underground waterways with their root mats.

It may therefore be assumed that the first Polynesian colonists found a much more favorable habitat so far as fertile soil, favorable climate and water supply are concerned, than their descendants were obliged to learn to live with after continuing volcanic destruction and subsequent deforestation had materially altered the aspect of their land; and that those climate factors presented them, at the time of settlement, with a well-established and valuable flora, which botanists give us reason to picture as giving Ka'ū a fairly continuous cover. (Handy and Pukui 1998:225–226)

Hawaiians were prolific in naming the natural world around them and the mountains were no exception. Kamakau gives a general description of the names applied to different mountain regions from a Hawaiian perspective in an article in the Hawaiian newspaper *Ke Au Okoa* in 1869. The translation of the newspaper excerpt is as follows:

Heights in the center or toward the side of 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 forest 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* 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 the delineations (*'ano*). The part directly in back and in front of the summit 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 is 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. ... 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 1869)

Two other sources that describe the various mountain regions are found in *The Polynesian Family System in Ka'ū* (Handy and Pukui 1998) and *Native Planters* (Handy and Pukui 1991). Particular locations in Ka'ū are mentioned, and the more general descriptions can also be easily applied to the zones found within the uplands of Ka'ū. The descriptions provide insight into the traditional, pre-Western, Hawaiian worldview and land practices associated with this perspective.

The *wao* (or upland jungle) was an important feature for the Hawaiian people as it contained many native plant species important to their culture. This section describes the many varieties of native plants prevalent in this particular realm of the Ka'ū forest and the distinct qualities of the plants that were significant for identification:

Wao means the wild—a place distant and not often penetrated by man. The *wao la'au* is the inland forested region, often a veritable jungle, which surmounts the upland *kula* slopes on every major island of the chain, reaching up to very high elevations... The Hawaiians recognized and named many divisions or aspects of the *wao*: first, the *wao kanaka*, the reaches most accessible, and most valuable, to man (*kanaka*); and above that, denser and at higher elevations, the *wao akua*, forest of the gods, remote, awesome, seldom penetrated, source of supernatural influences, both evil and beneficent. The *wao kele*, or *wao ma'u kele*, was the rainforest. Here grew giant trees and tree ferns (*'ama'u*) under almost perpetual cloud and rain.

The *wao kanaka* and the *wao la'au* provided man with the hard wood of the *koa* for spears, utensils, and logs for boat hulls; pandanus leaves (*lau hala*) for thatch and mats; bark of the *mamaki* tree for making *tapa* cloth; candlenuts (*kukui*) for oil and light; wild yams and roots for famine time; sandalwood, prized when shaved or ground as a sweet scent for bedding and stored garments. These and innumerable other materials were sought and found and worked by man in and from the *wao*...

The most prevalent feature of the rain forests was the variety of ferns, from tiny delicate ground cover to the majestic tree ferns. Among the many small species that the Hawaiians named, which we will not attempt to differentiate descriptively here, were the *Lau-kahi* (“single leaf”) or *Cliffbrake*; The *Pali-lau-li'i* (“little leaf”); *Palai-hinahina* (“lying flat”); *Kihi* (“angular”); *Wahine-Noho-Mauna* (“mountain-dwelling-woman”); *Pai* (a bracken); all air plants; the *Wawae-'iole* (“rat's foot”), or clubmoss, called by botanists “a living fossil”; a group of small “elephant-tongue” ferns all named *'Ekaha* by Hawaiians (as was also the very large “birdnest fern,” *Asplenium*, found usually in tree crotches); the filmy *'Ohi'aku* (“upright *'ohi'a*”), *Kilau*, *Owali'i* and *'Iwa'iwa* (maidenhair). Among the more distinctive larger fern clumps were the *Pala'ā*, whose

stems yielded a red dye; Pamoho, which hangs curtain-like over wet cliffs and cavern mouths; 'Akolea, a broad-fronded lacy fern; Ni'ani'au, a group of closely related sword-ferns; two lacy ferns, Palapalai, sacred to Laka and essential for the hula altar, and Palapala'a, sacred to Hi'iaka (her magical skirt was made from it), whose juices were used for dye and for medicine; Waimakanui ("great tears"); Ho'i'o, whose young leaves were edible. Other well known but less spectacular ferns were the A'e, Loulu, Kikawaio, Pi'ipi'ilau Mamana ("branching climbing leaf"), and the Pala.

Among the "vines" we note two that are unique. Maile (*Alyxia*), peculiar to the Hawaiian Islands, is more properly described as a twining shrub, whose fragrant bark and thick close growing oval leaves made it desirable for wreathing as lei and for ceremonial or festive decoration, particularly on the hula altar, as it was associated with the goddess Laka; there are many legends about the four maile sisters. The second "vine"...the endemic 'ie'ie also had many uses: the strong, durable roots were woven into tight carrying baskets and into fine meshed funnels for shrimp traps, and were also plaited to make a strong foundation for the feathered war helmets (*mahirole*); the stem fibers were pounded and made into binding twine for house rafters and canoe outriggers. 'Ie'ie branches formed part of the stipulated wildwood offerings on the *hula* altar.

'Ama'u fern on the other hand, widespread in the wao, is a generous host to seeds of other plants, particularly the 'ohi'a lehua, whose seeds lodge and sprout in frond bases of the ama'u stalks. The leathery fronds served for thatching upland shelters, for house decoration, and mulch for unirrigated forest taro patches. The starchy pith of the stalks, and young shoots, were famine food. The firepit of Kilauea Volcano (in the forest surrounding which it grows abundantly) is named Halema'uma'u, house of the ama'u fern –possibly because cooled lava outpourings in the vicinity often have a striking resemblance to the fern fronds. Koa in the rain forest develops a straight, massive bole, branching forty feet above ground, the best for canoe hulls. 'Ohi'a Lehua is here abundant, and large. Mamane attains a height of forty feet. 'A'ali'i, a shrub on the plains is a thirty-foot tree at 6,000 to 8,000 foot elevation. Kupaoa, an herb or shrub in lowlands, becomes here a twenty-foot tree. Pukiawe grows fifteen feet high. 'Alani (Pelea) is known only in the higher forest of the Hawaiian Islands. Its generic name Pelea is bestowed in honor of the volcano goddess, Pele. A smallish tree with leathery leaves, its nut, used medicinally, contains a fragrant oil reminiscent of that found in orange rind. Olopua (*Osmanthus*), the Hawaiian olive, having yellow flowers and bluish olive-like but inedible fruit, is abundant on the leeward lava slopes of Ka'u where it attains to sixty feet in height. The hard dark-brown wood was prized for making the o'o or digging stick, as well as for adze handles.

Kolea (*Suttonia*) is a small tree with very thick leaves, whose wood was favoured for kapa anvils, while its red sap was used as a dye. Kopiko (*Straussia*), is a glossy-leaved and magnolia-like in form, handsome but useless. A'e (*Sapindus*) or "Soapberry" whose fruit lathers in water, is a tall deciduous tree (sometimes eighty feet high) native only to the island of Hawaii, having a smooth light-brown bark which scales off in large patches. The large black seeds are prized for making necklaces. The 'oha ('ohawai or 'ohakepau), is a *Clermontia*, a genus peculiar to the Hawaiian islands, having a tall straight stalk topped by a crown of slender, dark, glossy leaves and pendant waxy flowers producing dark globular fruits. The sticky, milky sap (kepau) of the leaf branches was employed as birdlime. Hapu'u (*Cibotium*) are giant ferns, of which there are two forms. The hapu'u i'i trunk attains twenty-five feet in height, with fronds rising fifteen feet higher; the term i'i describes the stiff bristles on the stalks, suggestive of those on a hog's leg – hence this fern was a "form" of Kamapua'a, the hog god. The hapu'u pulu is slightly shorter and has soft down (pulu) surrounding budding fronds. The pulu was packed into body cavities in embalming, and used for other purposes. But the prime value of hapu'u was in the starch

core of the trunk, which was eaten as famine food. 'Iliahi (Santalum), or sandalwood, thriving best at 5,000 feet or more altitude in open drier areas, was prized for its heartwood (la'au 'a'ala, "fragrant wood"), which was powdered for perfuming bark cloth bed coverings.

Mau'u Ho'ula 'Ili or Mau'u La 'Ili (Sisyrinchium) is a yellow-flowered native grass found from median to high altitudes in boggy places, whose juice was used to burn designs on the skin. A native lily-like sedge called 'uki'uki is common here and was gathered for house thatch; it is identified as *Vicentia* and differs from the 'uki'uki (*Dianella*) found elsewhere in these islands. The large-leafed marsh plant 'Ape'ape and the herb 'Ala'alawainui thrive here as at low altitudes. 'Aku'aku (*Cyanea*) has lettuce-like leaves liked by bird and man. 'Ohelo (*Vaccinium*) is a relative of the blueberry and the cranberry, but our Hawaiian species is peculiar to volcanic areas of Mauna Loa on Hawaii and Haleakala on Maui, where its juicy edible red berries were identified with the volcano goddess Pele. Another variety, called 'ohelo kau ka'au, grows up to six feet high and has bitter berries. Naupaka Kuahiwi is a shrub of more compact growth than shoreline naupaka, having thick, smooth bright green leaves. It has the characteristic white half-flowers, but black fruit. False staghorn, Uluhe, proliferates massively in the uplands, a useless pest except for occasional use as temporary thatch. It stifles other vegetation.

The *ko kula uka* (on the upslope) was another significant zone in the uplands of Ka'ū as it was the home of many plants that were used for food, medicine, crafts, and adornment.

Here we found Kukaepua'a (*Digitaria*), a native crab-grass growing thickly around trees in woods where wild hogs dwell. The name means "hog's excrement". Its stem is hairy like a hog's leg. A kinolau or form of the hog-god Kamapua'a, it could be used as an offering in place of a pig in religious ceremonies. Its juice was used medicinally to heal birth lacerations. Pua Kala and 'Ala'Ala Wainui were here also. 'Ape'Ape (*Gunnera*), a marsh plant with large leaves looking like rhubarb, is peculiar to the Hawaiian Islands. Moa (*Psilotum*), a very ancient almost leafless small plant, growing on rocks and tree trunks, moist or dry, whose stems were brewed into a tea and used as medicine for thrush (ea) in infants, and a laxative; its oily spores were used under the malo like taluem to prevent chafing; it was taken internally to counteract diarrhoea. Wawae-'Iole (*Lycopodium*), a club moss descriptively named "rat's foot", which was boiled in water for bathing as a remedy for rheumatism. Uluhe (*Dicranopteria*) or false staghorn fern, which spreads in impenetrable thickets, growing over its own dead branches and engulfing other plants, and becoming, with its brittle undergrowth, a source of devastating fires. An infusion from its fronds was drunk as a laxative. 'Awapuhi (*Zingiber*), the native ginger plant, whose modest and deep green leaf stalks bearing small blooms grow prolifically in the kuahiwi (wet uplands). The rhizomes were powdered and sprinkled among the bed kapa for fragrance, the juicy stems were squeezed over the hair to perfume it, and the leaves were used in the imu to flavor the meat.

'Ilima, which at this altitude becomes a four foot shrub, known as 'ilima 'apiki (likewise called kanaka maika'i, "good man", i.e. Kane 'Apua, patron of husbandry and healing) the roots and flowers of which had medicinal uses. A close relative called 'ilima makana'a grew as straggling bushes on old lava flows and were pulled and piled up to make beds in caves or other temporary shelters. Ko'Oko'Olaw, the widespread native herb found from shoreline to an altitude of 8,000 feet, was also here. Kupaoa (*Bailliardia*) is an herb or shrub with purplish leathery leaves which thrives on open ridges; its fragrant root was used to perfume kapa and feather mantles. Pukiawe, one of the most characteristic shrubs of the dry slopes, with bracken-like straggling branches four to five feet high, fine, stiff-leaved, and fruited with dry multi-shaded berries, white

through pink to red at any one time. Its branches and leaves when burned give off a creosotiah smudge which was, according to the historian Malo, used ceremonially to divest an ali'i of his kapu on certain occasions, and for cremating the bodies of outlaws.

'Ulei (*Osteomeles*), a tall shrub thriving on 'a'a lava flows, up to 4,000 feet in altitude. Its strong pliable stalks were used as rims for fishnets, and for the musical bow, the 'ukeke. Papala (*Charpentaria*), a shrub whose light, gummy wood was highly inflammable and used for "fireworks" displays. The gum was smeared on sticks for snaring birds. The upland region in Ka'u known as Ka-papala, now a ranch, was named for this prevalent shrub. 'A'ali'i, a shrub at lower elevation, became a sizable tree on upland slopes. Its hard wood was found useful for tools, and its red seed capsules made a dye for kapa. Kauila, here grew up to forty or fifty feet high, a single tree thus giving a valuable supply of heavy hard wood for its many uses. Wiliwili grew in the drier upland areas, though more plentiful on the hot plains. Mamane (*Sophora*), a small tree peculiar to the Hawaiian Islands, in Ka'u being especially abundant at Ka-papala and Ka-pali-i-uka. It was notable for its golden yellow flower clusters and hard bitter seeds, and for its durable wood, a substitute for the rarer kauila wood for tools, holua sled runners, and ceremonial uses. Its branches, thrown into a muddy stream, were said to have the property of causing the mud to settle and the water to clarify. There is a Ka'u proverb: uhiuhi lau mamane ka wai o Ka-papala, meaning to let the mud of scandal settle as silt sinks in the waters of Ka-papala. Naio, the false sandalwood is here a tree of forty-five or fifty-five feet, and its fragrant wood was used for main house timbers.

'Ohi'a Lehua is prolific and larger in the uplands. Hawaiians distinguished several local varieties, these they named lehua mamo "royal scion" (orange flowering), lehua lauli'i ("small leafed"), lehua ku-makua ("parent erect"), lehua puakea ("white flowers"), etc. 'Ohi'a Ha (*Syzygium*), generically unrelated to 'ohi'a lehua, resembles it except in its smooth bark and its profusion of red berries in summer. It is a small shrub-like tree on exposed ridges. Its hard wood was used in house building and for fuel, and its bark rendered a black dye for kapa. Mamaki (*Pipturus*), a small tree with long drooping branches thriving in wet uplands up to 4,000 feet, was the most abundant source of the native bark cloth and was said to make a finer, softer cloth than did the wauke (*Broussonetia*) which later Polynesian colonizers brought with them. The mamaki was especially plentiful in the forest zone above Na'alehu, Ka'u, where it grew to thirty feet in height and a foot in diameter. In addition to its strong fibrous bark (light brown in colour) it was sought out for its berries, which were used as a digestive tonic for children, and (being slippery when chewed) were said to be good to stimulate bowel action.

Koa (*Acacia*), a stately upland tree found in Polynesia only in the Hawaiian islands, and after the 'ohi'a lehua the most wide spread. Notable in the forest for its grey-barked massive trunk and slender, hard, crescent-shaped, olive-green "leaves" (which are flattened elongated petioles) growing thickly on spreading branches. Its tough wood is the most beautiful in colour and grain of any native tree, and for old Hawai'i its primary use, because of its size and durability, was for boat hulls. It was also sought for images in the war temples (koa means warrior), for spears, bowls, spittoons, and other utensils. (Handy and Pukui 1998:216–219)

Hawaiians also had numerous names for the different rains that blessed their lands. One rain that was found in Ka'u was called the Ha'ao rain, and while it was heavy, it did not last for long:

Rain is the stranger to this land of Kau & the place where rain is found is in the upland of Waiohinu. It is called the "Haao" rain. If there is heavy rainfall, spreading through the ohia forest in the upland, the native sons of this land call it the ua puni or surrounding rain. This does not last very long. (HEN Newspaper, May 11, 1867)

Traditional Planting Techniques of Ka‘ū

Planting and cultivation played a vital role in Hawaiian lifestyle and through generations of trial and error the people learned to adapt and develop many unique techniques tailored to their environment. Depending on the altitude, different food sources were grown to accommodate the varying environmental factors:

Moisture increases and evaporation decreases with altitude here, so beyond the *kula kai* (the lowest habitable zone) were the dwellings “of the upland slopes” (*ko kula uka*), less accessible to the sea, but interestingly favorable for gardening. In addition to sweet potato, dry land taro of the variety called Paua was planted, and sugar cane flourished. (This is the zone of the sugar plantations today.) Beyond this the open slopes (*kula*) become fern lands, then gradually merge with the lower forest (*wao*). In this zone where fern, bushes and small tree prosper other varieties of upland taro requiring more water were cultivated, under mulch to keep in the moisture. This continued right back into the lower forest. Here were the wild bananas, wild yam, (*Dioscorea*), arrowroot (*pia*); and tree fern (*Cibotium*), whose starchy core was eaten, extending down into this zone from the rainforest. (Handy and Pukui 1998:20–21)

Wai‘ōhinu Valley was known as an especially fruitful place; regarded as one of the most productive areas in the district:

The valley of Waiohinu, according to early foreign observers, was the heart of the cultivated area of Ka‘ū. Verdant and blossoming, watered by a stream and by “never failing springs,” it was the centre of wet cultivation for the district. As late as 1833, according to the missionary surveyors, there were twenty sizable plots (lo‘i) of irrigated taro in Waiohinu village requiring constant flooding by flowing water, diverted from the stream in ditches (‘auwai). This indication both on abundance of water (considering the needs of the two or three thousand people estimated to be dwelling within the valley) and an intensive use of it in conjunction with fertile soil. In upland areas, away from flowing water, other varieties of taro were grown by dry cultivation methods. Along the gulches of Pakini and in areas of deep soil on the Kamao‘a plain a special variety of taro known as paūa was extensively planted. And all across the plain, unwatered save by rain, and in moist crannies in the lava, sweet potatoes (‘uala) were the staple. Everywhere in pockets of good soil bananas, sugar cane, gourds and other supplementary foodstuffs flourished. The early visitors saw the fertile sections of this now largely barren lower land as “one continuous garden. (Handy and Pukui 1998:242)

The people of Ka‘ū were well regarded in their traditional methods of cultivating the main food staples such as banana, taro, and sweet potato, as well as other important cultural plants such as *wauke* and *‘ipu*. These unique methods and techniques are referenced in *Native Planters* (Handy et al. 1991) with in-depth explanations of each plant and its cultural importance to the Hawaiian people.

Mai‘a (banana) is considered a pleasant dietary supplement and as a staple substitute in times of famine. Bananas have been planted by Hawaiians in clumps around dwellings and on the well-watered banks of flooded taro terraces. Traditional planting practices of the *mai‘a* began with the selection of the *pohuli*, root sprouts, and choosing the sturdier stocks would increase positive results. According to Pukui, the location of the sprout to be planted depends on its relation to the sun: the shoots on the east side of the plant that get the morning sun are the strongest and best for transplanting. A hole about as deep as the length of the arm from elbow to finger tip, *ha‘ilima*, and three or more feet in diameter, should be dug, and the plant set in the bottom and covered with earth. It is generally not necessary to use mulch in planting the banana because it is placed so deep.

The size of the hole depends on the nature of the soil and the amount of rain to be expected. Therefore, in Ka‘ū where soil is dry and hard, the hole should be dug deep enough and wide enough to contain roots and should be filled with good earth. Planting banana was not only a physical labor that relied solely on the placement of the *pohuli* into the soil but also included a spiritual component (Handy et al. 1991:163).

Mai‘a was regarded as a person and it was believed that the plant would be affected by acts, postures, and words. As explained by an old Hawaiian planter (Fornander 1919-1920, Vol. 6:164):

Dig until the hole is wide-open, about one and a half feet deep. The reason for digging so deep is that the banana may not be blown down by the wind. Then bring the seed banana [shoot or sprout, *pahuli*] and place it on the edge of the hole. Eat to satiety and then plant the banana. Grasp the seed plant, lift it up and exclaim in boasting words (with great force):

<i>Ka mai‘a nui e!</i>	<i>The great banana!</i>
<i>Ka mai‘a nui e!</i>	<i>The great banana!</i>
<i>He ‘umi eka ke hua!</i>	<i>It will yield ten hands!</i>
<i>‘A‘ole hiki ke amo!</i>	<i>The bunch cannot be carried!</i>
<i>‘Elua kanaka hiki ke amo</i>	<i>It will take two men to carry it</i>
<i>Hiki ‘ino ‘ino.</i>	<i>With difficulty.</i>

According to Pukui, the wild mountain bananas from the cold uplands were ripened in Ka‘ū, in pits just deep enough to take one banana and allow a few inches for covering with earth. The pit was lined with banana leaves, then the leaves were laid over the bunches, and earth was thrown on top (Handy et al. 1991:161–165).

Kalo cultivation methods were very unique to Ka‘ū because of the diversity in the local environment. *Pa‘eli*, literally meaning an enclosed place where a planter digs holes, applied to *kalo* plantings on dry lava slopes, where each *kalo* was planted in a hole excavated in the crumbling lava. In the upland plantations in clearings of the forested zones, *kalo* plantations were abundant near streams fed by the famous springs of those areas, allowing for wetland *kalo* to grow profusely in these areas. Planting was a cooperative effort within the communities in Wai‘ōhinu. The men would dig and open the holes for the *kalo huli* and the women would drop four *huli* beside each hole. Then when all the holes were dug, the men would slip in the *huli* and cover the holes with grass, which prevented runoff while it was raining and evaporation on sunny days. Dry planting was done at the very beginning of the rainy season in Ka‘ū, particularly in late spring and early summer (Handy et al. 1991:103–104, 585).

‘Uala (sweet potato) is a very valuable staple that can be grown in much less favorable environments. The *‘uala* matures in three to six months and requires minimal labor for planting and care in cultivation. According to Pukui, the crumbling porous lava in the district of Ka‘ū gives ample aeration without much mounding. A description of placing the *‘uala* cuttings in the prepared bed is as follows:

When the rainy season was about over and the ground ready for planting, cuttings were made and laid where they would not be disturbed. The cut ends were covered with layers of dried ti or fern leaves and left to send out rootlets.

When the mounds were made and all was in readiness for the planting, the planter placed three rooted cuttings in the palm of his hand with the leafy ends between the fingers. The hand was cupped with fingers and thumb meeting, suggesting the roundness of the

expected tubers, and laid, back of hand down, in the hole. Then the fingers were opened and the hand carefully slipped out, leaving the slips where they were to grow.

Ka'ū *'uala* gardeners were not overly concerned with lore or history. Their focus was on the rain, especially on the dry, windy slopes. They were still knowledgeable in some of the prayers but in regard to the rituals, which they acknowledged as an essential component to maintaining the periodicity of the rainy season, they also had to rely on the *kahuna* (priests) of Lono (Handy et al. 1991:131, 143).

Wauke (Paper Mulberry) was an important plant used to make *kapa*. Ideally, *wauke* was planted at the beginning of a rainy period and took about 18 months to mature. In the upland plantations the whole plant was sometimes pulled out for harvesting and the roots lopped off and cut into segments for replanting (Handy et al. 1991:209).

'Ipu (gourd) is a cultivated plant that was reproduced by its seed. In Ka'ū, the proper night for planting gourds is during the moon *Hua*, which translates as “fruit,” and *Hua* would manifest its meaning and give good fruit. The beginning of the rainy season is the ideal time to plant, which would allow for maturing within six months and then use the hot dry summer to grow to full size. The young soft gourd is covered with a downy pubescence. When this is rubbed off, the skin shrivels, withers, or becomes splotched. Black scale, insect stings, and aphids also blight the skin. Vines are sometimes shriveled by a blight that looks like black powder and when this occurred the Ka'ū people would pull up and burn the vines. This process was referred to as *nakaka*, which was the cracking of the skin, the cause of which was not known if it occurred before picking (Handy et al. 1991:216).

Ahupua'a (Land Divisions) within the Reserve and Place Names

Every place, feature, resource, and atmospheric element in the Hawaiian universe was either utilized or recognized by *nā po'e kahiko*, and described and recorded in the names given to places. Place names that are documented and that still live on in *mele*, *oli* and *mo'olelo* can help us decode and decipher the environment around us today to get a glimpse of how the Hawaiians of old viewed, understood, and utilized their surroundings. Furthermore, studying and perpetuating the place names of the land keep the memories and stories of the landscape alive.

A review was conducted on place names within all of the 39 *ahupua'a* that are located within the boundaries of the Ka'ū Forest Reserve. Place name information was collected from the Boundary Commission testimony, historic maps of Ka'ū, Pukui and Elbert's *Place Names of Hawaii'i* (1974) and Soehren's *Catalogue of Hawaiian Place Names* (2002). Due to the large size of the place name table, it was placed in Appendix A.

Table 1 and Figures 6–8 show the *ahupua'a* that are located within the boundaries of the Ka'ū Forest Reserve from south to north as they are situated geographically. Limited place name and locational information is included in the table. All information is from *Place Names of Hawaii* (Pukui and Elbert 1974) unless otherwise noted.

Traditional Bird Catching Techniques

One of the primary practices that brought Hawaiians into the upper portions of the forest was bird catching. There were different types of bird catching techniques as the references below portray. The following article describes three different methods including the *pekeu* method, the *puu* method, and the *pi'o* method. The article was published in three issues of *Ku'okoa* from May 2–

Table 1. *Ahupua‘a* within the Ka‘ū Forest Reserve

Ahupua‘a	Name and Locational Information
Pu‘umaka‘ā	Land section, Honu-‘apo qd., Ka‘ū, Hawai‘i, probably a man’s name. Lit., glowing eye hill
Kiolaka‘ā	Land sections and homesteads, Honu-‘apo and Ka Lae qds., Hawai‘i. Lit., throw roll. (There was a bowling course here. The hero Ka-miki and his brother Maka-‘iole were having a wit-matching contest [ho‘opāpā]. Maka-‘iole threw a paua taro to his sister, because pa- in the taro name would reveal to her that she was needed to come and help him ho‘opāpā.)
Wai‘ōhinu	Village and land division, Honu-‘apo and Ka Lae qds., Ka‘ū, Hawai‘i. Lit., shiny water
Kahaea	Kahea (MB 189). Kahaea bounds Waiohinu on the east. The boundary between Kahaea and Kahilipali-iki was not surveyed and the two Gov. lands have been consolidated, usually under the name of Kahilipali-iki. Sometimes written “Kahaiea” in BCT (Hawaii Place Names 2010).
Kahilipali 1-2	Cliff and point, Honu-‘apo qd., Ka‘ū, Hawai‘i, named for an ancient priest of that name. Lit., [wind-] swept cliff
Kāwala	Land section, Ka‘ū, Hawai‘i, extending from Kāhili-pali. Lit., strike backwards
Kaunāmano/Kaimano	Land sections, Hāmākua and Honu-‘apo qds., Ka‘ū, Hawai‘i. Lit., multitudes are placed [here]
Napauku	N/A
Kī‘olokū	Land section, Honu-‘apo qd., Hawai‘i. Kī: the plant, a bundle of 40 lauhala leaves, ‘amakihi, to shoot or aim, a trigger of a gun, key, latch, tea. ‘olokū: Boisterous, stormy, blustering, disturbed; upset, as stomach, fury, rage.
Honu‘apo	Land section, quadrangle, village, and bay, Ka‘ū, Hawai‘i. Lit., caught turtle
Hi‘ona‘ā	Land section between Pu‘u-makani and Ka-‘alā-iki, Ka‘ū, Hawai‘i. Lit., rocky appearance
Hökūkano	Land sections, Kai-lua and Honu-‘apo qds., Hawai‘i; named for a star called Hökū-pōkano
Ka‘alāiki	Land section, Honu-‘apo qd., Hawai‘i. Lit., small lava rock
Hīlea 1-2	Hīlea Iki: Land section below Maka-nau hill, Honu-‘apo qd., Ka‘ū, Hawai‘i. Lit., small Hīlea Hīlea Nui: Land section, Honu-‘apo qd., Ka‘ū, Hawai‘i. Lit., great Hīlea
Nīnole	land section, homesteads, village, cove, and gulch, Honu-‘apo qd., Hawai‘i. There are freshwater springs at the Nīnole in Honu-‘apo; see Pū-hau. A cannibalistic mo‘o, Kaikapū (hag), lived at the Honu-‘apo Nīnole; her pretty granddaughter led travelers to her cave, where she ate them raw (HM 264). Lit., bending
Wailau	Land section, Honu-‘apo and Pāhala qds. Lit., many waters
Punalu‘u	“Spring water dived for”, “Coral dived for”. Land section and gulches in Honu‘apo and Pāhala. Harbor, landing, and ancient surfing area. A cannibalistic mo‘o Kaikapu, lived here. She was killed by Laka and his helpers
Mohoeka	Land section, Honu-‘apo qd., Ka‘ū, Hawai‘i. Lit., white moho (Hawaiian rail, an extinct flightless bird).
Moa‘ula	Land sections and gulches, Honu-‘apo, Mauna Loa, and Pāhala qds., Hawai‘i; originally called Mo‘a-‘ula (lit., cooked red [by Pele's fires])

Table 1. (cont.)

Ahupua‘a	Name and Locational Information
Kopu	Comments: Returned by J. A. Kuakini Opio, retained by Gov. Coordinates estimated (Hawaii Place Names 2010).
Makaka	Comments: Returned by Keohokalole, Lunalilo and S. Kanae, retained by Gov. Coordinates estimated (Hawaii Place Names 2010)
Hianamoa	hiana “depression or hole, as underwater” / moa: “chicken, type of native banana, type of plant, type of fish.
Pālima	Comments: Not named in Māhele Book (Hawaii Place Names 2010). Fivefold, to divide or distribute in fives, a temporary booth occupied by priests during taboo days of a heiau.
Pā‘au‘au 1-2	Land areas, Honu-‘apo, Mauna Loa, and Pāhala qds. Lit., bath enclosure
Iiokaloa	N/A
Kaumu‘uhu‘ula	N/A
Kumu 1-8	Comments: Not named in Māhele Book. Written “Nakumu” in RPG 2604 (Hawaii Place Names 2010).
Halelua	Land section, Pāhala qd., Ka‘ū. Lit., pit house
Wailoa 1-3	Land section, Pāhala qd. Lit., “Long water”
Keāiwa	Land sections, Kī-lau-ea. Mauna Loa, and Pāhala qds.; gulches, Honu-‘apo, Mauna Loa, and Pāhala qds.; lava flow, spring, and site of the mudflow of 1868, Pāhala qd., south Hawai‘i
Kaapahu	N/A
Kanaio	“The false sandalwood tree”
Ka‘ala‘ala	Land sections and gulch on the southwest slope of Kī-lau-ea, in Kī-lau-ea, Mauna Loa, and Pāhala qds., Hawai‘i. Lit., scrofulous scar
Makakupu	Old name for a part of Wood Valley, Kī-lau-ea qd., Hawai‘i
Pu‘ukoa	Land section, Kī-lau-ea qd., Hawai‘i. Lit., koa tree hill
Waimuku 1-2	N/A
Ka‘ili‘ula 1-2	Land section, Kī-lau-ea qd., Ka‘ū, Hawai‘i. Lit., the red skin
Ahulili 1-2	Comments: Not named in Māhele Book. Cut off makai by Kapapala. Lexicology: ‘ahulili. PEM: perhaps formerly ā-hulili, glowing, dazzling (Hawaii Place Names 2010).
Kapāpala	Land section, Kī-lau-ea and Mauna Loa qds., Hawai‘i. Lit., the Charpentiera shrub

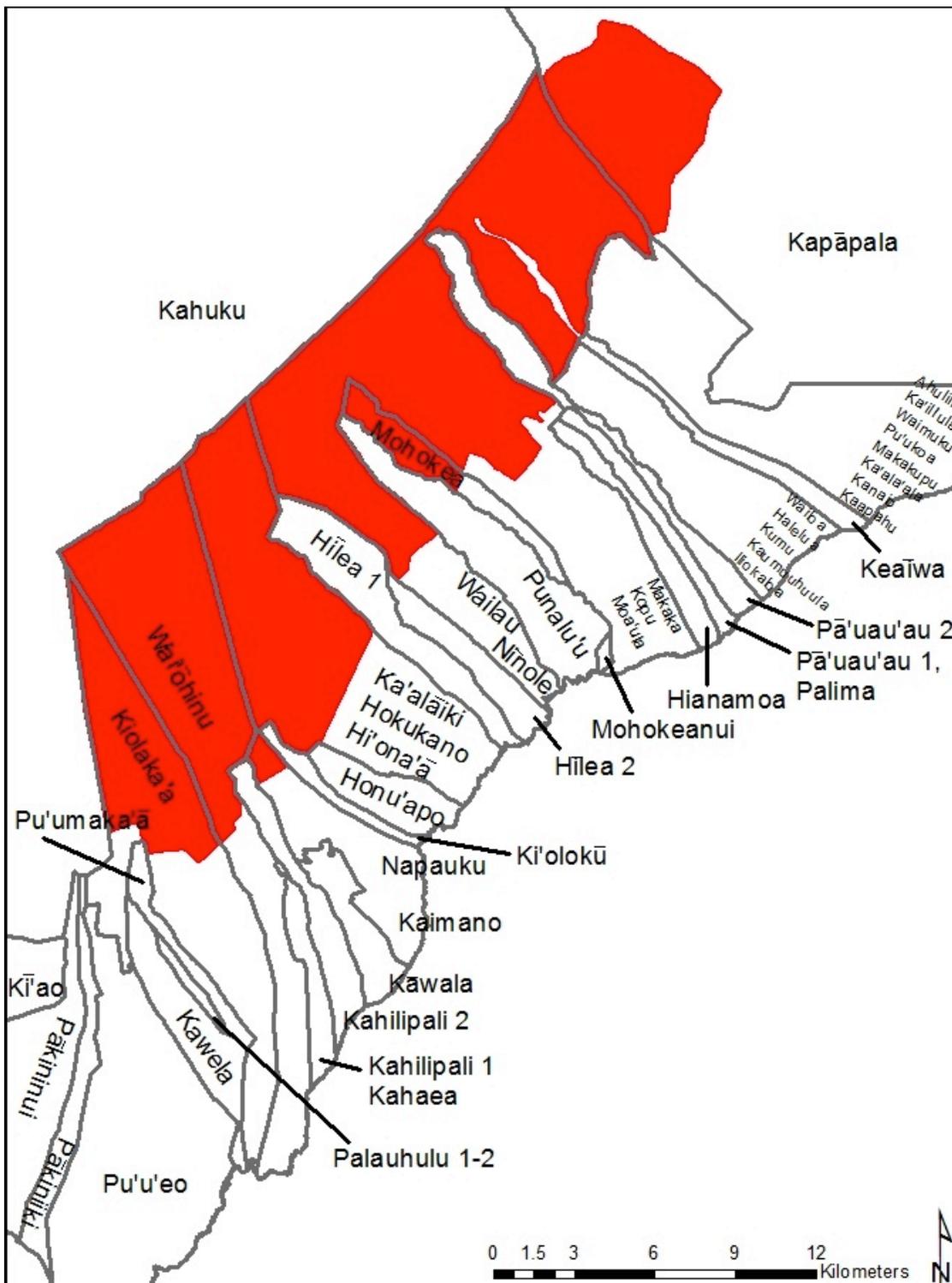


Figure 6. Location of *ahupua'a* in the Ka'ū Forest Reserve.

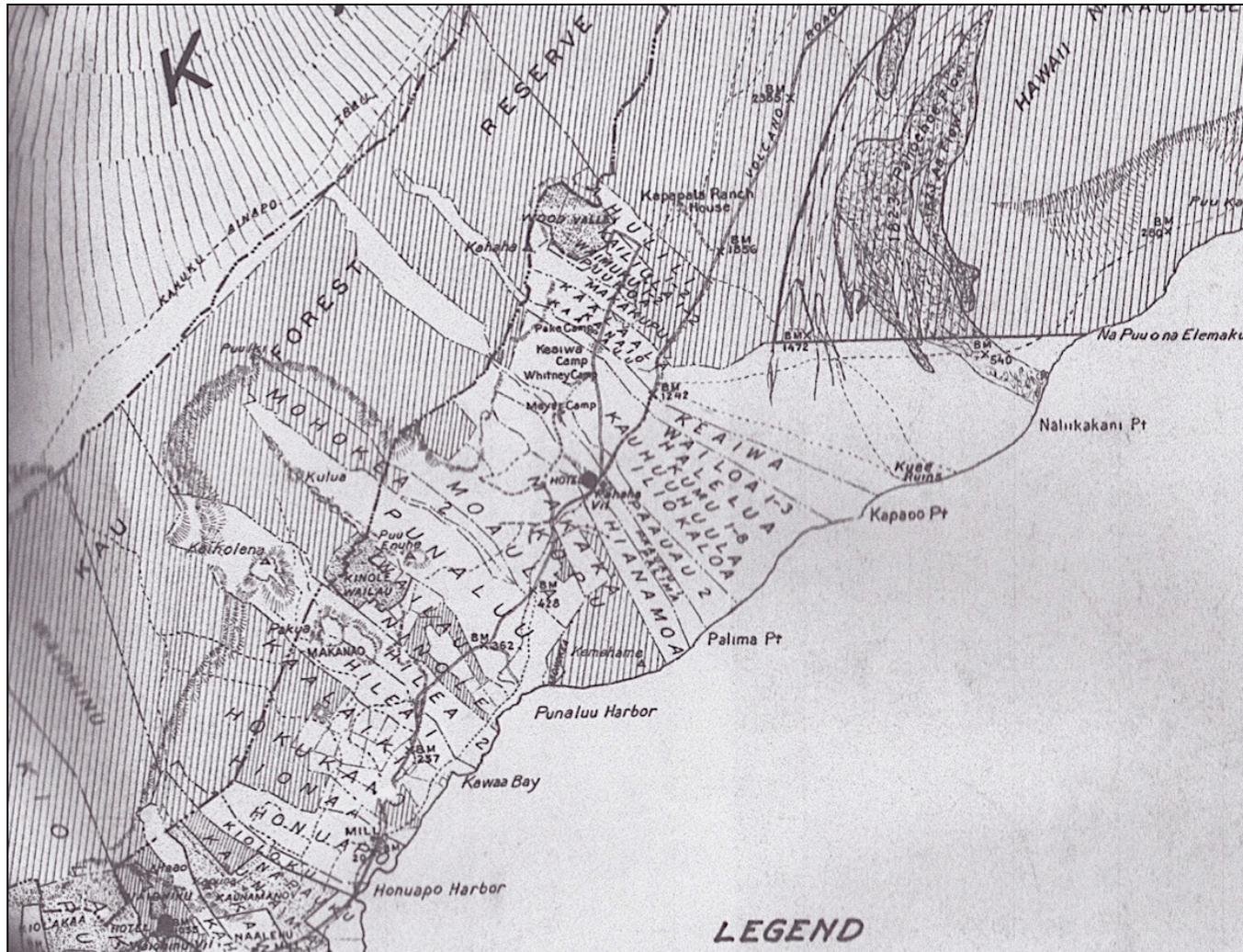


Figure 8. 1928 map showing the *ahupua'a* that make up the northern boundaries of the Ka'ū Forest Reserve.

May 16, 1863. It was written by G. W. Kahiolo of Kalihi, and titled *Ka Moololo o Na Manu of Hawaii Nei – Descriptions of Hawaiian Birds*:

... The pekeu method was another way employed by bird catchers to catch owls. A long stick was taken, a yard or more in length, and four ropes smeared with birdlime. The stick was made fast into the ground and the four ropes tied just below the end of the stick and the ropes stretched out and made fast just as one does for a flag pole. The ends of the ropes were not tied too securely so that they could slip out and entangle the wings of the owl. A chicken was tied at the base of the pekeu trap in order to attract the owl and catch him...

The puu was another method of catching plovers. One end of a cord was tied to a stone and the other end of the rope was made thin and fine and a chicken or turkey bone was tied to this end. The two ends of the bone were made pointed. The cord was tied to the center of the bone. The ends of the bone were thrust into lumps of earth and left in a good place, like a newly made patch or any other place where the plover would not notice the trap. When it swallowed the bone and walked away, the end that was tied to the stone pulled on the rope and made the bone lie crosswise in the throat. Thus the plover was killed.

Another was the pi‘o method. An arched stick was used with a slip noose at its end and a small crossed stick to the end of which a locust was tied. One end of the arched stick was securely fastened into the ground. The other end was bent down and the crossed stick laid across the loop of the snare to hold it down, then the loop was opened out neatly. When the plover came to peck at the locust that was tied, the crossed stick moved releasing the trap, which snapped upward catching the plover in the loop.

The lai was another method and still another way was to catch them in a net (uhau upena). The very best way to catch a large number was with a net fastened to a long stick. A man went in the daytime to look for the place where many plovers were to be found and when he discovered it, he returned there later with the net. When evening came the plovers flew about and the man imitated the cry of the plover perfectly. The birds then came in large numbers and so he raised his net and caught them all.

In order to catch the uwa‘u bird the bird catcher made a kono trap of ieie roots joined together in to a length of five, six or more fathoms long, which includes the kia or very straight stick. The reason why the ieie root was tied to the end of the stick was because the ieie root was supple and could bend in crooked holes, bending itself this way and that according to the crookedness of the uwa‘u’s home.

The bird catcher kept himself supplied with birdlime to smear at the end of the stick. The bird catcher carried these things to the uwa‘u hole, laid on his stomach and made a noise at the opening and cried in imitation of the uwa‘u bird so that he would know if there were any birds within. It was not well to lie too flat or have the face too close to the opening lest he be blinded by dust.

When the young uwa‘u heard the “tetegue” sound of the bird catcher, they thought that it was made by the parents and so they fluttered their wings in their mistaken joy and the dust were scattered from their feathers. There is nothing to compare the dust raised by them. Then the bird catcher inserted his stick with the ieie root at the end smeared with gum. He touched a bird with it and twisted the stick. The feathers of the bird were caught and it was drawn slowly and smoothly out.

The bird catchers did not take all the birds from a hole but took only from one to three and no more, so as to keep the birds in that hole, nor were the parents taken lest there be no birds there ...

This bird (the kiki) is a very delicious bird and tastes like the alaiaha. The way to catch it is for the bird catcher to make a big bonfire at night. The birds fly there in great numbers and fall down. They are caught by the man and killed. (HEN v.1:1014–1016)

The following reference came from an article in the *Ku'okoa*, on November 12, 1920. It is titled, *Ka Mo'olelo o Hema, ke Koaie Ku Pali*. This article describes the *kahekahe* technique, which uses gum on the 'ōhi'a lehua tree.

When it was light, he was in the lehua grove bending down the branches so as to reach the flowers.” He broke off most of the lehua blossoms leaving but a few which he gummed. He did this from one tree to another. This method of bird catching was called kahekahe and the early morning was the best time to catch birds. Later in the day, there were no birds for then they had stopped coming to the lehua blossoms. When he knew that he had enough gummed flowers he went back and found a large number of birds caught on his gum. He turned to gather them up. As he went along picking up the birds, other birds were being caught in the same places. He went back three times and broke off the branches so as not to catch any more. He then turned to go the lowland with the birds.

As he walked home he tied an olona rope around his waist, broke off branches of ti leaves and tied them around him like a hula skirt. This was to be used as wrappers for the birds he was carrying home.

When he arrived at the place where birds were caught, he saw that the lehua blossoms were falling and so he plucked a cluster of hala pepe berries. This plant is also called leie. The reddish leaves near the cluster he pulled off, tore into small strips and made them into a flower resembling the lehua, broke a branch of ohia-hamau and fixed his artificial flowers on it. When the birds looked at them, they looked like the natural lehua blossoms...When his bird lure was all ready he took a cluster of kikipoo berries squeezed the juices into his artificial lehua blossoms, gummed them with lime, took a long stick, tied the lehua branch on to it and fastened it securely in place. He moved directly under a lehua tree, poked his branch up among the branches of the tree.

The birds saw the blossoms, flew from here and from there till a large number gathered. The first birds to get there were caught fast. He pulled the stick down, removed the birds and raised the stick up again. This method of bird catching is called okuu ... In a very short time his container was filled with birds. He fastened it up in a carrying net. (HEN v.1:992–993)

In 1895, N.B. Emerson published an article describing the practices of the bird catchers of old. It describes the various values and uses of the different types of bird feathers. It also illustrates the variety of techniques used by the skillful bird catchers, stating that the techniques and implements used by bird catchers varied between islands, districts, and *ahupua'a*. Emerson also explains the unique characteristics of the birds and which parts of the forest they would frequent. This article is an invaluable resource found in Maly and Maly 2005:32–38.

...Bird catching, while of great fascination, was a most exacting profession, demanding of the hunter a master of bird-craft and wood-craft attainable only by him who would retire from the habitations of men and make his home for long periods in the wooded solitudes of the interior.

The kings of Hawaii constantly had men in their service who followed the vocation of bird-catching, called the *kia-manu*. It is related of one of the ancient kings that at a critical juncture in his affair he led off his warriors into the mountains with the purpose of pretext of engaging in bird-catching for plumage. But this is not a business in which a multitude can successfully engage in close proximity to each other. The *kia-manu* needs room; he must do his work in solitude, with the field to himself.

The feathers of Hawaiian plumage-birds may be divided, as to color, into several classes:

1. Pure yellow. The yellow feathers were taken either from the *o-o* or from the coat of the still rarer *mamo*. Those of the *mamo* were of a deeper tint, but of shorter staple than the former, and as the bird was shy and difficult of capture, they were greatly coveted for the richest articles for feather-work, cloaks, capes and necklaces. It is a question still in dispute whether this rare bird is not extinct.

The *o-o*, though a proud and solitary bird, was more prolific than the *mamo*. Its coat was of deep black, set off with small tufts of clear yellow under each wing and about the tail and in some varieties about the neck and thighs. Those from the axial were called *e-e* and were the choicest, and being of a longer staple were in the greatest demand for the *lei*.

No swan's down can surpass, in delicacy of texture, the axillary tufts of the *o-o*.

2. Red. Scarlet, or red feathers were obtained from the body of the *i-iwi* and the *akakani* (*akakane* or *apapane*). It may be disputed whether one of the other of these is not to be designated as common. The color-tone of the feathers varies. They were song-birds, and when on the wing, displaying their plumage of black and scarlet, were objects of great brilliancy. There was, I am told, another red-feather bird called *ula-ai-hawane*, a beautiful thing in scarlet, wild and shy, a great fighter, a bird very rarely taken by the hunter. Its plumage would have been a welcome addition to the resources of Hawaiian feather-workers had it been obtainable.
3. Green. Feathers of an olive green were obtained from the *o-u*, and from the *amakihi* those of a greenish-yellow. Though of less value than some others, the green feathers were an important resource in adding variety to Hawaiian feather-work. This color, however, was not used in the richest and most costly cloaks and capes.
4. Black. Feathers of black were obtained from the *o-o*, *mamo*, *i-iwi* and *akakani*, not to mention numerous other sources, including the domestic fowl, which also contributed feathers of white.

The methods used by one hunter in the capture of the birds differed from those used by another. They also varied somewhat, no doubt, in different districts, on the different islands, at different seasons of the year and seen in the different islands, at different hours of the day.

There could be nothing stereotyped in the way the hunter of birds practices his art. While the method might remain essentially the same, it was necessarily subject to a wide range of modification, to suit the skill and ingenuity of each hunter in his efforts to meet the habits and outwit the cunning of the birds themselves.

For the purpose of observing more closely the manner of life and methods of the bird-catcher, let us transport ourselves in imagination to the interior wilderness of Hawaii, and

live for a time amid the stretches of forest with which the climate of rainy Hilo clothes the volcanic debris of active Kilauea and extinct Mauna Kea.

There are two seasons of the year favorable to the operations of the hunter; first, during the months of March and April, extending to May, and second, during August, September and October.

These two bird-seasons corresponded with the two flowering seasons on the *lehua*. The *lehua* of the lower woods flowered in the earlier season, that of March, April and May, at the same time with the *ohia-ai*, (the fruit bearing *ohia*), commonly known as the mountain-apple.

The upland *lehua*, situated in a more temperate climate, flowered during the later season, that from the beginning of August till the last of October or into the early part of November.

The birds in general moved from upland to lowland, or vice versa, to be in the flowering season, and many of the hunters moved likewise.

In the early season (*kau mua*), the birds, except the *mamo*, who was a true highlander and despised the lowlands, migrated to the lower levels, *makai*. Later in the year, during the second season, the birds were to be found in the more interior uplands.

The yellow-green *amakihī*, and the *elepaio*, famous in legend and poetry, were exceptions to this rule. These two birds were insectivorous, in addition to being honey and fruit-eaters.

A bird-hunting campaign was not an affair to be lightly entered upon. Like every other serious enterprise of ancient Hawaii, a service of prayer and an offering to the gods and aumakua, must first be performed... ..Having selected a camp, he erects the necessary huts for himself and his family. His wife, who will keep him company in the wilderness, will not lack for occupation. It will be hers to engage in the manufacture of *kapa* from the delicate fibers of the *mamake* bark, perhaps to aid in plucking and sorting the feathers.

The early morning, when the vapors are beginning to lift, is the favorite time for most of the birds to visit their aerial pasturage. A few hours later, when the sun has had time to dull the edge of the sharp morning air, and to clear away the fogs, the aristocratic *o-o* will come to his more fashionable breakfast. Necessity makes the hunter an early riser, that he may repair to his chosen ground before the morning sun has begun to illuminate the summits of Maunakea and Maunaloa.

Behold him then setting forth at dawn from his rude thatched cottage, with the implements of his craft in hand. The bag, or wallet, hanging at his side contains, besides food for himself, fine lines twisted from tough *olona* fiber, to be used in making snares, also a supply of tenacious bird lime carefully wrapped in leaves of the ti plant.

This important article was made in several ways. The sticky gum of the breadfruit was sometimes used but that of the *papala*, and of the *oha* were more highly esteemed. Sometimes a compound of two or more was made, being mixed and purified while gently boiling with the water over a fire.

The most important implements of the hunter's craft were his spears, called *kia*, or *kia-manu*, a name often used to indicate his vocation. They were long, slender, well polished poles, like fishing rods, made sometimes of dark spear wood, *kauila*, also of tough *ulei*

wood from Kona. Bamboo was sometimes used, but for some reason or other it was not a favorite. The birds did not take to it. And as they were the ones whose tastes were most to be considered, that settled the question.

There were different styles of dressing the *kia*, and no one can assume to be acquainted with them all. One method is that illustrated in the cut.

The hunter himself must remain concealed beneath the shelter of the foliage, or, if that be too scanty, under a covert extemporized from material at hand, fern leaves, or *i-e-i-e* fronds. If the day is a good one and the charm of his prayers works well, the birds will presently make their appearance, singly, or by twos and threes. Anon a struggling and a fluttering of wings announces to have the watchful hunter that the little creatures have alighted on his poles and are held fast by the sticky gum.

It would seem as if the alighting of one bird on the limed fork or cross-piece of the hunter's pole did not deter others from seeking to put themselves in the same plight. At the right time the hunter cautiously withdraws one pole after another, and using care that no bird escapes, transfers the captured birds to the bag that hangs at his side, or to a cage of wicker work that is kept at hand.

It seems unaccountable, almost incredible, that any wild thing of the air should prefer alighting on the limed twig of the hunter's pole to seeking refreshment elsewhere from the scarlet honey-flowers of the *lehua* which at this season abound. The explanation given to me by the hunter was that he depended entirely upon the efficacy of his incantations to draw the birds to his *kepau* (birdlime). Sometimes instead of this formal arrangement of fork and cross-piece, a small branch with several twigs attached, the whole plentifully smeared with gum, was bound to the tip of the pole and displayed as before.

The hunter often made his pole attractive to the birds by baiting it with their favorite honey-flowers. This was done in a variety of ways, but always with an effort to imitate nature, appreciating that the highest art is to conceal art. With this intent he sometimes attached to his pole a flowering branch artfully smeared gum, or the *kepau* would be applied directly to some part of the tree where the hunter's judgment told him the bird would alight to feed.

Another ingenious plan was the use of the decoy called *manu* (literally bait). For this purpose the gay *i-iwi*, or *akakani*, were among favorites, perhaps because they were likely to be captured earliest in the day. The decoy, still alive, was tied in an upright position to the prong at the tip of the pole, together with an arrangement of flowers. It was necessary to smear the gum at such a distance from the decoy as not to be within reach of its wings, if extended in an effort to fly. It was a common practice to preserve alive in special cages certain birds to be used as decoys, feeding them daily with their nectar-flowers. The *o-o*, *i-iwi* and *kakakani* were thus treated. In time these wild things became quite domesticated and were of great service.

The *o-o*, with his suit of jetty black touched with points of gold, was of a jealous and domineering spirit that would allow no other bird to enjoy a meal peacefully in his presence. He no sooner espied the hunter's decoy, though of his own species, in quiet possession of a flowery perch than he would alight to dispute with him its tenancy and seek to drive him away, thus himself becoming a captive. The note of the *o-o* is one that no one who has heard it can ever forget; it may be properly described as "most musical and most melancholy".

It delights to sound it forth from the topmost branch of some over-looking forest-tree, either as a call to its mate, or in pure joy of existence, as a token that its delicate tastes have been satisfied.

The *mamo*, from the richness and brilliancy of its coat, as well as from the pride and audacity of its nature, was often spoken of as the prince, or king, of Hawaiian plumage-birds. If one is not to distrust the enthusiasm of a Hawaiian writer on birds, its actions and manners entitled it to that distinction. To quote from this writer: "The *mamo-kini-oki* was the king of the small birds of the uplands. This bird was most ostentatious in its bearing, proud and lordly. Look at it perched on its tree prinking and preening and displaying itself, turning this way and that, disdainingly the *o-o*, *i-iwi* and other birds that approach, attacking and driving away any bird that comes to alight upon its tree," etc. In addition to its mixture of pride and vanity the *mamo* had a reputation for great shrewdness and for being full of alert suspicion and watchfulness. The hunter had to use all his wits to compass its capture.

While the *o-o* haunted the depths of the forest and ranged equally the lower as well as the higher forest-regions, the *mamo* made his home principally in the upper borders, where the forest-vegetation is seen to have changed from its dense massing into a more open and park-like arrangement. Here the *lehua* no longer reaches its full height as the lord of the forest, and, becoming somewhat more branching and scrubby, yields its supremacy to the still more imposing *koa*.

The means generally employed for the capture of the *mamo* was the snare, *pahela*, baited with flowers or fruit.

The flowers of the *ke'a*, *oha*, *lehua* and *mamane* were often used, also the flowers and fruit of the banana, and the fruit (*kokole*) of the parasitic *i-e-i-e*, of which the *mamo* was very fond. The *hawane*, a palm that grew in the protection of the upland forest of Hawaii, had a flower, the nectar of which the *mamo* was said to esteem as a food and the hunter sometimes succeeded in capturing this bird by means of gum applied directly to its flower-stalk.

The greatest art was necessary in arranging the snare and bait for the *mamo*. The bird was most shrewd and observant, and if he detected any traces (*meheu*) of the hunter's work, from breakage of trampling his suspicions were aroused and he would take his leave at once. Having baited his trap and fixed in position his snare, which was a simple noose at the end of a fine line, fifteen or more yards long, the hunter placed himself in hiding, with his line in hand, and began to call the bird with an imitation of its penetrating whistle.

If the *mamo* was within hearing distance and pleased with the hunter's call, he would answer, and soon be on the wing in that direction to make acquaintance of the siren that had called him. At the bird's approach the hunter modulates his tone, only piping forth an occasional reassuring note, to lead the *mamo* still nearer, relapsing into silence and motionless quiet soon as the bird has come within sight of the baited trap. Having made his reconnaissance and satisfied himself that all is right, the bird alights and, warily cocking his head to one side and the other, to observe more closely, he moves forward to taste the hunter's bounty, in doing which he must set foot within the reach of the nicely placed snare;-on the instant the bird-catcher pulls his line and the bird is his.

One old bird-catcher aroused my incredulity by the surprising tale, which I recommended the readers of this article to take with as many grains of salt as are necessary for the attaching of a bird, that so long as the hunter remained rigidly motionless and kept his features hidden from the sight of the *mamo*, by bending his head forward upon his chest,

not even venturing to open his eyes, lest their flash betray him, the little creature took no offence, and would even go so far as to perch unsuspectingly upon the hunter's head and shoulders. "*Credatiste Judaeus! Non ego.*"

The plumage-birds, like everything else in Hawaii, were the property of the *alii* of the land, and as such were protected by *tabu*; at least that was the case in the reign of Kamehameha I, and for some time before. The choicest of the feathers found their way into the possession of the kings and chiefs, being largely used in payment of the annual tribute, or land tax, that was levied on each *ahupuaa*.

As a prerequisite of royalty, they were made up into full length cloaks to be worn only by the kings and highest chiefs. Besides these were capes, *kipuka*, to adorn the shoulders of the lesser chiefs and the king's chosen warriors, called *hulumanu*, not to mention helmets, *mahiolo*, a most showy head-covering. The supply needed to meet this demand was great, without reckoning the number consumed in the fabrication of *lei* and the numerous imposing *kahili* that surrounded Hawaiian royalty on every occasion of state.

It is, therefore, no surprise when we learn that in the economic system of ancient Hawaii a higher valuation was set upon bird-feathers (those of the *mamo* and *o-o*) than upon any other species of property, the next rank being occupied by whale-tooth, a jetsam-ivory called *palaaoa pae*, monopolized as a perquisite of the king.

While the plumage-birds were of such diminutive size and so difficult of capture that it would not have been profitable to hunt them for food, they were in reality such delicacies for the table, that the hunters were quite willing to use them in that way.

And, in truth, it is difficult to see what better disposition could have been made of them in many cases. In the case of the *mamo*, *i-iwi*, *akakani*, *o-u* and *amakihi* the extent of skin-surface left bare after stripping the plumage from the bird was so considerable that it would have been an act of cruelty, if not of destruction, to have set it loose in such a condition. It was entirely different with the *o-o*. In its case the injury done was trifling and constituted no bar to its being immediately released.

Kamehameha I is said to have reproved his bird-catchers for taking the life of the birds. "The feathers belong to me, but the birds themselves belong to my heirs," said the considerate monarch.

It was the practice of some hunters to release the first bird caught, unplucked, as an offering to the gods.

The greatest care was always used to keep the feathers from becoming ruffled or wet in rainy weather.

The *mamo*, *i-iwi* and such birds as were destined to be eaten after being plucked, were, as soon as caught, killed by pressure over the thorax and then wrapped in the dried parchment of the banana-stalk, and packed in the hunting bag. The *o-o* and birds destined to be released were secured in cages.

As a means of accomplishing the double purpose of protecting himself and of preserving plumage of his birds from injury by the wet, the hunter was provided with a long, hooded cloak that encased him from his head to his knees. The basis of this garment was a network, into the meshes of which were looped strips of dried ti-leaf that hung point down on the outside. The method was almost identical with that used in roofing a grass hut. The garment might with propriety be termed a thatched cloak. Its water-shedding power is

said to have been most excellent, of which it had opportunity to give ample proof in the fierce, tropical, down-pours of the region.

Hooded and encased in this unique garment, the hunter must have presented a fantastic resemblance to a Capuchin monk.

The days of the bird-catchers of ancient Hawaii are over. Their place has been taken by those who not know *Ku-huluhulumanu* and the other gods of the craft. In their hands, instead of the snare and pole, with its gum, its flowers and decoy, there is the deadly shot-gun.

The birds that were once the pride of Hawaii's woods have to content for their existence under conditions imposed by the marauding mynah and thievish sparrow, that seem to have been imported for their destruction. (Emerson 1895:102–111 in Maly and Maly 2005)

Pua'a, the Polynesian Pig

Noted Hawaiian researcher, Kepa Maly, conducted an extensive review of over 60,000 Hawaiian land documents ranging from 1846 to 1910 looking for references to *pua'a*. Of these documents, “nearly every reference was in the context of them being near-home and as being cared for (raised), not hunted” (Maly and Maly 2004:200). Maly also reviewed writings from native authors such as Malo, ‘Ī‘Ī, and Kamakau and discovered that the term “hunting” was rarely ever used in historical records, and the only type of “hunting” that was noted was the collection of native birds for food or their feathers (2004). In the early 1800s hunting was a more common practice for Native Hawaiians, but they were primarily hunting bullocks, goats and other introduced grazers. Additionally, these hunting practices were mainly carried out at the request of landlords and ranchers.

Further discussion of hunting as a traditional cultural practice is discussed in the Cultural Landscape section of this study.

Historic Period Accounts, Maps, and Land Use

This section includes an overview of the various visitor references, land changes and economies that occurred in the Ka‘ū Forest Reserve throughout the historic period (post-1778).

Early Western Visitors

Early visitors to Hawai‘i that mention Ka‘ū include surgeon and naturalist Archibald Menzies and Reverend William Ellis. They provide the first Westerner’s descriptions of the area.

Archibald Menzies, 1794

Archibald Menzies, the surgeon and naturalist aboard Vancouver’s vessel, was the first foreigner to visit the district of Ka‘ū. Menzies’ visit took place on his journey to the summit of Mauna Loa on a trail that lead up the mountain from the Kapāpala area. Menzies’ journals speak of fertile plantations that supplied the surrounding population with an abundance of agricultural goods. He also writes of the Hawaiian who specialized in traveling into the *mauka* regions to collect resources in the forest. The following account is of his visit to Kiolaka‘a Village:

...This was by far the most populous village we had yet met with since we left Kealakekua. Towards the dusk of the evening, there fell some showers of rain which gave

a gay and refreshing look to the most enchanting scenes of rural industry with which we were surrounded. The economy with which these people laid out and managed their ground and the neatness with which they cultivated their little field made the whole valley appear more like a rich garden than a plantation. A stream of water which fell from the mountain through the middle of it was ingeniously branched off on each side to flood and fertilize the most distant fields at pleasure. (Menzies 1920:185)

After leaving Kiolaka‘a Village, Menzies continued to make his way toward Mauna Loa, and was guided on an inland trail, climbing the hill on the eastern side of Wai‘ōhinu Valley. The following is Menzies’ description of the upland areas between Wai‘ōhinu and Honu‘apo:

We found the people everywhere busily employed in their little fields, many of which were here cropped with plantations and bananas that had a ragged appearance from having little or no shelter, yet they bore fruit tolerably well. We seldom observed these vegetables cultivated so low down on the western side of the island, where they generally occupy the verge of the forest, a situation which for shelter seems more congenial to their tender feelings. We observed here that they suffer many of their fields here and there to lay fallow, and these in general were cropped with fine grass, which they cut down for the purpose of covering their new planted fields of taro or yams to preserve them from the powerful heat of the sun. (1920:185–186)

Continuing his travels in the uplands between Honu‘apo and Nīnole, Menzies writes about the desolation on the lava fields, “...without even a hut or the least arable land for a considerable distance, and so arid that we could get no water to quench our thirst or refresh ourselves...by the time we got through this dreary tract, we were ready to drop with hunger and fatigue” (1920:186). However, later that evening his party came across a plantation at Punalu‘u that was said to belong to Kamehameha, though Menzies wrote no description of it. The next day, they continued traveling inland through another plantation of Kamehameha’s in Kapāpala. This is where an artist traveling with Menzies drew the famous picture of the “Village of Macacoupah” (likely the village of Makākupu), which borders Kapāpala and is located under Ipu‘u Hill (Kelly 1980:45).

Reverend William Ellis, 1823

Reverend William Ellis, a British missionary, passed through Ka‘ū in 1823 and described similar conditions as Menzies did in 1794. Reverend Ellis landed at Ka‘iliki‘i in Pakini and then made his way to Wai‘ōhinu where he encountered his first fresh water stream and lush valleys and gardens:

...a most enchanting valley, clothed with verdure and ornamented with clumps of kukui and kou trees. On the southeast it was open towards the sea, and on both sides adorned with gardens, and interspersed with cottages, even to the summits of the hills.

A fine stream of fresh water, the first we had seen on the island, ran along the centre of the valley, while several smaller one issued from the rocks on the opposite side, and watered the plantations below. (Ellis 1963:133)

As he left Wai‘ōhinu, he wrote:

Our road, for the considerable distance, lay though cultivated parts of this beautiful valley: the mountain taro, bordered by sugar-cane and bananas, was planted in fields six or eight acres in extent, on the sides of the hills, and seemed to thrive luxuriantly. (1963:134)

After leaving Wai‘ōhinu, Reverend Ellis made his way to the coast, traveling through various villages and writing short descriptions about Kapauku, Honu‘apu, Hōkūkano, Hīlea, and Punalu‘u before continuing inland again to Kīlauea crater. Ka‘ū is illustrated in one of his drawings (Figure 9).

Māhele

The change in the traditional land tenure system in Hawai‘i began with the appointment of the Board of Commissioners to Quiet Land Titles by Kamehameha III in 1845, and the Organic Acts of 1845 and 1846 introduced private property into Hawaiian society. The Māhele took place during the first few months of 1848 when Kamehameha III and more than 240 of his chiefs worked out their interests in the lands of the Kingdom. This division of land was recorded in the Māhele Book. The King retained roughly a million acres as his own as Crown Lands, while approximately a million and a half acres were designated as Government Lands. The Konohiki Awards amounted to about a million and a half acres, however title was not awarded until the *konohiki* presented the claim before the Land Commission.

In the fall of 1850 legislation was passed allowing citizens to present claims before the Land Commission for lands that they were cultivating within the Crown, Government, or Konohiki lands. By 1855 the Land Commission had made visits to all of the islands and had received testimony for about 12,000 land claims. This testimony is recorded in 50 volumes that have since been rendered on microfilm. Ultimately between 9,000 and 11,000 land claims were awarded to *kama‘āina* totaling only about 30,000 acres and recorded in ten large volumes. Land Commission Awards (LCA) generated during the Māhele offer valuable information regarding specific land use. The following is a summary of the Land Commission Awards and applications which were made within and near the project area.

In the entire district of Ka‘ū, six *konohiki* were awarded 20 *ahupua‘a*, and two *‘ili ‘āina*. Of these 20 *ahupua‘a*, some of them, including Nīnole, were given to the Hawaiian Government to pay off commutation fees, and other *ahupua‘a* were designated government lands by the King, such as Hōkūkano, Ka‘alāiki, Ho‘ona‘ā, and Wailau (Kelly 1980:ix). Of the 39 *ahupua‘a* that span the boundaries of the Ka‘ū Forest Reserve, 15 of them did not have any land commissions awarded on them (Appendix H). Because only a small portion of the population of Ka‘ū were awarded *kuleana* parcels, it is hard to develop a complete picture of the settlement patterns that existed in Ka‘ū at that time. However, the LCA maps that were created by Kelly (1980) and are presented below (Figures 10–14) do provide a helpful visual picture illustrating locations of the LCAs within nine *ahupua‘a* that were researched by Kelly.

Boundary Commission testimonies also provide detailed evidence on the natural and human-made features that were used to delineate *ahupua‘a* boundaries. In 1862, the Hawaiian government established the Commission on Boundaries, also called the Boundary Commission, to determine and certify boundaries for landowners with no deeds. Surveyors mapped out boundaries that were often described by *kama‘āina* and *kūpuna* who were intimately familiar with the natural and cultural landscapes of particular areas. Reviewing Boundary Commission testimony today can offer information on traditional cultural practices, place names, and locations of significant natural and cultural resources. Thus it is recommended that these materials be reviewed in the future to help reconstruct the traditional land settlement and use of the Ka‘ū district.



Figure 9. Drawing of *hale* in Ka'ū, during Ellis' trip around Hawai'i Island, 1823.

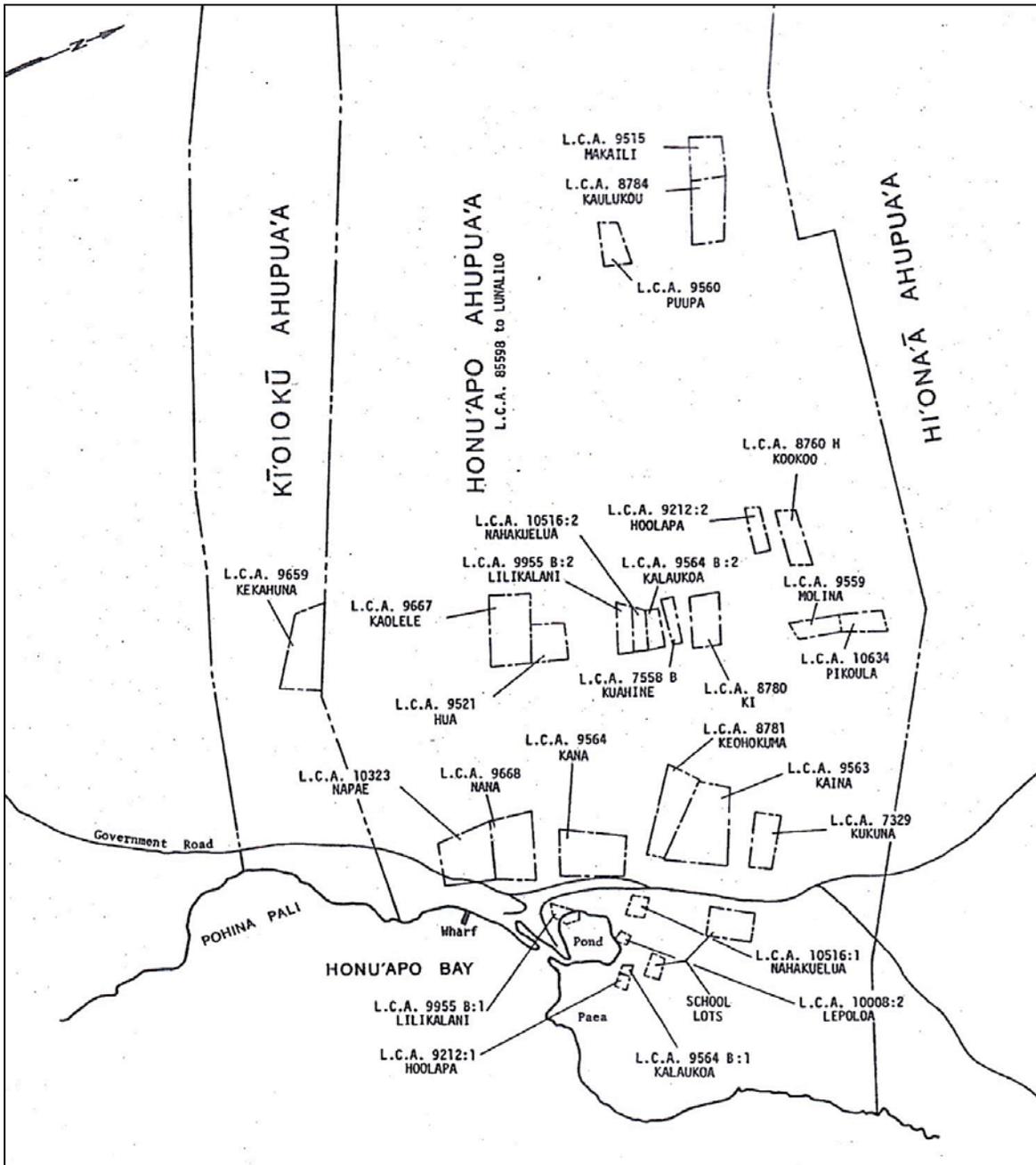


Figure 10. Kuleana awards in Kī'ōiokū and Honu'apo Ahupua'a, below the Forest Reserve (Kelly 1980).

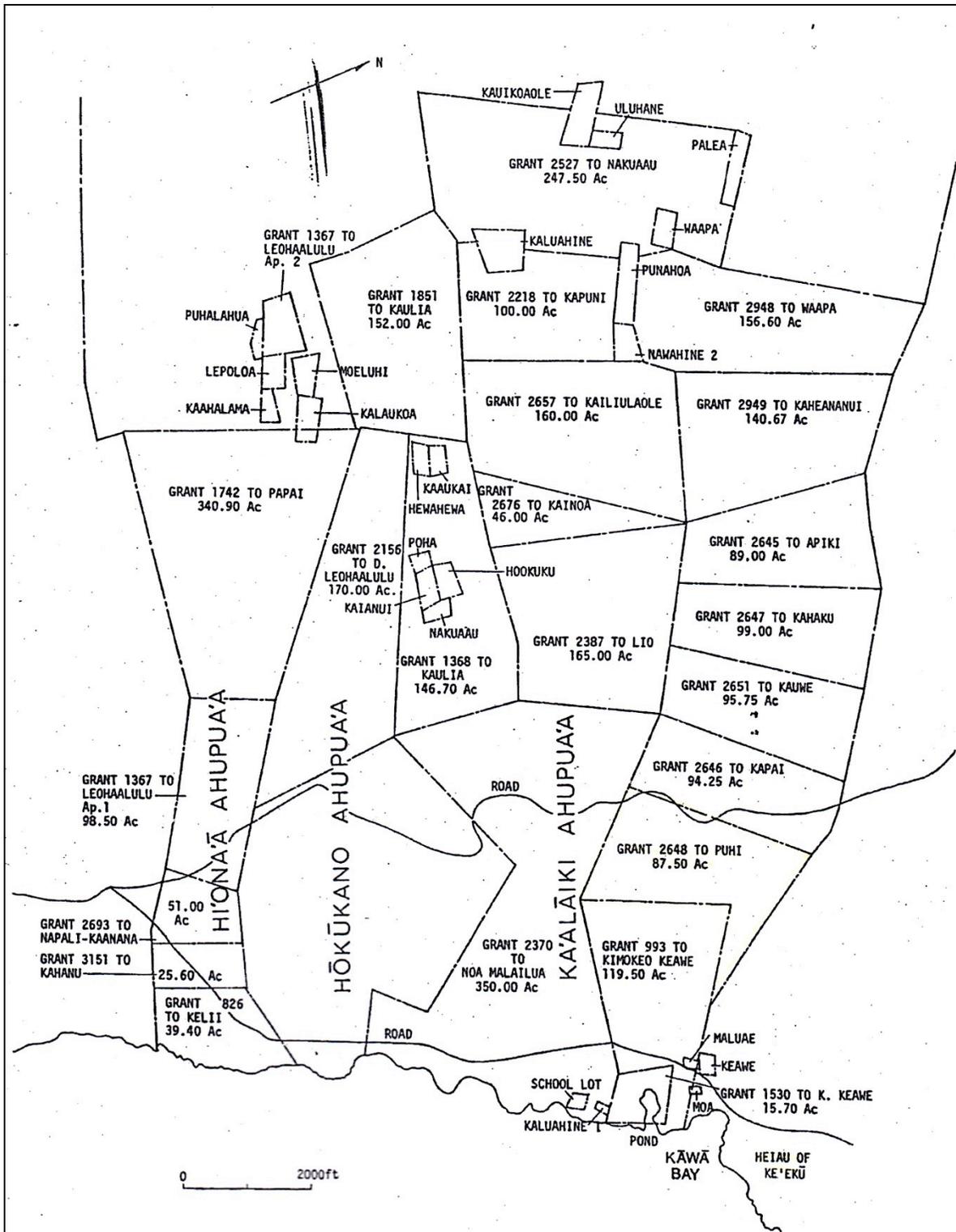


Figure 11. Kuleana awards and grants in Hi'iona'a, Hōkūkano, and Ka'alāiki Ahupua'a, below the Forest Reserve (Kelly 1980).

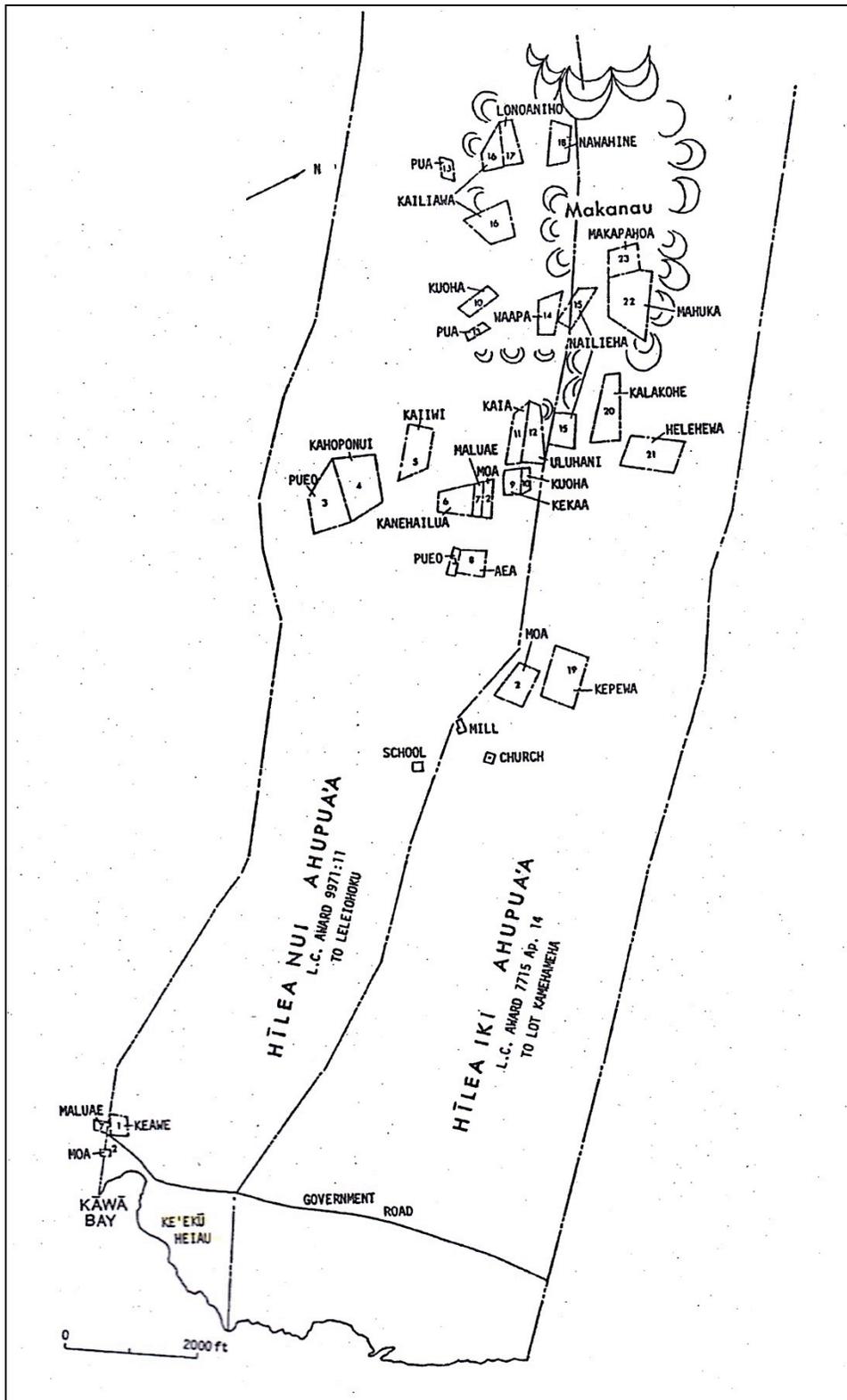


Figure 12. Kuleana awards in Hīlea Nui and Hīlea Iki Ahupua'a, below the Forest Reserve (Kelly 1980).

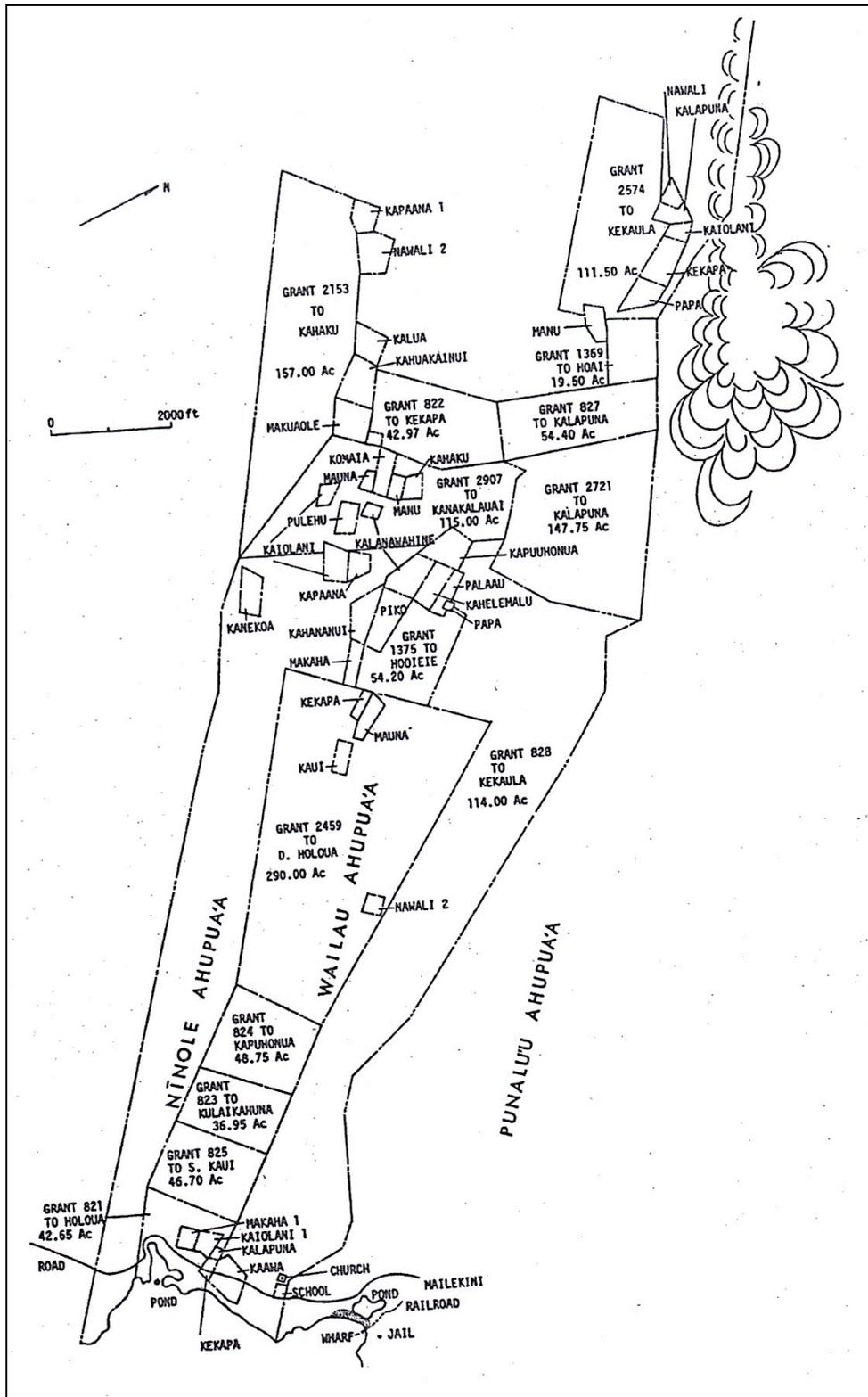


Figure 13. Kuleana awards and grants in Ninole and Wailau Ahupua'a, below the Forest Reserve (Kelly 1980).

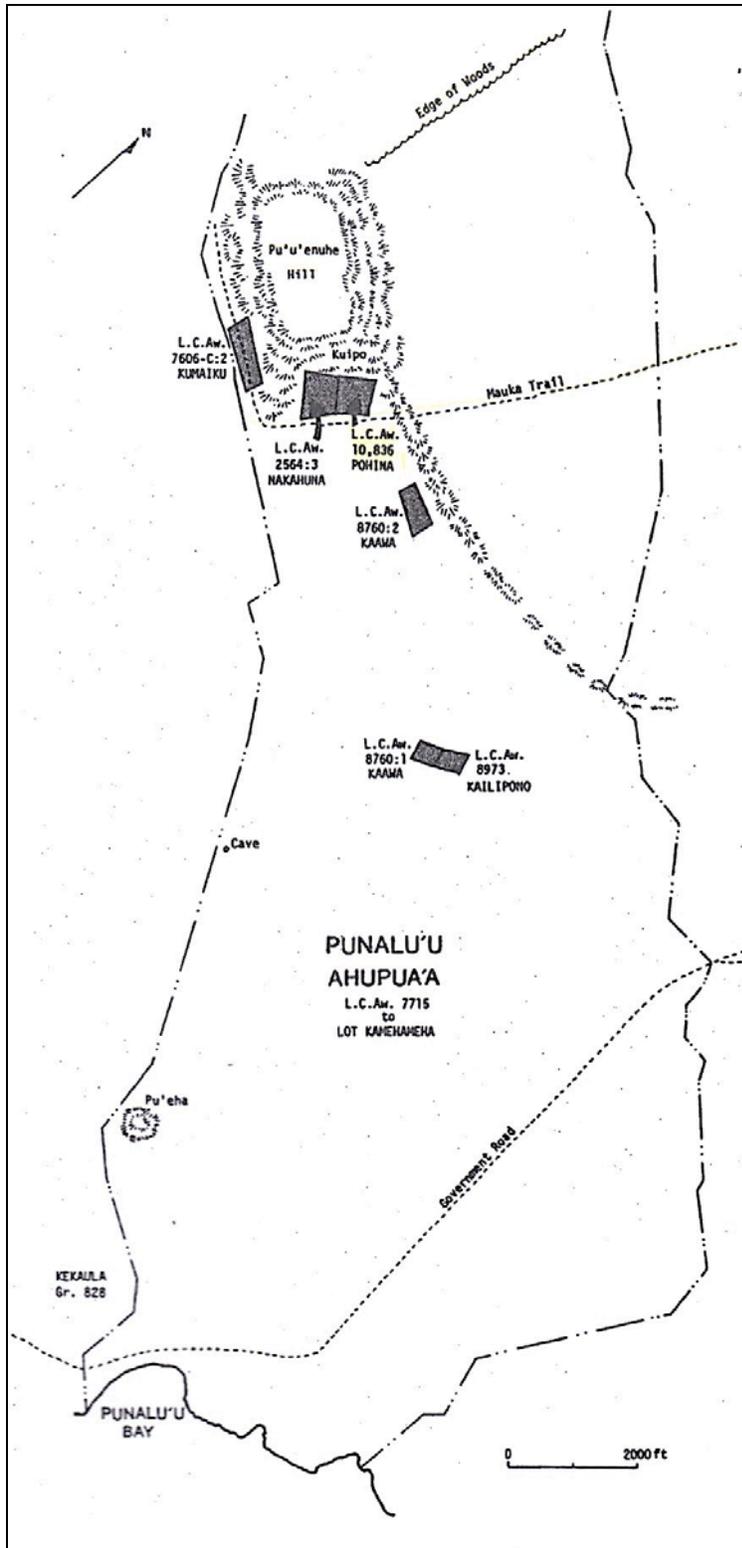


Figure 14. Kuleana awards for mauka Punalu'u Ahupua'a, below the Forest Reserve (Kelly 1980).

Historic Maps

Early maps of Ka‘ū provide information on what the landscape of the project area was like before modern times and the changes that occurred over the years. An 1894 map by Dodge (Figure 15) shows land settlement patterns from Kalae to Punalu‘u Ahupua‘a, depicting majority of the grants and Land Commission Awards (LCA) located from the *kula* lands below the current boundaries of the Forest Reserve to the coast. House lots were not common in the upper slopes of Mauna Loa, where the Ka‘ū Forest Reserve boundaries are today. This map also provides names of land owners and place names. An 1879 map drawn by Lyman (Figure 16) shows the *ahupua‘a* from Pakini to Mohokea in Ka‘ū, including grant numbers and unsold Government lands. A 1905–1906 Hawai‘i Territory Survey map of the Ka‘ū Forest Reserve shows the early boundaries of the Reserve with the total area at that time being 65,850 acres (Figure 17). The map also displays some of the larger surrounding land owners such as Hutchinson Sugar Company, Bishop Estate, and the Government.

The Changing Landscape

The influx of missionaries and foreigners played a vital role in the changing landscape of Ka‘ū. Many critical changes occurred in Hawai‘i during this time, having a major affect on the lifestyle of the Hawaiian people. Foreigners’ arrivals lead to the introduction of more non-native plant and animal species. These introductions then caused environmental changes that would eventually affect the native forests and plantations. This section describes the changes that occurred beginning in the late 1700s and their effects on the people and traditional landscapes of Ka‘ū:

Famine, Depopulation, and Economics

In the mid-1800s drought was widespread in Ka‘ū, which lead to famine and depopulation. This combination of circumstances created a downward spiral of reduced subsistence crops, increased dependence on selling *pulu* to traders, further reductions in subsistence crops, and finally depopulation (Kelly 1980:12). A Mission Station Report from Ka‘ū in 1846 states the following about the circumstances at that time:

Decrease in population and the cause. The population of Kau from all the information I have been able to gather, has been gradually dismissing for years but during the past year and especially the last six months it has been much more rapid. The influenza swept off a great many of the aged, the more feeble & infirm, & laid the foundation of disease on many of the strongest & most healthy constitutions which has greatly swelled the lists of mortality ever since.

Long and pinching famine for the last few months, has also contributed not a little to increase the number of deaths. Few, if any have died of actual starvation. But the sufferings of the very poor, the aged & sick, have been very great, & the nature of their food has been such as to produce diarrhea & other deseases (sic) which have terminated in death. Mortality has been very great among the children.

Another cause of depopulation has been the course pursued by the Government officers, in reference to taxes. They require that all taxes be paid in silver & gold & nothing else. But there is no silver in Kau. It does not grow there. The soil is good but is not adapted for the cultivation of silver & gold. Consequently all our able bodied men have gone money hunting – Some with their whole families & not a few of them have taken up their abode in the Cities of dollars & cents. If the people are compelled to pay their taxes in money only, I am satisfied it will be the cause of draining Kau of its inhabitants. This will

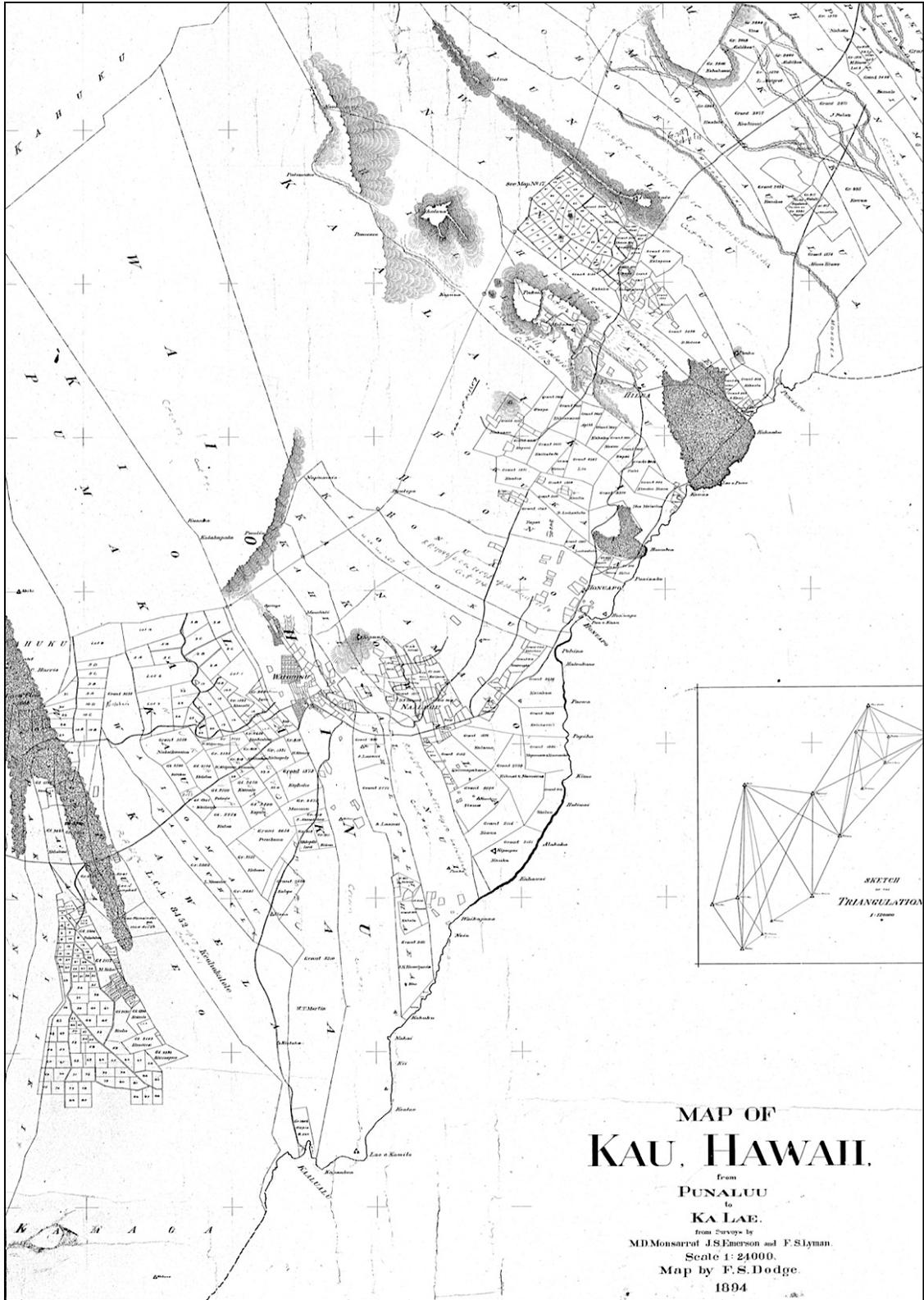


Figure 15. Early map of Ka'ū (Dodge 1894).

also be the case with all districts similarly situated, they will be depopulated, to enrich the Government & their inhabitants will become hewers of wood & drawers of water to a foreign people.

A letter written by W. Kahalelaau appearing in the Hawaiian language newspaper *Nupepa Ku'okoa* on July 5, 1862 also gives evidence of the troubles facing the people of Ka'ū during this time:

There is much trouble here in our land, Kau, and these are the troubles. 1. Too much sun; 2. Famine; 3. Animals. The worst of the three troubles just mentioned are the animals. We are not troubled by the animals owned by the natives but by those belonging to the Haoles, they dig the land bare and trample on the plants. There is nothing we can do. The natives work and the cattle crush. The places cultivated by the ancients were found to be fertile and much food produced, such as melons, sugar canes and other things. In the last two years we have experienced trouble for the first time and our misfortune is great. It would be well for the Haole's animals to go on their own lands but the trouble is that they go on ours. We did have a famine a few years ago but that was because we had too much sun and when rain fell we received life, plants were planted and our troubles were over. Now we haven't a safe place to plant our plants. The places that helped a little had to be paid for with money and even then some were distributed.

How are we going to recover from this trouble of ours? If some of you know, O my fellows, some way to end this trouble, tell it abroad so that our owners of many animals will see it. If you are puzzled, someone else may know, and if they haven't the solution, another person may have.

So hurry, so that you reach those persons and those others to the house of thinkers established by the Hawaiian government, so that we may be saved from this serious trouble. This isn't a trouble which you could pass without helping us. It will be a help if you told us what to do, so our faces will brighten.

Furthermore, in 1863 Reverend Gulick wrote about how the drought, wild animals, and the *pulu* trade lead to many hardships for the people of Ka'ū, but that there was still a supply of famine foods in the mountains of Ka'ū:

For two years famine has rages in Kau: - that is to say taro and poi are scarce. This has been owing, firstly to the drought, secondly to the free range of cattle and horses over lands once devoted to cultivation, and lastly to the *pulu* trade. The effect of the famine has been to send many of our people to Hilo, Puna, Kona and Oahu to sojourn. Still there is but little suffering from the famine, as the mountains contain a bountiful supply of pala fern and ti-root which afford a tolerable substitute for the taro. (Ka'ū Mission Station Reports 1863)

Pulu Trade

During the mid-1800s, *pulu*, or fern fiber, was gathered by Hawaiians under contract for local traders who shipped it to California where it was used to fill pillows and mattresses (Kelly 1980:11). The gathering and exporting of *pulu* had lasting negative impacts on the people of Ka'ū. Because one could make more cash money being involved in the *pulu* trade during this time, many farmers let their crops go fallow and focused their energies on gathering *pulu* to sell. Reverend Shipman wrote about the effects of the *pulu* trade on the people of Ka'ū:

...The effect – on them – is not good; not that the *pulu* is not a source from which they might secure comfort to themselves and families, but the actual result is the reverse. They

are offered goods to almost any amount, to be paid for in pulu; this to a native is a strong temptation to go into debt. Consequently many of them are deeply in debt and almost all to some extent. The policy of traders is to get them in debt and to keep them there so long as possible... When once in this condition they are almost entirely under the control of their creditors, and are compelled to live in the pulu regions, at the peril of losing their houses and lots, and whatever other property they may possess. Thus their homes are almost in reality deserted, ground uncultivated. (Ka'ū Mission Station Report 1860)

Hawaiians were also writing about the effects of the *pulu* trade on their communities and families. The following letter was printed in *Ka Nupepa Ku'okoa* on July 24, 1869 by R.P. Huia from Wai'ōhinu:

Wī o Ka'ū Nei (There is famine here in Ka'ū)

Because I have seen it and heard about it, that is why I am telling the public why there is famine in Ka'ū. This is it. All the people have gone to gather pulu and because they signed contracts to work for the Whites and then owed them. These are the major causes which we see, because the Whites take them and work them according to their wishes. The employers of these people are the admirable deputy sheriff L.E. Swain, N.C. Haley, Thomas Martin and N. George...

It is done in this way: for one thousand pounds, three dollars. Some white men paid four dollars per thousand pounds and some five dollars. This payment of the haoles please the natives so that they go to gather pulu, and desert their farming. Some people still stick to their farming and these are the ones that furnish a few bundles of poi, reaching up to eighteen pounds for the sale price of 6 ½ cents... How heartless the farmers are. Look, you farmers of other places and remember that money is considered [left] here in Ka'ū. I remember that food ran away from the face of money.

Perhaps Maui can bring us some bundles of poi that weigh thirty pounds to be paid for with fifty cents. Perhaps Molokai will, for this land is almost on the battle field of "Wiwikaniho" (gnashing-the-teeth) and the general is Kupōloli (dire hunger). In looking at the situation and understanding it, this is the worst of the big famines suffered by Ka'ū which scorch with heat as far as the windy cape of Hokekona.

Regards to the editor and printers. I am your obedient servant. Gratefully, R.P. Huia.
Waiōhinu, Ka'ū, Hawai'i.

Sugar

In 1868, Hutchinson established the first commercial sugar operation in Nā'ālehu. Around ten years later, the Reciprocity Treaty was signed with the United States, allowing free trade and leading to a boom in sugar mills in Ka'ū. By 1800, there were three sugar mills in Ka'ū, with Pāhala being the largest mill in all of Hawai'i. While most of the environmental impact from sugar plantations affected the lands below the Ka'ū Forest Reserve, water irrigation developments, such as canals, ditches, and flumes did extend into the Reserve. The plantations' effect on the water resources of Ka'ū became apparent when the canals and wells began to dry up. Ultimately, this helped to initiate the sugar plantations' involvement in establishing the Forest Reserve system in Hawai'i.

Ranching

George Vancouver introduced cattle to Hawai‘i in the early 1790s. At this time, Kamehameha I established a *kapu* on the animals so they could reproduce and increase in numbers. Within a few decades the number of cattle had grown exponentially, thus prompting the need for ranches and ranchers to help catch and control the wild cattle.

W.H. Reed and Charles Richardson established Kapāpala Ranch in 1860, attaining their first herd of cattle from Harry Purdy, an owner of Parker Ranch. In 1873, Reed bought out Richardson’s share of the ranch, and in 1876 the ranch was then sold to the Hawaiian Agricultural Company. There was a halfway house located in Kapāpala Ranch where cowboys and other travelers would frequently stop to rest on their travels between Punalu‘u and the volcano area. The house is no longer there, but a grove of eucalyptus trees stands in its previous location. Today, the ranch is owned and run by the Cran family. As of 2005 there were 20 working horses, more than 2,000 head of cattle and herds of goats and sheep on his ranch (Moulds-Carr 2005).

Robert Brown and his brother Theophilus Brown began Kahuku Ranch in 1866 when they purchased the entire *ahupua‘a* of Kahuku from C.C. Harris. The Browns started out with 500 head of cattle and went on to construct a stone ranch house above Pali o Māmalu. However, the volcanic eruption of 1868 destroyed their home and much of their assets, so they ended up selling the ranch shortly after. An early visitor to the ranch, Mrs. Alura Brown Cutler, wrote that the ranch had miles of stone walls that enclosed gardens, cattle yards, calf pastures, and goat and pig pens. Cutler also described fig, peach, banana and mulberry trees, and lots of flowers. She also noted that the Brown house was located roughly seven miles from the coast and that there were five additional stone houses that were occupied by families who worked on the ranch (Moulds-Carr 2005:59).

The Kahuku Ranch has changed owners numerous times over the years. The Damon Estate sold 116,000 acres of their property to the Hawai‘i Volcanoes National Park in 2003. The National Park Service partnered with the Nature Conservancy to purchase this parcel for \$22 million. This land acquisition was the largest land conservation deal in Hawai‘i to date, and it increased the size of Volcanoes National Park by 50% to 333,086 acres (Moulds-Carr 2005:57).

Volcanic Activity

The *kama‘āina* of Ka‘ū have always maintained a close familial relationship with the volcano goddess Pele and her entire *‘ohana*. Living so close to the realms of the volcanic goddess has formed a unique bond between Ka‘ū people and Pele. It is clear that the volcanic elements and environments of Ka‘ū have shaped the behaviors and personalities of the individuals living on these lands as illustrated in the passage below:

...The great ocean and the Pacific’s greatest volcanoes respectively formed the outlook and the background of every locality in which Hawaiians of Hawai‘i were born and reared, lived and loved and hated, laboured, planted, hunted, fished, played, fought and worshiped. Its active volcanism certainly had a dynamic effect on the culture of this island, and may be presumed to have affected directly the organisms that were the folk who live intimately with and within and upon the stupendous earth-drama of lava eruptions accompanied by seismic and meteorological disturbance, and the explosive seething of forest and ocean when the molten rivers of pahoehoe (flowing lava) and steaming smoking a‘a (crumbling cooling rubble) poured or crept seaward from pits and vast fissures on the slopes of Mauna Loa. With the life spans of my colleague, Mrs. Pukui, and of her mother and grandmother, dwelling in Ka‘u, that land has been the

scene of eight great flows that have crept from Mauna Loa's barren uplands, through forests and over the inhabited plains, four of them plunging into the sea.

Ka-'u is the most rugged, the most forbidding, of all the areas of habitation in these islands, with its lava strewn coasts, vast windswept plains are almost treeless, beyond which rise the majestic slopes of Mauna Loa, deeply forested just above the plains, but snow-covered towards the summit in winter months. The toughness of Ka-'u folk was the result of their rugged homeland and hardy life in wrestling a living form from the land and sea. It was affected certainly by the extremes in temperature as between night, when the breezes and winds flow seaward from frosty altitudes, to midday when the black lava of plains and shore is furnace-hot from the sun. (Handy and Pukui 1998:xvi)

The people of Ka'ū knew that Pele could make herself known and take what she wanted at anytime. Like the above reference states, Ka'ū *kama'āina* have lived through eight major lava flows in their homeland, which did not deter them to leave. However, there were some volcanic events that were more devastating than others. The eruption and subsequent natural disasters that occurred in 1868 had a lasting effect on the environment and community of Ka'ū. The following account was provided by the Hawaiian Volcano Observatory on their webpage (hvo.usgs.gov/volcanowatch):

On Friday, March 27, 1868, at 5:30 a.m., several whaling ships anchored in Kawaihae Harbor noticed a dense column of fume reflected by a bright light southwest of the summit of Mauna Loa. An eruption near Moku'āweoweo had taken place, lasting several hours before subsiding. Pele's hair had drifted down upon the residents of Ka'ū and South Kona, indicating the presence of lava fountains above.

In near synchrony with its larger neighbor, Kīlauea Volcano began to shake at 10:00 a.m. the next day with a series of earthquakes that increased in intensity for several days. Cracks appeared around the summit of Kīlauea; the level of the lava lake in Halema'uma'u fluctuated rapidly. Stone walls collapsed, houses shook, and trees vibrated.

The largest historic earthquake in the Hawaiian Islands happened at 3:40 p.m. on April 2. The earthquake had an estimated magnitude of 7.9. Clocks stopped on O'ahu. At Kohala, the shock was so strong that it stopped all of the engines at the Kohala Mill, including the 75-horsepower main engine. All over the Island of Hawai'i, the effects were felt as a large portion of the coastline from Honu'apo to Kapoho subsided 1.2 to 2.1 meters (4 to 7 feet).

Coastal villages were inundated by a huge tsunami, at places over 15 meters (50 feet) high. The coastal villages of 'Apua, Keauhou, Punalu'u, Nīnole, Kawa'a, Honu'apo and Ka'alu'alu were destroyed. There were five large waves in succession. The largest came first. A total of 75 people and numerous animals were swept out to sea and drowned.

Along with the coastal subsidence and tsunami, the earth at Kiolaka'a, near Wood Valley, broke loose and slid 300 meters (1,000 feet) down from the summit and southeast side of the hill onto the valley below, covering houses and trees. This event, known as the mud flow, buried people, horses, cattle, goats and sheep under a thick layer of mud. The mud flow was 5 km (3 miles) long, as wide as 1.5 km (1 mile), and varied in thickness from 1 meter (3 feet) to 27 meters (90 feet).

All stone walls and dwellings in Ka'ū were flattened by the earthquake; people and animals were thrown down, and ground cracks appeared throughout Kīlauea and in the district of Ka'ū. Landslides occurred island-wide, and plantation chimneys in the Hilo

area fell down. Aftershocks almost as violent as the April 2 event hit at 12:20 a.m. and again at 12.45 a.m. on April 4.

At about 5:00 p.m. on April 7, a great crack opened along Mauna Loa's southwest rift zone above the Captain Robert Brown ranch in Kahuku. Lava gushed from the earth and flowed directly toward the ranch house. Captain Brown, his wife, and nine children ran for their lives as the molten flood engulfed their home. Within three hours, the flow reached the sea, a distance of 17 kilometers (10 miles) from the vent.

Establishment of the Ka'ū Forest Reserve

The establishment of the Forest Reserve system originated in the Kalākaua era when the kingdom began to notice the severe impact that introduced hooved animals had on native forests. In 1876 King David Kalākaua signed into law an Act for the Protection and Preservation of Woods and Forests, that helped to protect government-owned forest lands and water resources that were threatened by animals (Maly and Maly 2004c). Additionally, lobbying efforts by sugar plantation owners and forestry leaders in the continental U.S. helped demonstrate that the real value of the forest did not lie with its timber resources, but with its water resources. This was especially true for the sugar plantations that relied on the forest watersheds to continually supply water for their plantation operations.

The Forest Reserve System that is in operation today was officially created in 1903, through Act 44 of the Territorial Government of Hawai'i. The first Forest Reserve that was established was the Kohala Forest Reserve in 1904, and the Ka'ū Forest Reserve was developed a few years later in 1906. Below is a brief summary of the events relating to the establishment of the Ka'ū Forest Reserve (DOFAW 2011):

The Ka'ū Forest Reserve was established by Governor's Proclamation on August 2, 1906 to protect the forest on the lower slopes of Mauna Loa. The Reserve was established because of its importance in maintaining the favorable conditions on which the water supply of the agricultural lands in the Ka'ū District depend (Hawaiian Forester and Agriculturist 1906).

In 1906, The Board of Commissioners of Agriculture and Forestry, on the basis of a report by Ralph S. Hosmer, Superintendent of Forestry, recommended to the Governor that a Forest Reserve be established in Ka'ū. Lands proposed for this Reserve had been under a lease to Hawaiian Agricultural Company and Hutchinson Sugar Plantation Company and many of the leases were about to expire. The leases required protection of the forest, including fencing out cattle, and these companies installed 52 miles of fencing around the forest and developed a water supply with tunnels and ditches.

Although the sugar plantations had installed a system of irrigation, it was deemed the responsibility of the Territory to perpetuate the forest for the procurement of water. The Ka'ū Forest Reserve boundaries were drawn to exclude private land at Kahuku, grazing land at Kāpāpala and land considered important for agriculture along the lower Reserve boundary (Hawaiian Forester and Agriculturist 1906).

Ralph Hosmer, Hawaii's first Territorial Forester, noted the importance of the Ka'ū forest stating "perhaps nowhere in the Territory is there a finer example of the fern jungle, with its dense mass of tree and other high-growing species". Hosmer also noted that "since the forest fence was completed ten years ago [1896] a wonderful difference has been noticed in the appearance of the forest" (Hawaiian Forester and Agriculturist 1906).

Hosmer's report recommending the establishment of the Reserve discussed both the direct benefits to the plantation as well as indirect economic benefits to the territory through taxation and agricultural activities. Most portions of the Reserve were recommended for protection, with no cattle grazing proposed and limited areas for growing trees for timber and fuel collection (Hawaiian Forester and Agriculturist 1906).

Hosmer summarized the locations and condition of existing fences to protect the forest in a 1912 report on the Reserve in DOFAW files. The report noted that the Hawaiian Agricultural company completed 35 miles of fencing to protect the eastern half of the Reserve in 1896, including fencing through the interior of the forest from Kahuku to Pu'u Enuhe. In 1903-1904, The Hutchinson Sugar Plantation Company constructed a fence, about 17 miles in length, around most of the western end of the Ka'u Forest Reserve, connecting on the mauka side with the existing Hawaiian Agricultural Company's fence. Only some portions of the lower boundary of the Reserve were left unfenced, most being protected by cane field and other fences.

Previous Archaeological Studies

No previous archaeological reports were found for the Ka'u Forest Reserve, as most archaeological research was done from the coastal areas of Ka'u to roughly 2,500 ft. in elevation (Table 2). The following is a brief summary of archaeological research found for the region of Ka'u, focusing in greater detail on work completed at higher elevations, closer to the Ka'u Forest Reserve.

The earliest archaeological work done in Ka'u was by John F.G. Stokes in the early 1900s. Stokes surveyed and documented *heiau* on the island of Hawai'i for the Bishop Museum. Approximately 29 *heiau* were identified for the Ka'u region. By the mid-1900s the hot topic in archaeological research was the arrival of Polynesians, with radiocarbon dating and excavations focusing on coastal areas. These investigations shed light on settlement patterns within Hawai'i and Polynesia at large. Bishop Museum archaeologists such as Kenneth Emory, William Bonk, and Yosihiko Sinoto carried out intensive research at Ka Lae. Their research focused on the Pu'u Ali'i Sand Dune at South Point (Site H1), the Waiahukini Cave Shelter (Site H8), and the Makalei Shelter (Site H2). Excavations yielded large amounts of fishing-related artifacts, including vast assemblages of fishhooks, which together with the radiocarbon chronology led to the following conclusion: "The fishermen at South Point as having set up their establishment not earlier than AD 1000, and having continued its occupation to about AD1350... saw the beginning of change to the new fishhook form" (Emory and Sinoto 1969:15).

Since Emory, Bonk, and Sinoto's seminal work, there have been various reconnaissance, inventory, and salvage surveys done along with dating and excavation. The following paragraphs summarize archaeological reports from areas of Ka'u closest to the Ka'u Forest Reserve. Locations of these studies are shown in Figure 18.

In 1992 Cultural Surveys Hawai'i conducted an archaeological inventory survey at the Ahupua'a of Makaka, Hionamo, Pā'au'au 1 and 2, and Iliokoloa in Ka'u, covering about 800 acres (McDermott et al. 1992). The area is located at the southeast end of Mauna Loa at 220 ft. above sea level. A total of 138 sites were identified, consisting of temporary and permanent habitation, agricultural, and a possible burial site. The sites were mostly located toward the coastal side of the project area.

Table 2. Previous Archaeological Investigations in Ka‘ū (complete citations in references)

Author(s) Year	Ahupua‘a	Type of Investigation	Sites Identified	Features Identified	Description
Emory and Sinoto 1969	South Point	Excavation & Radiocarbon Dating	3	3	Radiocarbon dating and research on Polynesian settlement.
Emory 1969	Waiahukini	Excavation	1	1	Further investigation for cave shelter.
Wallace and Wallace 1969	Kama‘oa & Pu‘u‘eo	Data Recovery	3	3	Unknown
Hommon 1970	Ninole & Wailau	Salvage Survey	114	Not reported	Sites included walls, habitation shelters, platforms, enclosure, depression, mound, and terraces; 18 of the sites need further investigation.
Ayres 1970	Honu‘apo, Hiona‘a, & Hokukano	Reconnaissance Survey	208	183	Sites included habitation, agricultural, burials, and ritual sites. Evidence of historical and modern use. Fishpond, and trails.
Kelly and Crozier 1972	Waiohinu	Reconnaissance Survey & Excavation	7	35	Unknown
Crozier, Barrera, and Hommon 1972, 1974, 1980, 1986	Wailau, Ninole, & Punalu‘u	Salvage Survey	287	373	Examined <i>heiau</i> in coastal areas.
Mann and Bowen 1976	Ka‘alaiki & Hilea Nui	Salvage Survey	10	32	Artifacts associated with fishing, and sites that were habitation and agricultural, and possible burials.
Ewart 1978	Ka‘alaiki	Reconnaissance Survey	26	4	Habitation sites and walls.
Landrum 1984	Kama‘oa & Pu‘u‘eo	Reconnaissance Survey	77	396	Habitation, agriculture, and burial sites, including trails, wall, and cairns.
Rosendahl 1984	Honu‘apo	Reconnaissance Survey	3	3	Unknown
Cleghorn 1984	Kama‘oa	Reconnaissance Survey & Auger Testing	9	Not Reported	Habitation sites, mounds, platform.
Hammatt 1988	Punalu‘u & Kapao‘o	Reconnaissance Survey	30	Not Reported	Unknown
Hammatt 1989	Kahilipali	Reconnaissance Survey	Unknown	Unknown	Unknown
McDermott et al. 1992	Makaka, Hionamoā, Pa‘au‘aul & 2, Iliokoloa	Archaeological Inventory Survey	138	Not Reported	Permanent and temporary habitation sites, agricultural sites, a large possible burial complex.

Table 2. (cont.)

Author(s) Year	<i>Ahupua'a</i>	Type of Investigation	Sites Identified	Features Identified	Description
Rechtman 2000	Ki'oloku & Honu'apo	Assessment	0	0	No sites were found.
Haun 2004	Honu'apo	Archaeological Inventory Survey	32	76	Complexes with enclosures, mounds, concrete slab, stone wall, platforms, modified outcrops; 17 of the sites were pre-contact or early historic traditional Hawaiian sites. Petroglyphs and two burial sites were also found.
Haun and Henry 2004	Palima & Paauai	Archaeological Inventory Survey	1	1	One historical feature found.
Haun et al. 2004	Honu'apo	Archaeological Inventory Survey	32	76	Habitation sites from pre- contact and historical periods, including agricultural sites, walls, and a fishpond.
Haun and Henry 2005	Kaunamano	Archaeological Inventory Survey	0	0	No sites found.
Guerriero et al. 2006	Ki'oolokū & Kaunamano	Archaeological Inventory Survey	4	6	Habitation sites from pre- contact and historical eras.
Quiseng 2008	Kahuku- Ainapō Trail	Archaeological Reconnaissance Survey	28	110	Reconnaissance survey of trail (Site 24121), transect surveys on portions of Kahuku Management Unit.
Tuggle and Tomonari- Tuggle 2008	Hawai'i Volcanoes National Park	Archaeological Overview & Assessment	NA	NA	
Escott 2009	Kāwala	Archaeological Inventory Survey	3	44	Historical and modern sites, one which was a community cemetery.

In 2004 Haun and Associates conducted an archaeological inventory survey in Honu'apo around the 10-70 ft. elevation (Haun et al. 2004). A total of 32 sites were identified, with 76 features associated with the sites. Of the 32 sites, 11 were complexes and 21 were single sites, of both habitation and agricultural function; 25 of the sites were evaluated as significant for the information they hold for historical land use. In addition, seven sites were recommended for preservation because they exhibited unique characteristics. Two charcoal samples were submitted for radiocarbon dating. One was from a well-preserved platform that dated to AD 1435–1645. The other sample was from a large wall, which returned an age range of AD 1450–1685.

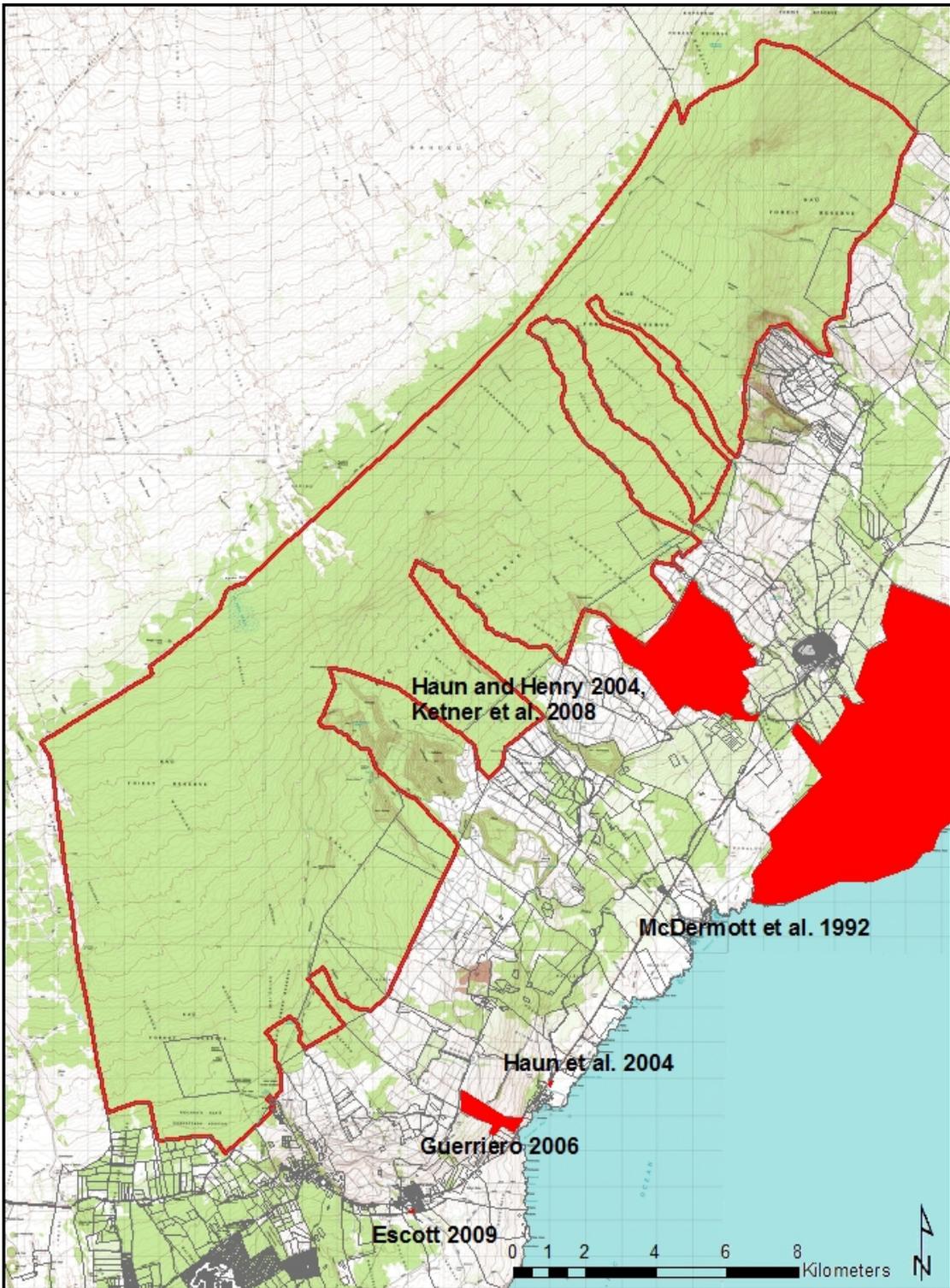


Figure 18. TMKs where previous archaeological work was conducted (solid red) in relation to the Ka'u Forest Reserve (red outline). Note that the Quiseng (2008) study was conducted on the large parcel adjacent to the project area on the north and west that extends off the map.

Haun and Associates also conducted an archaeological assessment at the Pahala Plantation Project in 2004, in the *ahupua'a* of Makaka, Kopu, and Moaula with a total of 2,000 acres, at the 400 to 2,500 ft. elevation (Haun and Henry 2004). Within the project area they found mostly sites that were associated with the sugar plantation camps. There were two major plantation camps, one named Higashi Camp, and the other Middle Moa'ula Camp. The sites were historic in age and were both habitation and agricultural. The sites included three flumes, three plantation supervisors' homes, foundations for three additional houses, a bridge that crossed Moaula Gulch, and two sugarcane camps.

In 2006 an archaeological inventory survey was conducted in the *ahupua'a* of Kioloku and Kaunamano at the 200–1,375 ft. elevation range (Guerriero et al. 2006). A total of four sites were identified, including 66 features. Within those sites there were boundary walls that are thought to have been traditional walls re-used for sugarcane cultivation. One of the sites dated to the historic period, as evidenced by the use of mortar. The two other sites were traditional habitation areas with possible religious and burial association.

Rechtman Consulting conducted an archaeological inventory survey in 2008 in the Ahupua'a of Kopu, Makaka, and Moa'ula, at elevations ranging from 680–2,400 ft. (Ketner et al. 2008), in the vicinity of the earlier Haun and Associates project (Haun and Henry 2004). A total of eight archaeological sites were recorded, with three of these evaluated as significant for the information they might yield. In addition, two sites contained human skeletal remains that were also considered significant for cultural practices that were once carried out. The eight sites were used in both traditional and historic periods, and additional inventory was recommended.

In 2008 Quiseng published a report for field work conducted at the Kahuku Management Unit by the Hawai'i Volcanoes National Park Cultural Resources Management Division in 2004 and 2005. Field work consisted of a two-phase Reconnaissance Inventory Survey of the Ainapō Trail within their Kahuku Management Unit (between 2,000 to 9,000 ft. elevation). Phase I (2004) of HAVO reconnaissance survey consisted of 234 acres where they conducted survey transects from the Kahuku boundary to the projected trail location. During the survey they found the pre-existing trail route from the southern boundary of Kahuku at Pu'u Nanaia to Punalu'u Kahawai. Nineteen trail and road segments, five cairns (*ahu*), one enclosure, one cabin, one cleared area, four walls, one waterhole, one lumber milling station, and four artifacts were also located totaling seven sites that consist of 37 features. In addition, apart from the Kahuku-Ainapō Trail, six site areas were represented by two cattle walls, a cleared area identified at the Wright Camp, a historical-era enclosure, a lumber milling station, and piled milled *koa* wood planks (Quiseng 2008:19-32).

Phase II (2005) of the Kahuku-Ainapō Trail Reconnaissance Inventory Survey, included locating and documenting the archeological site types and distribution patterns within the remote areas of the HAVO section of the Kahuku Forest. The survey covered an area of 722 acres. During this survey HAVO staff identified numerous sites that date back to the pre-contact, historical, and modern eras. Types of features that were found include thirty excavation pits, ten cairns, three rock walls, two c-shapes, two trail segments, two enclosures, one rock shelters, two hearths, two modified lava tubes, and six artifactual remains. Historical and modern era features that were located include three cattle walls, one lumber milling station, one cinder pit, and two pieces of heavy machinery. A total of twenty-one sites consisting of 73 features were identified during the survey (Quiseng 2008:45-48).

In 2008 Tuggle and Tomonari-Tuggle completed an Archaeological Overview and Assessment for Hawai'i Volcanoes National Park. The report consisted of a general overview of patterns of culture and history; a review of the archeological information and the status of research at HAVO; recommendations for a continuing program of archeological investigation, including development

of a Research Design to guide future work; and recommendations for a framework and guidelines for organizing archeological data, information related to archeological data, archeological site definition, and information recording.

In 2009 an archaeological inventory survey was done by Scientific Consultant Services in Nā'ālehu in the *ahupua'a* of Kāwala around the 700 ft. elevation (Escott 2009). This survey found three sites, comprised of 44 features. One site was a community cemetery that is preserved, and the other two sites were a historical house lot and foundation of an early bathhouse.

In addition to the studies listed above, the National Park Service has conducted numerous cultural resource studies over the years within the boundaries of the Hawai'i Volcanoes National Park (HAVO). While most of these studies are located outside the boundaries of the Ka'ū Forest Reserve, they can provide information on the environmental characteristics, site types, and feature distribution that could be compared to the conditions in the Forest Reserve. Figure 19 is a map of survey locations within HAVO.

Site Types

The Hawai'i Volcanoes National Park (HAVO) cultural resource division completed a cultural resource overview and annotated bibliography of the Ka'ū and Kapapala Forest Reserves in 2009. This study provides the most comprehensive and up to date listings of archaeological projects that have been conducted in *mauka* Ka'ū. From the records that were gathered, HAVO staff were able to compile a general overview of cultural resource site types potentially found in *mauka* Ka'ū.

According to their research, site types within the upland regions of the Ka'ū district can be described as follows:

...It is posited that land use follows established land use models for the leeward portions of the island and was structured on usages based on environmental/elevations zones. Coastal areas are likely to contain residential complexes, ceremonial sites, limited agricultural complexes, cave sites (habitation and burial internment), burial sites, and trail networks extending parallel with the coast, connecting residential complexes, and trail routes oriented inland, connecting upland agricultural areas with coastal communities. Inland areas most likely contain a lesser density and variety of site types and include agricultural complexes (mounds, pits, terraces, modified outcrops, walls, kua'iwi), with scattered temporary habitation features (c-shapes, enclosures, platforms, paved terraces) that were utilized on short term basis. These features most likely coincide with favorable agricultural soils and lava flow types and are generally situated within optimal rainfall isohyets. Additional inland sites include trails (connecting with coastal communities), cave sites, and ceremonial sites.

Sites within the upland regions were most likely limited to specialized resource extraction including bird catching/collecting, harvesting hardwoods and forest plants for traditional and medicinal usage. Remains associated with these activities are difficult to identify and result from traditional practices that appear to be transitory in nature and required short-term excursions into these resource areas.

Table 3. Site Types Potentially Found in *Mauka Ka‘ū* (Burrell et al. 2009)

Site Type	Site Function
Temporary habitation sites (e.g. C-shapes, overhang and rock shelters)	Habitation
Caves	Temporary habitation, water collection, burial/internment
Ponds/water holes	Resource procurement
Ahu	Marker
Trails	Transportation
Excavated pits	Resource procurement
Shrines/heiau	Ceremonial
Ranch structures	Habitation
Walls	Boundary
Paddocks	Animal pens
Enclosures	Habitation, animal pens
Temporary (historic) camps	Habitation
Water tanks	Resource management
Irrigation systems	Resource management
Logging/milling stations	Resource collection/processing
Roads/trails	Transportation

known today. The highest of these was likely Halepōhāhā, located in the *ahupua‘a* of Kahuku. Halepōhāhā was built by ‘Umi and was a *luakini heiau* (Stokes 1991:13).

Kalalea Heiau is located in the *ahupua‘a* of Kamā‘oa at South Point (Kalae). It stands near the area where two ocean currents meet. This *heiau* is associated with fishing and Kū‘ula, the fishing god. Stokes relates a story of Kū‘ula’s son ‘Ai‘ai:

Kū‘ula married a female, and had a son, ‘Ai‘ai. They left Kahiki and came to these Islands, settling on Kaua‘i. ‘Ai‘ai left his parents on Kaua‘i and went on a sightseeing tour to the island of O‘ahu, Molokai, Maui, and Hawai‘i. When he reached Ka Lae, he looked around and saw that it was a fine country, a nice place to live in and well supplied with fish. He returned to Kaua‘i and brought his parents back with him, and they all lived at Ka Lae. While his parents were living at Ka Lae, ‘Ai‘ai set out for Kahiki and brought back many people: Kilokilo (seers) Kuhikuhipu‘aone (architects), and ‘ā‘īpu‘upu‘u (stewards). He also brought back many different foods... And when ‘Ai‘ai saw that the food and the men were ready, he gave commands to all the menehune, and the erection of the heiau went on until the walls were completed. It was named Kalalea, which the name still stands today. (1991:119)

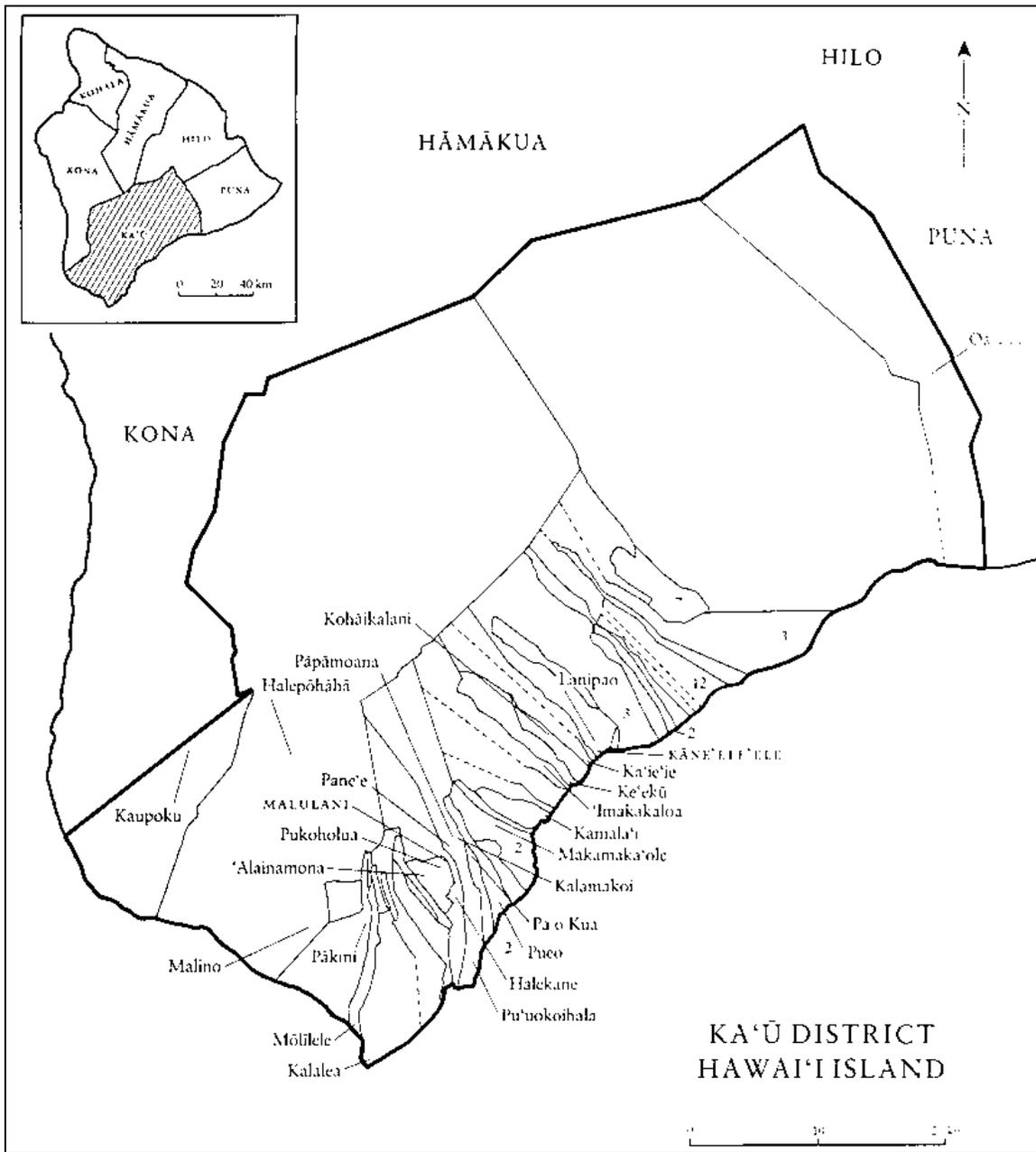


Figure 20. Location of *heiau* in Ka'ū as documented by Stokes.

Table 4. Heiau in Ka‘ū

Name	Ahupua‘a	Function	Description
Pakini	Pakini nui	Unknown	Built by Kalaniopu‘u and dedicated to Kūkailimoku (Thrum 1905).
Kalalea	Kamaoa at Kalae	Fishing <i>Heiau</i>	Dedicated to Ku‘ula the fishing god (Stokes 1991).
Molilele	Pakini iki	Unknown	At the top of Pali Hā‘uke‘uke. Destroyed (Thrum 1905)
Kamalai	Honu‘apo	Luakini Heiau	Destroyed by tidal wave (Thrum 1905).
Auolele	Boundary of Honu‘apo/Hiona‘ā	Luakini Heiau	Never seen (Thrum 1905).
Imakakaloa	Ka‘alaiki/ below Pu‘uenuhe	Hula Heiau	Named after a famous blind chief of Ka‘ū (Thrum 1905).
Ke‘ekū	Hilea at Kawa Bay	Luakini Heiau	Almost all destroyed by tidal wave.
Kohaikalani	Hilea	Luakini Heiau	Named after a Ka‘ū <i>ali‘i</i> that was killed there. The small stones of the <i>heiau</i> were brought from Nīnole.
Ka‘ie‘ie	Nīnole	Luakini Heiau	Offerings made to Kamohoali‘i, the shark god, and Pele's brother (M. Farias).
Mokini	Nīnole	Unknown	Never found (Thrum 1905).
Lanipao	Punalu‘u	Possible Hula Heiau	Built by Laka, the <i>hula</i> goddess (Stokes 1991).
Mailekini	Punalu‘u	Luakini Heiau	One of the two <i>heiau</i> of Punalu‘unui, the other was Halelau (Thrum 1905).
Halelau	Punalu‘u	Luakini Heiau	One of the two <i>heiau</i> of Punalu‘unui the other was Mailekini (M. Farias, Thrum 1905).
Punalu‘unui	Punalu‘u	Luakini Heiau	Other names are Kane‘ele‘ele and Keone‘ele‘ele. Composed of two <i>heiau</i> , Mailekini and Halelau (M. Farias). Associated with Wahaulu in Puna and built by Pa‘ao (Thrum 1905).
Alainamoana	Kioloka‘a	Unknown	Small high platform <i>heiau</i> (Stokes 1991).
Kalamakoi	Waiohinu	Unknown	L-shaped <i>heiau</i> .
Halepōhāhā	Kahuku	Luakini Heiau	Built by ‘Umi (Stokes 1991).
Kaupoku	Maunakā	Unknown	Also known as Kanēikaupoku. Magical bananas grew there (Stokes 1991)
Malulani	Kioloka‘a	Unknown	Could have been a <i>pu‘uhonua</i> and not a <i>heiau</i> . Reported destroyed.
Halekane	Kioloka‘a	Unknown	Unknown
Pane‘e	Waiohinu	Unknown	Destroyed (Thrum 1905).
Pāpāmoana	Waiohinu	Luakini Heiau	Imakakaloa was sacrificed here (Stokes 1991).
Pa O Kua	Kahaea	Unknown	Used for <i>ho‘omanamana</i> , or wizardry (Stokes 1991).
Pueo	Kāhilipali	Unknown	Unknown (Stokes 1991).

Table 4. (cont.)

Name	Ahupua‘a	Function	Description
Makamaka‘ole	Kaunamano	Unknown	It is said that this <i>heiau</i> was brought from Nīnole (Stokes 1991).
Oalalauo	Keauhou	Unknown	Mentioned by William Ellis (Stokes 1991).
Malino	Kahuku	Unknown	Unknown (Stokes 1991).
Kaneikaupoku	Manokuka	Unknown	Never found (Stokes 1991).

Because of Kū‘ula having a significant role in Ka‘ū, Kalalea is still a very important *heiau* to fishermen today. Those who are still dedicated to Kū‘ula use the *heiau* to carry out their ancestral religious practices and Kalalea has been restored. Stokes described Kalalea in 1906 as a small enclosure measuring 43 by 35 ft. (1991:116). There were platforms attached to the outside of the western wall of the structure. The largest platform measured 20 by 16 ft. and up to 2.5 ft. high. A smaller platform rose a foot higher and both were paved with ‘ili‘ili. The *heiau* floor was overgrown with *mānienie* grass. There were stones that represent the fishing gods Kū‘ula and ‘Ai‘ai.

‘Imakakaloa Heiau is located in the Ahupua‘a of Ka‘alāiki. It is said that this was a *hula heiau* (Stokes 1991:128). ‘Imakakaloa is composed of a series of enclosures with walls that form a platform. The large enclosure on the southeast is said to have been for the chiefs and *kahuna*. Within the large enclosure is an altar. The other two enclosures are the *hale o papa*, and the *hale hula*. The *hale hula* is the second largest enclosure between the larger enclosure, and the *hale o papa*.

Kohāikalani Heiau is located in the *ahupua‘a* of Hīlea at Kawa Bay on the northeast end of the bay on the sea cliff. This *heiau* has several features within it. There is a large enclosure, and within the large enclosure there is a bench-like wall that runs across the northeast wall. In the north corner of the enclosure there is a platform that might have been used for the *hale ali‘i* (Stokes 1991:128). In the south corner is a *kū‘aha*, or sacrificial altar. Outside the enclosure are two platforms connected to the wall, one on the southwest, and the other on northwest. Outside the enclosure are two other platforms that were possibly used for *ho‘okupu*, or offerings (Stokes 1991:128).

Lanipao Heiau is located near the southwest end of Punalu‘u at roughly 1,600 ft. in elevation. According to Stokes, the *heiau* is a small L-shaped enclosure with walls approximately 6 ft. high and 6 ft. thick (1991:132). The southern portion of the *heiau* has three terraces, each rising about a foot. Outside the west wall are adjoining walls that form an enclosure with smaller walls. It is said that Laka of Kaua‘i built this *heiau* (Stokes 1991:132). Lanipao Heiau has unique characteristics, for the *heiau* had a low triangle-shaped platform and ‘a‘ā paving (Crozier 2007).

Ka‘ie‘ie Heiau is situated on the west end of Nīnole Bay. There is not much left of the structure, “for all that was found was a cleared level stretch of ‘a‘a paved with beach pebbles. On the east it overhung the sea” (Stokes 1991:131). Hawai‘i Island historian Russ Apple wrote that the *heiau* was used as a site for ceremonies transforming selected stones from nearby Koloa Beach into a “game god” (Apple 1987).

Punalu‘unui Heiau is located on the east end of Punalu‘u, adjacent to the Punalu‘u wharf. The *heiau* is enigmatic, as it was known by several different names and is made up of two smaller

heiau that combine to form a significantly large religious complex. The other names that are used are Kāne‘ele‘ele, Mailekini, and Halelau. Due to its size and location, Punalu‘unui Heiau held great spiritual and religious importance.

In 1905, Thrum stated that the only remains of Punalu‘unui were a 687 foot-long wall running *mauka* and a 240 foot-long wall at the lower end (1905:47). He also related that “Kāne‘ele‘ele is an important ancient heiau, said to have had affiliation in its working with that of Wahaula, in Puna” (Thrum 1905:47).

A year later, Stokes wrote a more detailed description of the *heiau*:

The heiau site consisted of a large level area of ‘a‘a about 700 by 500 feet, which had been leveled off and partly paved with beach pebbles. The only definite feature remaining was a large wall on the eastern side, 8.5 feet high and 9 feet thick ran for 648 feet. From either extreme, broken walls continued at right angles towards the west for about 230 feet. Outside the southern wall was a large flat stone, called locally ‘the sacrificial stone’ East of and adjoining the large wall was another paved area, measuring about 500 feet each way. It was not enclosed and was better and more evenly paved with beach pebbles than the first portion described... The first name heard locally was Mailekini, and later another native stated that there were two heiau, that one on the south being known as Halelau and that on the north as Puanlu‘unui.

The Punalu‘u National Register of Historic Places describes the *heiau* as follows:

Kane‘ele‘ele Heiau, a site encompassing several acres within its massive walls. Stretching inland from Kane‘ele‘ele along the cliff, however, are other features, which might have been community-oriented structures as well whether heiau, mua, or shrines cannot be determined... Certainly a heiau of the size of Kane‘ele‘ele required a large group of priests retainers, and other religious functionaries in order to operate efficiently, and these people would have needed residences in the near vicinity. (Crozier 2007:4)

The Ainapō Trail

The Ainapō Trail (Figure 21) is a culturally and historically important trail in the region. Used to get to the spiritual realm of the gods in the high elevation on the summit of Mauna Loa, and to Moku‘āweo Crater, the trail is listed on the National Register of Historical Places. It is located between the elevations of 7,500 and 13,000 ft. and stretches 34 miles above the Ka‘ū Forest Reserve. This trail is located in cold and desolate, rugged terrain of the slopes of Mauna Loa. The ‘Ainapō Trail route is described on the National Register of Historic Places nomination form below (1972):

A narrow, single-file, twisting, and occasionally slightly abraded trail over fields of cooled, hard, tough lavas; some fields being rough and scoriaceous and other smooth and billowy; above 11,600-foot elevation; leading up the broad southeast flank of Mauna Loa volcano to and along the east side of Mokuaweoweo, the major summit crater.

According to a 1994 inspection, the Ainapō Trail appeared to be well defined, and in good state of preservation:

On the ‘a‘a flows, the trail appears to have been defined primary by clearing loose stone from the route and by repeated usage. No formalization curbstones were noted although informal alignments of piled stone do occur along some segments, most of which were

probably formed as the trail was cleared...The trail route over the pahoehoe is less clear but is marked by intermittent ahu and discoloration of the pahoehoe surface caused by use wear. (Buck 1994:2)

The trail was used from traditional times through 1916 (Apple 1965:1). Located on the high slopes of Mauna Loa, the trail was consumed by frigid cold that caused the hike to be longer and unbearable in the winter. The trail was quite different during summer, but it was still a rough and hard terrain to cross. According to Apple, the men that hiked the Ainapō Trail suffered from thirst, starvation, and altitude sickness (1965:3–12). It is said that the trail was built and used to provide shelter, drinking water, and firewood between the nearest permanent settlements. In later years, the shelter, water, and wood became less important as inexpensive animal labor caused the trail to be used less frequently. For a brief period, the trail was used for tours to the Mauna Loa summit. In 1915 the Army utilized the trail, altered some sections for hoofed animals, and added a second trail to the summit of Mauna Loa (Apple 1965:3).

Apple writes of traditional views of accessing the Mauna Loa summit:

Long before Western-style trespass became legally possible in Hawaii, Westerners tried various hiking routes up the broad flanks of Mauna Loa, most often unsuccessfully... Before 1819, the disapproval of Hawaiian chiefs and priests. Hawaiian elite gave only token cooperation and support to their guests from overseas who insisted on trying routes and paces at the variance with Hawaiian advice and experience. (1965:6–7)

In 1794, Menzies, his crew, and Hawaiian guides took the Ainapō Trail to the summit of Mauna Loa. Menzies was the first known foreigner to summit the mountain, and the only one to do so with Kamehameha's authority, or any type of royal consent. During the hike the men suffered from cold, sickness, and fatigue. It was not a pleasant hike, although the vision of reaching the top was what drove Menzies on. Ultimately, he and his men had to turn around, due to exhaustion (Apple 1965:9–11).

Wilkes' adventure on the trail of Ainapō was "harsh and un-amusing," and "the mountain became in consequence a scene of confusion" (Apple 1965:11). Wilkes also forced the Hawaiian guides to go off the trail and caused himself and everyone in his group to suffer from thirst, hunger, snow blindness, and other sicknesses. Luckily Wilkes lost none of his men.

In the early 1800s, Douglas and others traversed the Ainapō Trail with bird catchers. The bird catchers were very knowledgeable and were accustomed to the higher elevations. Douglas suffered, however, as he lacked the knowledge and stamina for the high altitude environment.

The Kahuku-Ainapō Trail

The Kahuku-Ainapō Trail is a separate trail that connects to the Ainapō Trail. The Kahuku-Ainapō Trail is located above Ka'ū Forest Reserve within the *ahupua'a* of Kahuku (Figures 21 and 22). According to Quiseng, "The Kahuku-Ainapō Trail is a segment of an 'old trail system' that was used in historic times for bringing cattle between various cattle ranching operations associated with Parker Ranch. Stops over locations include various ranches in route including Kapāpala Ranch, Keauhou Ranch, Humuula Sheep Station, and Pu'u O'o Ranch" (2008:19).

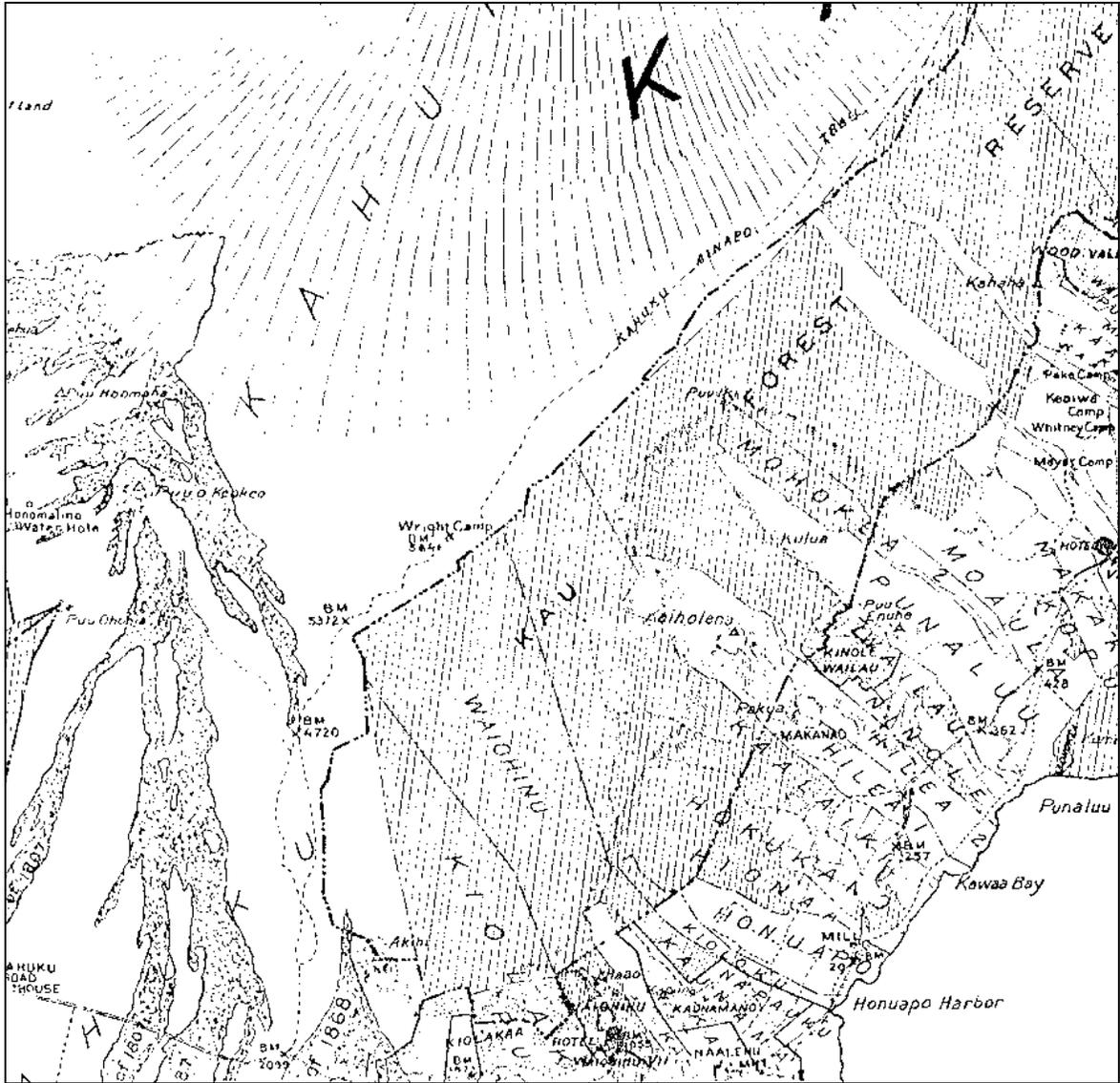


Figure 21. 1928 map showing the location of the Kahuku-Ainapō Trail.

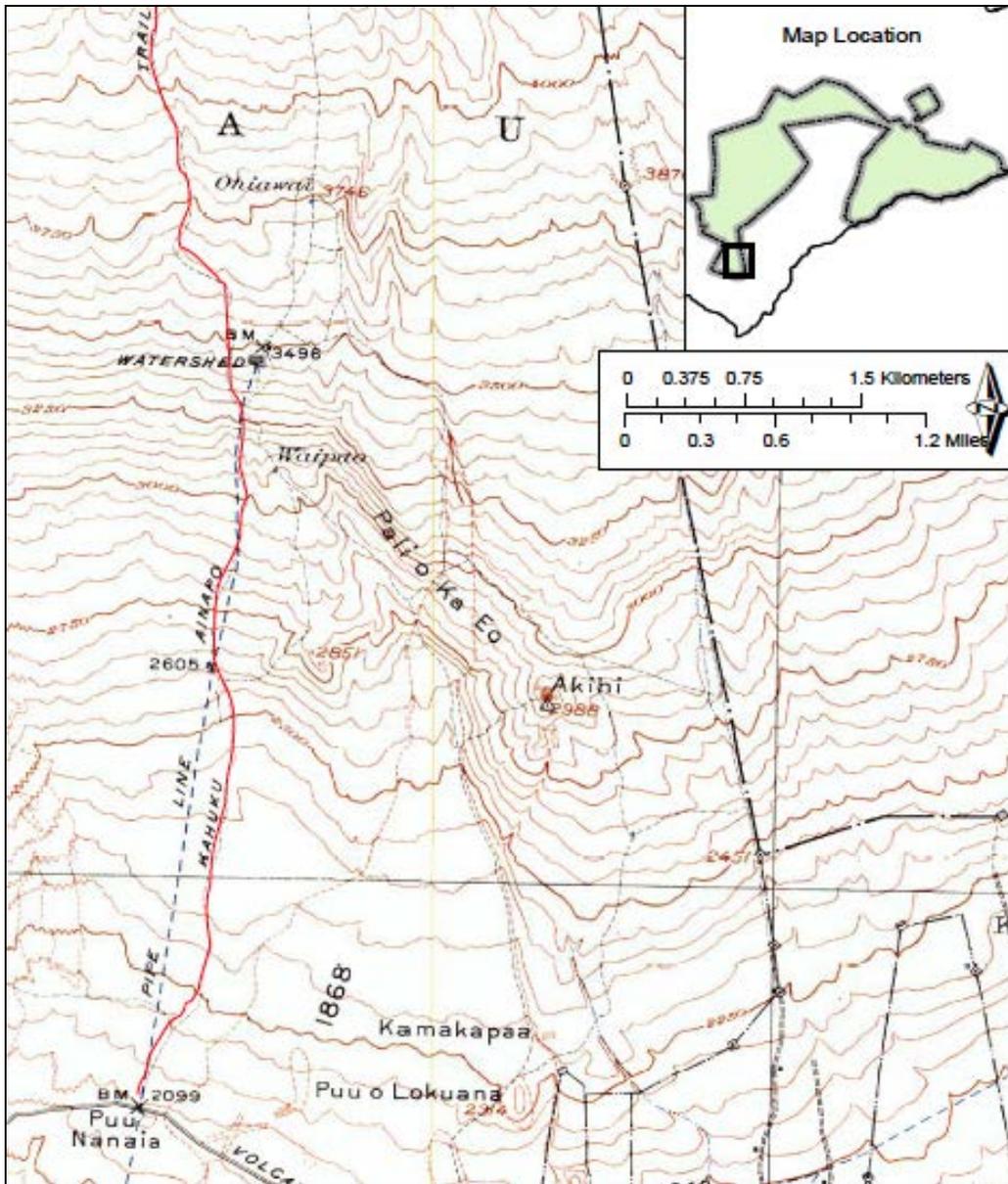


Figure 22. 1928 Honuapo quadrangle map illustrating the Kahuku-Ainapō Trail (from Quiseng 2008).

A more detailed description on the Kahuku-Ainapō Trail can be found in Tuggle and Tomonari-Tuggle (2008):

Kahuku-‘Ainapō Trail (Site 24121)

The Kahuku-‘Ainapō trail is a segment of an “old trail system” that was used in historic times for driving cattle between various cattle ranching operations associated with Parker Ranch (ca. 1912-1947) and is located in the Kahuku Management Unit of the National Park. The trail route included stopover locations at Kapāpala Ranch, Keauhou Ranch,

Humu'ula Sheep Station, and Pu'u O'o Ranch. The Kahuku-'Ainapō trail illustrated on the 1928 USGS Honuapo quadrangle map is a pathway leading north/south through the southern central section of Kahuku to approximately 5,000ft elevation, where it turns to lead northeast/southwest into the upper eastern section of the Kahuku Unit, parallel to the eastern park boundary. The total length of the Kahuku-'Ainapō trail located within the Kahuku Unit of the national park boundary is 35,000 meters (21.7 miles). The remainder of the trail extends beyond the northeast park boundary, into the state Ka'ū Forest Reserve and Kapāpala Ranch. Currently, the trail courses over a'a and pahoehoe lava types, and bisects various vegetation types that include pastureland, ohia and koa forests, and pūkiawe scrublands. A portion of the Kahuku-'Ainapō trail equal to 24,600 meters (~15 miles), from Pu'u Nanaia (2,000' elevation) to Punalu'u Kahawai (6,167' elevation) was surveyed during the archeological investigations of 2004. The survey identified 24 features associated with the Kahuku-'Ainapō trail that consist of trail segments, trail/road segments, and cairns. The trail segments range from winding single file width pathways to bulldozed road segments wider than two meters. Significant sections of the trail have been impacted by historic lava flows, vegetation overgrowth, ungulate trampling, and ranch development activities (i.e., modern roads, water system development, and logging). Surveyors experienced difficulty in identifying many of the trail segments in the upland forests, which coincides with earlier attempts to locate upland mountain trails on Mauna Loa's slope region. The majority of trail segments identified and recorded within the pasture land area (2,000ft 5,000ft), have sustained a moderate to high level of disturbance through pasture development fence line construction, and road system development and improvements (i.e., bulldozing, widening, rerouting). A condition assessment of the site was obtained on 11/14/06 by relocating and observing 8 of the subsites which include H4, H5, H6, H8, H9, H11, H18, and H19. The site can be seen as a pathway through various terrain, including a'a and soil. It has been obscured by vegetation in many locations. In at least one location rock walls are located in the vicinity and are probably associated with the trail and trail activities. (2008:246)

Historical and Cultural Sites Associated with the Ainapō Trail

The Ainapō Trail has provided a means of travel for Hawaiians to visit the *wao akua* for spiritual and cultural practices. Traditional cultural sites located along the trail, such as markers, walls, caves and habitation sites are most likely connected to the efforts of Hawaiians traveling to Moku'āweoweo or Mauna Loa. It was also a trail used for a safe traveling, where water, supplies, and shelter were available between villages.

In an Environmental Assessment for the Trail in 1992, there were two sites located during an aerial survey (Buck 1992:3). These two sites were walled enclosures located around the 6,700 ft. elevation. Another wall that intersects the trail and extends across most of Kapapala Ahupua'a was also documented. According to Buck, the wall was probably constructed for ranching purposes (1992:3).

Buck's report also mentions modified *pāhoehoe* outcrops that are located along the southeast end of the trail. In their description, the ground floor of the outcrops were noted to have been flattened or smoothed, allowing for a comfortable rest area or shelter (Buck 1992:2). According to Buck, "The chosen area for shelter is about 16–20 feet, and has been cleared of vegetation. Also, there was no sign of past human use in the cleared area of the shelter" (1992:2).

Another feature that was documented along the Ainapō Trail included trail markers or *ahu*. These *ahu* were found dispersed along the trail and according to the National Register of Historic Places application, the trail did not appear to have been used for some time.

The last type of cultural site that was found along the western end of the trail were lava tubes located around the 9,000–10,000 ft. elevation. These lava tubes have yet to be surveyed (Buck 1992:3).

There are several post-Contact or historical sites that are documented on or near the Ainapō Trail. In 1994, aerial reconnaissance of the trail was conducted, and some areas were inspected on foot. The findings were described as thus:

The only indication of past use in this area is a redwood tank, a small shelter abutting the tank, some glass and iron debris near the shelter and remnants of wire corral probably shelter site, is in disrepair and the open- air shelter consists primarily of a corrugated iron roof and a wooden platform. A stone and concrete fire hearth lies adjacent to the shelter... Although the age of these features has yet to be determined, we do not expect them to be of much significance. (Buck 1992:2)

Other known sites are Wilkes' campsite at 13,240 ft. in elevation, and two other campsites, known as Camp 2 and Camp 3. Camp 2 is located at the edge of the forest, and Camp 3 is situated within a large lava tube. Camp 2 was a temporary village used for royal trips to the summit. Camp 3, in the large lava tube, provided water to Camp 2 (National Register of Historical Places).

There is an Old Campsite located at Halewai that is on the Ainapō trail. This site is located at the elevation of 7,750 feet, near the Kapāpala Forest Reserve (Buck 1992). This campsite consisted of two small three-sided shelters, a water tank and a corral. This site was possibly used for overnight camping during hikes to Mokuaweoweo, and during the long hauls of transporting cattle.

During an aerial survey of the Ainapō Trail Buck observed two sites that were visible around an elevation of 11,000 feet. These sites included two stone wall enclosures located near the trail and the intersection of the trail and a stone wall that extends across most of Kapāpala Ahupua'a around 6,000 ft. elevation. In addition, a series of lava tubes located west of the trail at an elevation of 9,000-10,000 feet were also located (1994:3).

Previous Interviews

The Hawai'i Volcanoes National Park (HAVO) cultural resources division staff conducted the following interviews with Freddie Rice, Rally Greenwell and David Greenwell as part of their efforts to gather histories, stories, and information on the newly acquired Kahuku section of the Park. The HAVO staff was kind enough to share these interviews with us to use in this study.

Freddie Rice

The succeeding interview summary is taken from an interview with Freddie Rice that was conducted by Laura Schuster on June 6, 2004. Schuster provides a summary of Rice's descriptions and memories at Kahuku Ranch:

Wildlife

There was no wildlife on the Ranch and the introduction of mouflon was primarily for commercial hunting, to bring money to the Ranch. The sheep were first introduced into a *kipuka* around the 4700 feet elevation. Other animals that were introduced at the Ranch included pheasants, francolins, and turkey.

According to Mr. Rice, Hawaiian crows were frequently seen on the Ranch. He went on to say that any slight disturbance would chase away the crows. He specifically noted that bulldozing activity really bothered the crows. That they would fly off and out of the forest.

Mr. Rice spoke of a cave below the road, on Kahuku property, that the bats used. He said there were plenty of bats on the Ranch during his years.

Pasture and Forest Areas

During the site visit to the Kahuku portion of Volcanoes National Park, Rice described the passing features to Schuster.

Mr. Rice pointed out areas on the Ranch where he felt they were successful with their clearing and pasture management techniques, and areas where they had failed. All manipulated paddocks during the Damon period were on the right side of the main road going mauka.

The paddocks on the left side of the road were developed by Parker Ranch prior to 1947. The existing fence along the road was put in by Glover, and kept up by Damon. The Parker Ranch paddocks were larger and not dissected as those on the left side are now.

The area adjacent to the airstrip was the primary area where Glover took his trees for the lumber mill. Mr. Rice called this “lumber mill track”. The area just north along the road was the extent of the Damon bulldozing. The clearing was done with a D9 tractor and the dozer operator was instructed to leave the big trees, but take the smaller ones. The first prominent hill was what Freddie said was a failed attempt at clearing. It was too severe and should have left the hill with more trees. The hill is primarily cinder.

For the clearing, they would first doze the land, and then use a harrow that would break up the surface, then roll the area and drag several bars behind the dozer. Once this was completed, they would drag a small wagon behind the dozer and the workers would toss seeds out the back of the small wagon. Sometimes they would even use plugs of grass and plant the pasture.

As we moved up the road, Mr. Rice pointed out the area where they stopped the dozing and tried to keep more of the forested area intact. This is a spot on the road where the first really big *koa* trees start to appear on the north.

The paddocks above this point were completely covered in blackberry and Christmas berry, so they would take a smaller dozer and work these areas. Once clear of the invasive vegetation, they would push the trees that they cleared into piles and just seed the open areas with grass.

The Ranch's Water System

The water system was a really important piece of the pasture development. Mr. Rice described some of the workings of the tank water line system and justified why the larger wooden tanks were needed. He lamented that they were no longer being used because they were the key to maintaining the water flow levels for the stock.

The first large wooden water tank on the north side of the road was put in by Parker Ranch. The rain shed was the catchment area, the first large wooden tank would be the primary, and a second smaller tank was used for chemicals (supplements for the stock).

Glover increased the catchment area by paving an area above this tank system. It was used to collect water that was fed through pipes to the large tank. The Damon Estate further developed this system when they constructed the water tanks at the 5,000 feet elevation (these are the large asphalt reservoirs). But by this time, the metal pipes were no longer working, so a replacement pipe was added and a lot of water was lost as a result of the new system.

Above the asphalt reservoirs the landscape is sparse with only a few large trees. This area was rolled according to Mr. Rice. He said that when the dozer operator had time, he would just go in and roll some of the areas, but only those areas that had easy access.

Cattle

During his time at the Ranch there were 2,500 head of cattle. The rotation schedule was such that the cattle only stayed on the property for 10 years at the most. This might be for just the old cows that were no longer calving.

I asked about any wild cattle and he told me that at one time he purchased a herd of wild cattle (remnants of the original herd introduced by Vancouver) from someone in the South Point area. He brought the herd up to Kahuku and shot the bulls, and introduced a long horn bull from Texas. Thus any remnant “wild” cattle are from that herd and still can be considered part of the original introduction.

Place Names

Place names that Mr. Rice mentioned included Charlie Stone Kipuka (near the green gate on the road to the Civilian Conservation Corps (CCC) cabin, Wright Camp (same as whoever the person was for Wright Road), and Kipuka Nene.

The CCC boys built the wall along the Ka‘ū Forest Reserve, and the cabin. They also had a camp near Kilohana named “Camp 6”, it is a meadow or open area up at the 7,400 feet elevation. There is an apple orchard in the Kipuka Pahipa area, and Mr. Rice pointed out the road that leads to that orchard.

Access Routes and Roads in Kahuku Ranch

Mr. Rice mentioned two routes that lead to the CCC cabin area. The more *mauka* one is the old trail, and the newer road is the current access route that we have been using. The intersection of these two routes and the route to the orchard is found just east of the green gate at the corner of the Ka‘ū Forest Reserve and Kahuku Ranch.

There is a little *kipuka* with the green gate where a plot with a large number of same age *koa* is located. This is the spot where Mr. Rice said he planted pangola grass during a period when the pangola was suspected of having some type of disease that was killing all the pangola. The pangola was an important grass for pastures so he wanted to “save” the grass for a “seed bank”, so planted the grass a good distance from any other area. The pangola died off, but the disturbed area came back as a forest of *koa* trees.

Trails

Mr. Rice pointed out the old Kahuku – ‘Ainapō trail above the 4,700 feet elevation. We discussed this trail a bit and he agreed that it was probably a prehistoric trail that was just used by the Parker Ranch and subsequent owners of the Ranch.

Rally and David Greenwell

The following interview with Rally Greenwell (RG) and David Greenwell (DG) was conducted by Kepa Maly (KM) and Laura Carter (LC) on February 15, 2004. The interview took place at the Kahuku portion of Hawai'i Volcanoes National Park. Below are portions of their transcribed interview that are relevant to this CIA.

Fencelines, Trails, and Roads

- LC: [pointing to locations on quadrangle map] This is the upper section. This is where the cabin is, Punalu'u Kahawai.
- RG: Kahawai.
- LC: Right, Kahawai that's where the cabin is. That's the CCC [Civilian Conservation Corps] cabin that was put in.
- LC: And when Rally and I spoke before, he was telling me about the fence line that went along the boundary. And you said that it was the boundary between Kapāpala?
- RG: Kahuku and Kapāpala, as I remember.
- LC: That's the higher up boundary. There is the CCC road that comes in here, and this is part of a trail, the Kahuku-Āinapō Trail, it continues up above the house.
- KM: 'Ae
- LC: From here they would drop down to Kapāpala.
- KM: Did you ever run *pipi* from the Humu'ula section across here?
- RG: No.
- KM: You didn't?
- RG: Yes and no. I took cattle from here, Kahuku along down to Wai'ōhinu, up to Kapāpala, to the halfway house in Volcano. And then from Volcano to Humu'ula. Willie Kaniho came from Humu'ula side.
- KM: Right.
- RG: I never went down that road.
- KM: Did you go to the Keauhou Ranch Headquarters as far?
- RG: Yes.
- KM: Not up to Keawewai?
- RG: No.
- LC: You did go up to Keawewai, the CCC house you mean?
- KM: No. Keawewai is *mauka* of Keauhou.
- LC: Okay.
- RG: But this was all rough country, muddy and forests [pointing to Kahuku uplands on map]. I think Freddy Rice tried to do something up here. He let buffalo go up there, and some long horn Texas cattle, I don't know what else.

Heiau and Burials

- KM: Did any of the cowboys ever say, "here's a cave where someone sheltered or the old people used to stay." Did people talk about *heiau* or burial sites or anything on these lands?
- RG: No. I gave Tommy Kaniho's name to Laura, that might be the only fella alive today that might know, because old man Martinson was his grandfather, who was manager here.
- RG: I don't think there were any burials. I never heard of them up here.
- PG: Hard digging.

‘Alalā and other Birds

- RG: ...below the house Parker Ranch leased a little plantation land down there and we did go down.
- LC: So when you were here, do you remember seeing any wildlife at all? What kind of wildlife did you see?
- RG: Including cattle?
- LC: Sure [chuckling]. Or otherwise, how about birds. What kind of birds did you see over here?
- RG: Crow.
- KM: You did see *‘alalā*?
- RG: *Mauka*, in the *koa*, where the *koa* was.
- RG: Other than that, I don't ever remember seeing any pheasants, turkeys or anything, just way up the crow.
- LC: And no *nēnē*, you don't remember any *nēnē* or anything over here?
- RG: No.
- KM: When were you out here? What period of years about? How many years?
- RG: Probably...maybe 1936, '37, '38, '39, '40, '41. I think when the war broke I think we'd moved out of here. I think.

Vegetation in the Forest

- KM: You see here [pointing to map] Nāmanuha'alou, this boggy portion. Interesting.
- LC: Yes. It's still wet, when it's been raining a lot you can still see standing water in this area, and some sort of little rivulet things in here. The forest changes dramatically as you go up, and beyond the wet forest it becomes very open. Right above the cabin here, it's an incredible...
- KM: Do you think, was there this kind of vegetation back then? You see the *māmane* and *lehua* like that?
- RG: Yes.
- KM: It was pretty much down here?
- RG: Just about the same.
- KM: Okay. You mentioned the *‘alalā mauka* like that. Would you compare it to the similar amounts like you had at home when you were growing up in Honokōhau?
- RG: No, no.
- KM: Much smaller population?
- RG: That's right. You might see three or four or five up here. Kona by the hundreds.
- RS: Ron Bachman was telling me about the *‘alalā* up above Nā'alehu.
- RG: Must be same.
- RS: He said used to be plenty up there, not too long ago I guess. Now you only hear about them only in like by McCandless Ranch or something up there.
- DG: Olinda, Maui.
- KM: I think maybe they've lost the last one above McCandless, Keālia section or something.
- RS: Yes. The hawks eat 'um.
- KM: That's what they've been saying, because it is receded they're more susceptible to depredation.

Summary of Background Information

Through examination of Ka'ū's environmental and cultural background one can more fully understand the natural, traditional, and historical significance of this place. The Ka'ū Forest

Reserve consists almost entirely of native ecosystems and is the largest expanse of intact native forest remaining in the Hawaiian Islands. 'Ōhi'a lowland wet forest, 'ōhi'a montane wet forest, koa/'ōhi'a montane wet forest, koa/'ōhi'a montane mesic forest, and 'ōhi'a montane mesic forest make up the native dominated natural communities within the Reserve. Eight watersheds are also located within the boundaries of the Reserve providing a vital resource for not only the flora and fauna of the forest, but for humans as well. The Ka'ū forest is also home to many native bird species such as honeycreepers, the Hawaiian 'io, the 'ōma'o, and the 'elepaio. Additionally the Ka'ū forest was once home to 'alalā, and as part of the Reserve's general management plan, it will hopefully become home to the 'alalā once again.

Mo'olelo referring to many *wahi pana* in Ka'ū also offer insights into the natural landscape and traditional practices of the area. In these *mo'olelo*, Ka'ū is the stage upon which legendary figures such as Nī'auepo'o, Kū, Hina, Kauila, Nīnole, Kumuheā, Kawelo, Makanikau, Kūmauna, Hala'ea, Kohāikalani, Koihala, Nu'uanupa'ahu, Nānaele, Pā'ula, and many others travel around and discover fascinating places and characters.

'Ōlelo *no'eau, mele* and *oli* of Ka'ū highlight the natural resources and cultural practices associated with this place. Many of the 'ōlelo *no'eau* reveal the strong willed traits of people from Ka'ū (*Ka'ū 'āina kipi, Ka'ū, land of rebels*, the people of Ka'ū were known to rebel against oppression, even killing their own oppressive chiefs), as well as provide us with a glimpse of how the environment was understood and utilized (*Ka ua Hā'ao o Waiōhinu, The Hā'ao rain of Waiōhinu*, the Hā'ao rain comes down from the mountain in columns to Waiōhinu).

Compiling the traditional land uses of Ka'ū such as the ecological zones that Native Hawaiians utilized for different resources, the native flora and fauna found specifically in Ka'ū, and the traditional planting techniques of this area provides a deeper understanding of how the people of Ka'ū adapted and developed methods tailored to their environment. The landscape of Ka'ū is generally depicted as barren lava, dry, and hot, however, there are many lush valleys and vibrant forests that make up a large part of the district. From the *kula kai* (coastal regions) to the *piko* (summit) of Mauna Loa, there is an abundance of environmental resources, both natural and human modified, that supported the pre-Contact population of Ka'ū. Common foods that were cultivated in Ka'ū included dryland *kalo*, 'uala, *pia*, *uhi*, and *mai'a*. Non-food plants and trees that were also significant in the religion included *wauke* to make *kapa*, 'ipu for containers, and *koa* for canoes.

Another important land use practice connected to forested areas was bird catching. There were different types of techniques and implements that were used from district to district, thus making it a resource-based and placed-based practice. We did not uncover any specific bird catching techniques for the Ka'ū region, but we can assume that the bird catchers of the past utilized the heavily forested areas in Ka'ū because of the abundance of 'ōhi'a *lehua* trees and native birds located there.

Historic accounts from early visitors such as Archibald Menzies and William Ellis provide valuable information on population centers, traditional land use practices and environmental elements dating to the early post-Contact eras. The early visitors described Ka'ū as containing fertile plantations that supplied the surrounding population with an abundance of agricultural goods.

Land Commission Awards are an important resource for identifying traditional land use practices. Examination of the amount and location of awards on maps begins to shed light on the settlement patterns of Ka'ū. Most of the awards were on the coast or in the *kula* regions, implying that the main villages and political centers were close to waterways or in the fertile slopes and valleys.

Reviewing Boundary Commission Testimonies will also help reconstruct the traditional land settlement and use of the Ka‘ū district for future research.

After contact, the natural and social landscapes of Ka‘ū significantly changed. The introduction of foreign diseases coupled with harsh weather conditions and a changing economy lead to difficult times in Ka‘ū during the mid 1800s. New industries such as the *pulu* trade, sugar plantations, and ranching prompted a shift from a self-sufficient economy to a cash economy where Ka‘ū locals became dependent on cash, stores, and material goods which could only be purchased. These growing industries also had an impact on the natural environment of Ka‘ū. Foreign plants and animals were taking hold in Ka‘ū while forests and traditional agricultural fields were being demolished for sugar plantations. Even the water resources in Ka‘ū were drying up, and this prompted efforts to protect native forests and waterways. The Ka‘ū Forest Reserve was established in 1906, and has grown to encompass 61,641 acres in Ka‘ū today.

No formal archaeological work has been conducted in the Ka‘ū Forest Reserve, however the forest area is known to have been used for traditional practices such as bird hunting, harvesting timber for canoe-making and gathering forest plants for medicinal and cultural practices. So, it is possible that the forest contains cultural sites associated with these activities such as *ahu*, trails, trail markers, temporary habitation sites, boundary walls, and possibly burial caves. There are some known archaeological sites, such as trail markers, shelters, and hearths associated with the Kahuku-‘Ainapō Trail, which is located mostly above the Reserve, with portions within the Reserve. Historical activities such as water catchment and diversion occurred in the Reserve, therefore, historical features such as trails, walls, tunnels and infrastructure from old water systems are likely present. Future archaeological investigations can help to locate and document traditional and historical sites within the Reserve, which can provide valuable information on the previous uses of the forest areas in Ka‘ū.

ETHNOGRAPHIC SURVEY

The ethnographic survey was conducted to collect information about what kinds of cultural properties are located in the Ka‘ū Forest Reserve, what kinds of cultural practices are/were carried out there, how DOFAWs management of the Reserve might affect these cultural properties and practices, and mitigation options for those effects. This was accomplished through interviews with individuals who are knowledgeable about Ka‘ū, and can provide information about cultural practices or traditional knowledge (*mo‘olelo, mele, oli*, place names, etc.) associated with the area. Interviews for this study were conducted from October to December 2011. Sixteen *kūpuna* and/or *kama‘āina* participated in a total of 11 interviews for more in-depth contributions to the CIA (Table 5).

Table 5. List of Organizations and Individuals Contacted for Interviews

Name of Contact	Position/Affiliation	Result of Contact	Contact Date
Pele Hanoa	<i>Kupuna, kama‘āina</i>	Interview	September 26, 2011
Janette Howard	<i>Kupuna, kama‘āina</i>	Chose not to participate	September 26, 2011
John Replogle & Shalan Crysdale	The Nature Conservancy (Nā‘ālehu)	Interview and site visit to the reserve	September 26, 2011 & October 7, 2011
Kalani Decoito	<i>Kama‘āina</i> , hunter	Interview	October 6, 2011
Larry Galban	<i>Kama‘āina</i> , hunter	Interview	October 6, 2011
Susan Pua	<i>Kupuna, kama‘āina</i>	Interview	October 17, 2011
Earnest Peewee Breithaupt	<i>Kupuna, kama‘āina</i>	Interview	October 17, 2011
Mable Kaipo	<i>Kupuna, kama‘āina</i>	Interview	October 19, 2011
Kilohana Domingo	Master <i>lauhala</i> weaver	Interview	October 21, 2011
Keola Awong, Helen Wong-Smith, Laura Schuster, Lora Gale	Hawai‘i Volcanoes National Park	Interview	October 25, 2011
Thomas Kaniho	<i>Kupuna</i> , rancher	Interview	October 28, 2011
Kama Dancil	Kamehameha Schools Land Manager	Interview	November 16, 2011
Iwi Joaquin	Kamehameha Schools ‘Āina Ulu Partner	Interview & visit to Keauhou Bird Conservatory	November 16, 2011
Clyde Namu‘o	Office of Hawaiian Affairs	Letter	October 26, 2011
Theresa Donham	State Historic Preservation Division	Referral to archaeological studies at Hilo SHPD office	October 26, 2011
Pua Kanahale Kanakaole	Kumu hula of Hālau o Kekuhi	Did not make contact with	

The following interview summaries are arranged by interview date, with the earliest interviews first.

Pele Hanoa

Representatives from Keala Pono Archaeological Consulting, LLC (Keala Pono) and the Department of Forestry and Wildlife (DOFAW) met with Aunty Pele Hanoa (Figure 23) on September 26, 2011 at her beach *hale* at Punalu‘u Beach Park in Ka‘ū. Aunty Pele was born on August 8, 1923 in Punalu‘u and is the oldest child in her family. Being raised at Punalu‘u Beach, Aunty Pele was always in the ocean, either fishing, throwing net, torching, diving, swimming, or gathering marine resources. Ka‘ū is Tutu Pele’s *‘āina* and Aunty Pele’s home.

Wahi Pana in Ka‘ū

Aunty Pele shared her knowledge of the *wahi pana* Pu‘u Enuhe, also known as Caterpillar Hill:

Pu‘u Enuhe is called Caterpillar Hill. Kumuhea, son of the god Ku, an *‘aumākua* or family guardian. No one knew that he could change himself into a huge caterpillar, they only thought of him as a handsome young man.

After his marriage, Kumuhea spent his nights as a worm eating potato leaves and returned home in the morning. Being soft and flabby like a worm, he did not know how to work to support his wife, but expected her to pick up whatever she could for food.

As she grew thinner and thinner through starvation, she reported her distress to her father and he inquired where her husband went at night. In order to track her husband, she tied a hemp string to him (attached to the appendage found on the back of a caterpillar), which uncoiled as he went out.

But the string tangled on a bush and he discovered the trick. This made him so angry that he returned home to attack all the potato patches in the vicinity, after first taking his unfortunate wife to the hill in Ka‘ū district called Hill of the Caterpillar, Pu‘u-e-Nuhe, where he made his home.

So destructive was he that the people appealed to Kane to save them. Kane discovered the god near the hill cave and cut him up into tiny bits, in which size the cutworm remains to this day.

Kumuhea is an *‘aumakua*, or family guardian, for the people of Ka‘ū, and she is the *po‘o* or head of all of the caterpillars. Aunty Pele remembers when she used to have to walk to school barefoot, from Honu‘apo to Nā‘alehu, the road would be covered with caterpillars at certain times of the year. She would tiptoe around the caterpillars to be sure not to kill them, since they are revered as a family deity. However, cars would drive past and run over many of the caterpillars on the road.

When asked if she ever saw the Kumauna *pōhaku* that is associated with Kumauna Hill, Aunty Pele shared the following:

Kumauna is the water god of Ka‘ū, between Kaiholena and Makaanau. Mr. Searle was the plantation manager for Hutchinson Sugar Mill of Hilea in the 1940s. Mr. Searle dynamited Kumauna rock and that caused the flood in Hilea that destroyed Hilea Camp. Mr. Searle was saved by Kainoa Kaheamanui, but he later became insane and died.



Figure 23. Aunty Pele Hanoa.

Another cultural site located up *mauka* is Kohāikalani Heiau, located on Makanau Hill, above Punalu‘u. Aunty Pele shared that this *heiau* is associated with Punalu‘u Nui Heiau which is located on the coast by Punalu‘u Bay, and Ke‘ekū Heiau which is also located on the coast in Kāwā. All three *heiau* are *luakini heiau*, and Kohāikalani is the *piko*, or center, of the triangle formed by the three *heiau*. According to the stories, this *heiau* was built with stones from Koloa Beach that were passed up the hill by men standing in a chain. Today, only remnants of the *heiau* are left, and according to Aunty Pele, C. Brewer demolished portions of the *heiau* when they planted sugarcane on top of Makanau Pu‘u.

‘Ohana Homestead

When asked if she would go up *mauka*, and for what purposes, Aunty Pele shared that they stayed up *mauka* in their family homestead by Wailau, and that was where they grew taro. They would use their taro for a variety of things including *poi* and *kulolo*, and they would also mix the taro with pumpkin and use it for fish bait. She said that there were a lot of Hawaiians that lived up *mauka* in Wailau and Punalu‘u. Many Japanese who worked for the plantation also lived up *mauka* and there was a Japanese Temple in Wailau.

Aunty Pele and her ‘*ohana* would get their water out of a well or *punawai* when they lived up *mauka*. They also had a drain on their house, so when it rained it would drain the water down to fill up barrels, and that was their water source. Aunty Pele explained that most houses had their own wells in their backyards since there was no running water in Ka‘ū.

Gathering Plants in the Forest

Aunty Pele gathers a variety of plants from the forest to make *lei*. She gathers *palapalai* and uses this fern to wrap around the *wili* or string so you do not see it in the *lei*. She also gathers *maile* from the forest because it is abundant in Ka‘ū. Another plant she gathers for *lei* is ‘a‘ali‘i. She likes the different shades of ‘a‘ali‘i including dark red, green, and light red.

Sugar Plantations

During the sugar plantation times, Aunty Pele recalled that there were many camps on the hillsides. But when they condensed the smaller plantations into larger ones at Pahala and Na‘alehu, most people left the camps up *mauka*, and now those areas are empty.

So today when you drive on the highway to Ka‘ū and you see all of those empty lots that used to be all sugar cane fields. And the worst part about it, is that the land is no longer fertile because of the cane, so it’s hard to grow anything on it now.

Waiohinu used to be very productive and Hawaiians would grow banana, ‘ulu, the sweet and soft Hawaiian cane, mountain apples, and all other types of food. But people don’t grow these plants up *mauka* anymore.

When asked if she ever saw any remnants of the old Hawaiian agricultural walls, Aunty Pele said she has not because they were all destroyed by the sugar plantations. According to her, there used to be so many rock walls but they do not see them anymore because the sugar planters came in and demolished everything in sight.

Concerns and Recommendations

Today, Aunty Pele sees many changes in Ka‘ū. A lot of the old Hawaiian families are gone and the children are also leaving to get educated and get jobs elsewhere. Nowadays, she notices many outsiders coming to Ka‘ū and buying land in the Discovery Harbor and Ocean View subdivisions.

A concern for Aunty Pele is that there are not a lot of programs and teachers that educate the children of Ka‘ū about the Hawaiian culture and the significance of the natural, cultural, and marine resources located there. She recommends that DOFAW start educational programs in Ka‘ū for the children, so they can learn more about their environment. “It would be good for the kids to see the *makai* areas, and then take them up to the forest to learn about the native plants like *maile*. It’s good to also teach the kids how to properly pick *maile*.”

According to Aunty Pele, the Ka‘ū forest is in very good condition compared to other forests around the state, and it must be kept that way. She recommends getting rid of the invasive species of plants in the forest, so the native species can grow and flourish.

We have plants here like *ho‘io* and *palapalai*, and you don’t find them anywhere else, only in Hawai‘i. The *palapalai* makes nice *lei*. I used to make *lei* with the *palapalai* all the time, cause it’s good to use to cover the *wili* or string. So those kinds of plants we want to keep since it’s so unique and only found here.

Aunty Pele is very pleased that there are Hawaiians (at DOFAW and Keala Pono) that are doing this type of work. She admits that not a lot of people do work that gives back to the Hawaiian community. She left us the following advice, “Keep in mind how our *kūpuna* were brought up, and

their way of life, because the modern generation has different *mana* 'o. If you want to live *pono*, and live the best way you can...do the right thing.”

John Replogle and Shalan Crysdale, The Nature Conservancy Hawai'i

Representatives from Keala Pono and DOFAW met with John Replogle and Shalan Crysdale on September 26, 2011 at The Nature Conservancy (TNC) office in Na'alehu. The Nature Conservancy of Hawai'i owns and manages four forest preserve units within the Ka'ū Forest totaling 3,548 acres. The lands of TNC's Ka'ū Preserve include Kāhilipali, Kī'olokū, Kaiholena, and Keāiwa. The Preserve is located on the southwest flank of Mauna Loa between 2,160 and 5,770 ft. in elevation. TNC is also part of the Three Mountain Alliance, a partnership of nine large land owners (including DLNR-DOFAW) who own lands around the Kīlauea, Mauna Loa, and Hualālai mountain regions. The goal of the Alliance is to sustain the variety of ecosystems around these mountains by responsibly managing the watersheds, native habitats and species, and natural and cultural resources so the land and its people remain vibrant and healthy.

According to the TNC website:

Ka'ū Preserve is part of the largest and most intact expanse of native forest in the state. Made up of four separate parcels of forested land, the preserve features mountainous ridgelines with narrow plateaus broken by alternating steep valleys. Closed-canopy *koa* and 'ōhi'a forest shelters a lush understory of native *uluhe* and *hāpu'u* tree ferns. Rare plants like the *nuku 'i'iwi* still survive here, along with rare and endangered forest birds like the Hawaiian hawk ('io) *'apapane*, *'i'iwi*, *'elepaio*, *'amakihi* and *'ākepa*.

All four parcels consist of nearly pristine native forest and form a boundary between the largely intact native alpine and subalpine forest above, and the agricultural land below. During the last century, regular burning of the former sugar cane fields kept most weeds out of the forest. But the demise of sugar operations in 1997 opened up private lands to new weed invasions, which, in turn, threatened the native forests. In 2002, the Conservancy purchased four parcels of private forestlands adjoining the Ka'ū Forest Reserve from a subsidiary of C. Brewer & Co., Ltd. Acquisition of these parcels enables management access to state forest reserve lands.

The 100,000-acre Ka'ū forest region consists primarily of state-owned forest reserve lands that were difficult for the state to access when these lands were bordered above and below by private land holdings. The Ka'ū Preserve land now provides four different entry points to assist management of state lands. The Conservancy is actively managing the land to reduce feral animal populations and prevent new weed invasions. We are also working with neighboring landowners, local communities, state agencies, the National Park Service, and neighboring private landowners to protect the larger forest landscape.

TNC has held multiple community meetings over the years, especially regarding the purchase and management of their Kaiholena property, so they have a good gauge on how the people of Ka'ū feel about forest preserves, fencing, hunting, and access issues. Below is a summary of John's and Shalan's *mana* 'o regarding TNC's involvement in the Ka'ū Forest and ideas for future management of this special area.

Fencing

TNC constructed a 1,200 acre fence unit in Kaiholena, which they believe has been successful on a variety of levels. Firstly, before they began their construction of the fence line, they worked with Taupori Tangaro, a renowned cultural practitioner, to conduct a cultural impact assessment of the

area and with Jen Waipa from the National Park Service to conduct an archaeological assessment of the proposed fence line. Secondly, the clearing for the fence line was done very strategically. The cut alignment was only four feet wide, and if the alignment of the fence was going to impact any native trees or plants, they moved the line to avoid harming any native species. The only trees that were cut down were dead trees, and the *hapu'u* that they took out were eventually replanted and have grown back. Thirdly, TNC worked with the local hunters in Ka'ū to remove the ungulates within the fenced unit. Within the first month, Ka'ū hunters took out 33 pigs. So according to John, this method helped the local community feel more involved with the long-term management of the project.

In regards to DOFAW's plans to fence certain areas in the Ka'ū Forest Reserve, Shalan believes that the proposal to construct the fence line around 4,000 ft. would not be a good elevation to place it. Around 4,000 ft. the area is very wet, and the fence would get rusty and deteriorate quickly. Shalan suggested that the fence should go around the 5,000 ft. elevation where the forest is not as wet, and where the fence could be better maintained.

Access to the Forest

According to John and Shalan, Kaiholena can be accessed by hunters or practitioners through a road that is maintained by TNC. One just has to call TNC beforehand to get the combination code for the locked gates and sign a waiver form. The Kaiholena Preserve goes up to around 5,100 ft. in elevation. A 7 ft. fence and a crossover is located at 3,500 ft at the boundary between TNC lands and State lands (Ka'ū Forest Reserve).

In terms of access to the Kahuku portion of the forest, John noted that there are very few people that accessed that area because the Kahuku Ranch would always strictly control access, and if you wanted to hunt, you needed to go with a Ranch employee. He explained that he knows of hunters from Ka'ū that have walked up *mauka* to access the Kahuku lands, but they have to leave at three in the morning, so it was something that did not happen often.

In terms of public access to the Ka'ū Forest, Shalan believes that there is adequate access for the public to get to the Reserve. He mentioned three of the most accessible roads; Ha'ao behind Wai'ōhinu, Lorenzo Road, and Charlie Young Road (Kiolaka'a Road). He believes that there might be confusion about the access locations and requirements, so that might be a reason why some people are requesting for more access points into the Reserve. In addition, Shalan shared that TNC and DOFAW are working on providing an easement along the Ka'ū Forest Reserve boundary to increase public access along five miles of forest.

Water Resources

According to John:

Up at Kāhilipali is Portuguese Springs, and that is an area where there is a small gulch, but there was so much rain there. And when water fell up there it caused the river to go through Wai'ōhinu where there was a large agricultural area. So the plantation constructed this dam made out of concrete with pipes and put it in the flumes. It's all *hapu'u* now, but you can still see the grade that they made to bring water down. You can also still see the old flumes in the forest. The old plantation springs, during droughts would put out about 500 gallons per minute. And that's water that is filtering down from the top of Kūmauna or Maka'alia and Mauna Loa. The importance of water is a big issue that we push in our education and outreach. The water from the forest is coming up through the springs down on the coast, providing nutrients for sea life.

Pigs and Hunting

According to John, they still see signs of pigs in the forest but not as much as they used to. There have not been any scientific studies done to prove this, but from John's years of observation in the Ka'ū forest, he is certain that their numbers are decreasing. Shalan noted that TNC has been doing ungulate transects, but most of the transects took place in the fenced area of Kaiholena, so the data is not representative of the typical forest conditions.

Collaboration and Future Management

Overall, TNC is very supportive of DOFAW's proposed management plan for the Ka'ū Forest Reserve. They believe that constructing fences, removing invasive species and ungulates, replanting native species, and potentially releasing the 'Alalā back into its native habitat will also help to support TNC's efforts in Ka'ū. The staff at TNC and DOFAW maintain an open and collaborative partnership that ultimately helps both agencies succeed in their individual goals, as well as assisting in the larger effort of protecting and stewarding the Ka'ū forest and all of the living creatures that depend on it.

TNC continues to provide education and outreach to the local Ka'ū community as well as the larger public by providing access and tours on their lands, visiting local schools, and working with interested members of the public. Both John and Shalan are very passionate about the work they do, and are committed to doing what they can to preserve and perpetuate the health of the Ka'ū forest.

Kalani Decoito and Larry Galban

Representatives from Keala Pono and DOFAW met with Uncle Kalani Decoito and Uncle Larry Galban on October 6, 2011 at Wai'ōhinu Park in Ka'ū. Both are respected members of the Ka'ū community that are knowledgeable about the forest resources that they utilize to provide food, medicine, and a means of food to support low income families and maintain the Ka'ū lifestyle of living off the land (Figure 24).

Importance of Access

Uncle Kalani and Uncle Larry are concerned that this proposed project for the Ka'ū Forest Reserve management plan will impact the Ka'ū "way of life." They both commented that restricted access into the forest due to private landowners is already a big problem. They are concerned that this project will propose further restriction from access routes and hunting in the forest. They further stated that the forest is a resource that is utilized for gathering, water sources, and "living off the grid."

The Natural Migration of Pigs

Uncle Kalani explained the importance of pigs migrating during the different seasons. During the summer, the pigs go higher up into the mountains to cool down and breed. Then during the winter months, when the mountains get colder, the pigs come down and give birth. He stated that fencing the forest affects the migration of the pigs. His great-grandfather was a caretaker of the forest, and he told Uncle Kalani that the birds spread more seeds than the pigs. He explained that the pigs help to cultivate the forest by creating compost out of plant material such as the *hāpu'u* that allows plants to grow.



Figure 24. Ka‘ū Forest Reserve.

Protecting Resources for the Community

Uncle Kalani emphasized that people in Ka‘ū depend on hunting for food, to save money, and it is an essential part of their lifestyle. He shared, “you fish, you hunt, and you no starve.” Uncle Kalani stated that they are not trophy hunters. The pigs in the forest are grown organic and that is the best kind of meat. He explained that those who hunt do not need to go to KTA or other island markets for meat. They make all kinds of multicultural food dishes with the meat that they get from hunting, such as adobo, smoke meat, sausage, and roasts, among others.

Other resources that they collect from the forest include, *piko* “*pako*” for food, *māmaki* for tea, and *maile* that is used for *lei* on special occasions throughout the community. He also commented that a lot of outsiders come to Ka‘ū and impact the health of the forest by over harvesting *maile* to make money, and not picking it correctly. Both Uncle Kalani and Uncle Larry were taught to pick *maile* the proper way by pulling and breaking it off so that the plant can continue to re-grow.

They both recalled that in an area known as “Waterfalls” there are roses, beettlenut, palm trees, and other planted trees. Uncle Kalani recalls this area as being very quiet. He collects a very dark purple *māmaki* from there to make tea.

How the Land Functions

Uncle Kalani and Uncle Larry commented on the spiritual strength in Ka‘ū. They are careful when going through the forest and are aware of their surroundings and how things feel in certain places.

They both talked about the fog in the mountains that sets in at about 9:00–10:00am. When hunting, Uncle Larry starts going *mauka* at about 3:00am. He explained that it takes about four hours to go up to the *mauka* portion and about ten hours to get back down. Both men explained that after 12:00 noon, once the clouds set in, you cannot see anything. They also added that those who do not make it back by lunch usually have to sleep in the mountain.

Uncle Kalani and Uncle Larry mentioned that people still go up into the forest and know what to pick for certain kinds of medicines. A protocol that they live by while collecting is to “only pick what you eat.” If there is extra, community members will give to each other so that nothing is wasted.

Recommendations and Suggestions

According to Uncle Larry, there were some *'alalā* in Ka‘ū forest and an abundance of *'io* (Hawaiian hawk). Years ago *'alalā* were mostly in the slopes way up in the mountains. They both suggested that DOFAW release the birds into Kahuku because it is already a preservation zone that is enclosed and protected. They also agreed that an area away from hunting zones would be better for bird monitoring. They both commented that the Sierra Club bird watching, with their big speakers of bird calls, is disruptive and gets in the way of hunting.

They suggested a stable type of forest management. Uncle Kalani commented that the Forest Reserve is open 365 days a year and everyone from the whole island comes to hunt. As an alternative, he suggested that DOFAW open and close certain areas for one year and annually alternate those areas.

Uncle Kalani verified that hunters still utilize roads to the forest and go all the way up to the top gate. Of the four fencing alternatives, both Uncle Kalani and Uncle Larry preferred the Kaiholena section. They pointed out that it is already a Nature Conservancy area that allows them to hunt and already has management policies in place. Uncle Kalani explained that The Nature Conservancy utilizes hunters to manage the area with GPS, monitoring invasive species, and collecting pig counts. If the Kaiholena area is chosen to be fenced off, he would like DOFAW to agree that the surrounding areas would remain open and would not be fenced off in the future. He also suggested to set up gates on access roads and open and close them every other year.

Uncle Kalani further suggested that DOFAW work with the Ka‘ū locals to put up and monitor access through the gates. He believes this would reassure people in the Ka‘ū community that the gate is for them and that they would have access. In turn, DOFAW would have free security. He added that there is no guarantee that if DOFAW builds the fence without collaborating with the local community, that people would not tear it down. He also agreed with the idea of one-way gates that would allow pigs to go into one area, therefore making it easier for hunters.

Both parties agreed that DOFAW should have more of a presence in Ka‘ū. Uncle Kalani commented that the Ka‘ū community members are the best stewards of the land because they are connected to and deeply care for their homeland. He suggested having individuals from the local community to be a part of the management team for the Forest Reserve. In turn, this would enable DOFAW to get feedback and work more intimately with the Ka‘ū community. Overall, Uncle Kalani and Uncle Larry are primarily concerned with the health and accessibility to resources that the Ka‘ū community depend on. They are willing to work with the State, but want to ensure that the entire Forest Reserve does not get fenced off in the future and that the Ka‘ū people will always have access to the resources that are passed on to future generations and perpetuate their lifestyle.

Susan Pua

Representatives of Keala Pono and DOFAW met with Susan Pua, at her house in Pahala on October 17, 2011. This meeting was arranged to obtain information concerning the management plans for Ka‘ū Forest Reserve, and also to understand the history, stories, and traditional cultural practices of Ka‘ū.

Aunty Susan Pua was born at Ho'okena, South Kona, and grew up in Ka'ū in Kamaoa at Keolaka'a. At four days old, her birth father gave Susan to his sister, Mrs. Beck. Aunty Susan went to school at Na'alehu, and helped her family grow *kalo*. They would sell their *kalo* to Higashi Store. She became a mother of 12 children, which she and her husband raised in Ka'ū. She lived in Kahuku Ranch for nine years with her husband and their family. Her husband was a worker for Kahuku. Susan danced *hula*, played *'ukulele*, and composed songs. She was a stay at home mother, and worked at Na'alehu School teaching children about the history of Hawai'i, Ka'ū, and Hawaiian music.

Kahuku

Aunty Susan talked about Kahuku, and explained how much she enjoyed living there. She mentioned that the land they lived on was very fertile, and it was good for planting. Her husband, Samuel Pua, worked for Kahuku Ranch.

She expressed the vastness of Kahuku's hunting areas. Her husband and some of his friends hunted, but hunted only what was needed. They would hunt mostly pigs and sometimes goats. She explained that the women in Kahuku used to be in charge of smoking the meat that their husbands caught. She recollects memories of picking *'ohelo* to make jam. She also would pick the shoots of the *'ohelo*, and boil it to drink for medicine. She explained that remedy would help strengthen the kidneys. She also picked *pōpolo*, and *kukui* for medicine, and she sadly expressed that she cannot remember the names of some of the plants that she collected for medicine (*la'au lapa'au*). She mentioned that in Kahuku there were silversword plants, and remembers their sweet fragrance, and beauty.

When Aunty Susan was asked if she knew of any areas that had cultural sites, she remembered the special places that her husband Samuel took her in Kahuku. She spoke of a place where the rocks would sink, and mentioned that her husband would tell her about that place, and finally he took her on a trip to look at the sinking rocks. She remembers that there was a name for the area, but could not remember the name at the time of the interview. She also mentioned her husband took her to another place with a lot of birds, however, she could not remember the names of the birds but there were yellow birds and black birds with red beaks.

She explained that there were a lot of *heiau* at the beach area named Kahakahakea. One of the *heiau* was structured like a stadium, and near there she saw footprint petroglyphs in the rocks.

The last days of living at Kahuku Ranch resulted from Aunty Susan's husband wanting to quit the ranch so that their kids could have a good education. Samuel Pua noticed that they were raising their children as cowboys and cowgirls, and he wanted something more for them. Therefore, he quit the ranch, moved their family into town, and began working for the Ishmaru service station.

Punalu'u

Aunty Susan expressed how much she loves going to Punalu'u, and that Punalu'u is still a very important place to her family. Her husband was a fisherman. While she was sharing about her days in Punalu'u, she mentioned a song that she composed there. The song is called *Mai Poina i Punalu'u*, and she explains the story of how she composed the song:

The first time that I went down to Punalu'u I had the hardest time taking my *'ukulele*. Well, one day I told myself that I want to go down and practice the *hula*, but I did not tell my husband anything. I took the *'ukulele* in the car, and he was taking all his fishing stuff. After, he looked in the back and saw my *'ukulele*, and asked me how come I was

taking the *'ukulele*? I said I want to go down there, and I want to practice your daughter's *hula*. What for, he asked me. I told him I'm just going to take it, and he was so upset at me. So I took the *'ukulele* with me and I went down on the *laupapa*, and I was practicing all the songs for my daughter's *hula*. After, I was singing these words, and I don't know what I was singing. I stopped, and I was kind of afraid, but I thought, wow, what is this? So, I went to get a paper while I was singing, and I wrote it down all in Hawaiian...everything. After I was *pau*, my husband came back and I said, I want to sing you something. He said, what for? I said I just want to sing you something. I said please listen I told him. When I sang him that song, he said, where in the hell did you get that song? I just got it here, and I have to find somebody to tell me what it is. So I went to Janet Howard, and she was the one who told me what the song was about. *Mai Poina i Punalu'u*, which means don't ever forget Punalu'u. After that, my husband said I can bring my *'ukulele* to the beach.

Suggestions and Recommendations

When asked if she had any suggestions or recommendations about the Ka'ū Forest Reserve management plan, Auntie Susan stated that water is essential, and that something needs to be done to help and protect the watershed. She also recommended that something must be done to protect the Native Hawaiian birds, animals, and plants. She said that she hopes that the forest will not get destroyed, and that it is worth preserving, and taking care of.

As far as the youth program, Auntie Susan expressed that it would be great for the children to experience and learn about the birds and about medicinal plants in the forest (*la'au lapa'au*).

Earnest "Peewee" Breithaupt

Representatives from Keala Pono and DOFAW met with Uncle Earnest "Peewee" Breithaupt on October 17, 2011 at Wai'ōhinu Park in Ka'ū. Uncle Peewee has lived in Ka'ū his whole life and is concerned with protecting the water sources that the forest and people of Ka'ū depend upon.

Water Sources

Uncle Peewee regards the Ka'ū forest as a very fragile ecosystem because of its water resources. He stated that developing even one road in the forest would change the water table and he does not want that to happen. He spoke about the importance of Hā'ao Spring, where his mother resided from 1914 with her grandfather, Edwin Macomber, who lived there with his family since the 1800s. Their family home was located just below the spring in an area known as Puna-wai-o-Hā'ao, which means "the springs of Hā'ao." He explained that there was enough water for everyone. The *ahupua'a* of Wai'ōhinu that extends up to Kīpuka 'Ākala had taro patches and banana fields. His great-great-grandfather had a *lo'i* at the boundary of Kiolaka'a and Wai'ōhinu at Pu'ulepo, Kipuka and Honohono.

Uncle Peewee explained that people from Kama'oa would travel to Kiolaka'a on donkeys and bring their calabashes to fill them up with water. He said that the Kamao trails had caves along the side that people could stay in and collect water from as they traveled. According to Uncle Peewee, when the county made the roads they destroyed the caves within Kiolaka'a.

Uncle Peewee further mentioned two springs near the Ha'ao spring called Kapuna and Mau'uli'uli, a spring above the waterfall on Kūmauna, and another spring in the Kahuku forest. He explained that water from the Kahuku spring used to run almost all the way down to Kalae. He also stated

that the area known today as Kahuku is traditionally a part of the Keauhou Ahupua‘a that connects the Volcano and Kona areas.

Utilizing Natural Resources

Uncle Peewee mentioned that there are a lot of Hawaiian trees and species in the Ka‘ū forest. He would use the *‘ākala* raspberries to make wine and continues to utilize the root of ti plants to make *‘ōkolehao*. According to Uncle Peewee, the real name for *‘ōkolehao* is “*kulu*” because of the drips of the liquid when making the beverage. He recalled that people in the Ka‘ū community used to harvest the roots of ti that grew along the edge of Makaanau. He said that some of the roots weighed up to 2,000 pounds and everyone would work together to roll them into the back of the truck. His great-grandfather would make *‘ōkolehao* to exchange with community members for other things that were needed. He further mentioned that they would use the *iholena* banana trunk as a flume to divert the spring water to make *‘ōkolehao*. Uncle Peewee also mentioned *māmaki* and *olonā* in the forest. He remembered that at one time, the top of Kūmauna was called *olonā* because of the abundance of this species that grew there.

Other plants that Uncle Peewee spoke of were plum trees along a fenceline in the forest, *loulou* palms that were stolen from the mountain house, and Irish potatoes that he found growing at Kīpuka Nēnē. He collected a few vines of the potato from Kīpuka Nēnē and grew them at Kiolaka‘a. Uncle Peewee also mentioned that he and his father, who was a forest ranger, would pick the seeds of the silversword and send bags of them to various countries for people to grow and study. He observed that the pigs were good for the silversword and helped these species spread. Uncle Peewee further stated that the cows are worse than the pigs when it comes to destroying the forest. He recalled that his father would go up into the forest and kill the bulls in the area because they would destroy the forest.

Accounts of Ka‘ū

As a member of the McCumber family, Uncle Peewee stated that his family bought the *ahupua‘a* of Palauhulu from the Kingdom of Hawai‘i. He also explained that the *makai* portion of Kiolaka‘a was taken away by Bishop Estate and that Kawela Ahupua‘a belonged to Kalākaua’s mother Keohokālole.

Uncle Peewee explained that in the 1800s Wai‘ōhinu was the headquarters of Ka‘ū, with a jailhouse, courthouse, circuit judge, and district judge. He also remembered that during this time people could catch a boat from Honu‘apo Harbor to Honolulu for only \$2.00.

Uncle Peewee further spoke of the presence of the military in Ka‘ū during World War II. He explained that mounds of dirt were made at Kalae and other flat places on the island so that enemy planes could not land. These heaps of dirt can be seen at Kalae to this day. He also found documents that provide evidence of executions that took place in Kahuku. He explained that there are no names on the documents, but there are certain dates that the executions took place.

Trails and Cultural Sites

Uncle Peewee would often ride his horse along the trails in the forest and would travel the Ainapō Trail to the Punalu‘u Kahawai Trail. He spoke of the cabin at Kapāpala he would often frequent to check the rain gauge. He recalls that there is an *ahu* located on the corner boundary of the Keanakolu Trail. Uncle Peewee further mentioned that the community continues to use a *ko‘a* at Kalae Point. He also spoke of two sacred ponds at Ka‘alu‘alu and Kamilo with a stone in the middle of one that has a petroglyph on it.

‘Alalā

In Uncle Peewee’s opinion, the ‘*alalā* are intelligent birds. The last time that he saw ‘*alalā* in the forest was in the 1960s. He would see most of the ‘*alalā* above Honaunau Forest Reserve. He also mentioned that there were ‘*alalā* at Manukā and in the uplands of Hōnaunau in Kona. He remembered that they would sit way up in the ‘*ōhi‘a* trees and when people or pigs came around, they would make a lot of noise. Uncle Peewee also shared that Hawaiian bats can be seen at Kioloka‘a and Okoe forests in the evening.

Management Recommendations

Uncle Peewee shared that people in Ka‘ū usually frequent the forest above Hā‘ao and Wai‘ōhinu. He explained that there are a lot of places in the mountains where the land tilts and gives the appearance of walking *makai*, when you are really walking *mauka*, and that is why a lot of people get lost up there. He suggests that the best area for fencing is above Kaiholena. He explained that there are a lot of steep crevices in the area that make it harder for pigs to roam around there.

Mabel Aulike Kaipo

Representatives from Keala Pono and DOFAW met with Aunty Mabel Aulike Kaipo on October 19, 2011 at the Ka‘ū Community Center. The purpose of this meeting was to present the proposed management plan for the Ka‘ū Forest Reserve, in hope to get insight from Aunty Mabel on the project, the history of Ka‘ū, and what she would like to see in the future.

Memories in Waiohinu

When asked about changes in Ka‘ū, Aunty Mabel shared about changes in Wai‘ōhinu because she grew up in this area. As a child, Aunty Mabel would often frequent the forest of Wai‘ōhinu, and she remembers seeing mangoes and coffee trees. Aunty Mabel and her friends would yell down from the forest so that friends below could hear their echo. Pu‘ulena above Wai‘ōhinu, is one of her favorite places in Ka‘ū and is where the windmill stands today. One of her uncles planted taro up there, and another uncle pounded *poi*. According to Aunty Mabel, it used to be all forest in the back of Wai‘ōhinu. She recalled that before you could not see Pu‘ulena, but that now you can because of the increased development in the area.

When she was younger, Wai‘ōhinu was the main town in Ka‘ū. When World War II broke out, Wai‘ōhinu had a courthouse and tax house. She remembers huge *kukui* trees and “*inia*” lavender trees that were planted along Wai‘ōhinu town.

Her uncle told her that the name of the river in Wai‘ōhinu is called “Na‘u ke po‘o”, which meant “take off the flea and smash.” She recalls that this river was still flowing in the 1940s until the plantation diverted it for the cane field. She also recalls that Na‘alehu used to be all cane fields and a lot of Hawaiians worked at Honu‘apo to load sugar onto the boats.

‘Ohana

Throughout the interview, Aunty Mabel spoke about her family. Her great-grandfather was from Boston and good friends of Queen Emma Kalanikaumakaamano Kaleleonālani Na‘ea Rooke. He married Kahula, the great-granddaughter of Kekuhaupi‘o. The Kahula family came from Kona. That is how she is part of the Kahula ‘*ohana*. Her ancestors from her grandmothers’ side are from Wai‘ahukini where Kalani‘ōpu‘u reigned. Aunty Mabel’s grandfather spoke fluent Hawaiian and

would translate Hawaiian for people in the courthouse. Her grandfather taught her to say “*Wela ka ‘amo*” as a joke to say you’re welcome.

Cultural Practices

When asked about cultural practices that she is familiar with in Ka‘ū, Aunty Mabel immediately mentioned Tūtū Kele‘ehue Kamau. Tūtū Kele‘ehue Kamau knew all of the Hawaiian herbs. A lot of people came to her to gather information, even Mary Kawena Puku‘i. She spoke Hawaiian and used to weave *ulana* mats. She also composed an *oli* for the Hutchinson Plantation. Aunty Mabel learned how to make fiber from ‘*olonā*. She also used *ulana* to make hats. She and her sister danced for their *kumu hula*, Rose Kuamo‘o and would make *lei haku*. Her favorite plants to include in her *lei* are *palapalai*, *moa*, and *pūkiawe*.

Aunty Mabel’s husband is from Kapa‘ahu, Puna. He fished at Kalae and made money from fishing. He would catch ‘*opelu* and *ahi*. When he had a lot of fish, he would stop at every house in Wai‘ōhinu and give fish away. Aunty Mabel recalled that the season for ‘*opelu* is November and the season for *ahi* is December. She also shared that her favorite fish is *kawele ‘ā*. When asked if her husband used a canoe for fishing, she said that he did not, and added that those who lived at Punalu‘u used canoes for fishing. She continued to talk about her husband and his preference for ‘*ulu poi*. Her husband would borrow the *poi* board from her father and make his ‘*ulu poi*. She shared that for ‘*ulu poi*, you pound sideways, and for taro *poi*, you pound up and down.

Cultural Sites

When asked about cultural sites, Aunty Mabel recalled a few places in Ka‘ū. She shared that the largest Hawaiian *heiau* was at Discovery Harbor. She could not recall the name of the *heiau*, but she did remember the impressive terraces that were a part of the structure. She recalled that the Hawaiian name for Discovery Harbor is “Kau,” meaning “mine.” She also remembered that the name of one of her family plots and *heiau* across the street from the larger *heiau* is called Palauhulu. She further explained that the large terraced *heiau* was on McCumber land and got bulldozed, but there is a *kukui* tree marker where the *heiau* used to be. She shared that Arthur Akamu bulldozed it down and died shortly after. There was a place in this area to walk down and *ulana* because it was a cool place. Aunty Mabel also recalled that there was an *ahu* in Wai‘ōhinu where the *ali ‘i* used to collect taxes, but it is overgrown today. When asked about traditional winds or rains in Ka‘ū, Aunty Mabel could not recall any specific names, but shared that there are five rains in Ka‘ū that start from Kahuku.

References to Caterpillars in Ka‘ū

Aunty Mabel shared her memory of caterpillars in Ka‘ū. She remembered that they were seasonal and would travel from the mountain toward the sea every year. She recalled thousands of caterpillars crossing the road and making the road appear green. She explained that when going to school, she and the other children would have to walk over them barefoot and that people would often run them over on the road.

Native Birds

Aunty Mabel recalled that when she was younger, she used to walk up a trail that had a lot of ‘*ōhi ‘a* and ‘*alalā*. Today, this area is pastureland. She would also see ‘*i ‘iwi* birds. She remembers a tree with red blossoms that grew on the hillside of Wai‘ōhinu. She said, “In Wai‘ōhinu, it represented the ‘*i ‘iwi* bird.”

Management Suggestions

When asked if she had any recommendations regarding the proposed project, Aunt Mabel suggested that nurseries be set up for native plants so that they can be replanted in the forest. She has noticed over the years that the native plant population in Ka'ū has decreased. She feels that there is a need for someone to teach the kids about various plants, how they got here, and how to use them.

Overall, Aunt Mabel Kaipo is in agreement with the main goals and objectives of the Ka'ū Forest Reserve management plan, as long as it does not negatively affect the Ka'ū community. She expressed the importance of keeping Ka'ū, Ka'ū and does not want Ka'ū to become overdeveloped. In the words of Aunt Mabel, "Progress is slow because we are rebels. Once you go ahead, *pau*, we lose everything."

Kilohana Domingo

Keala Pono met with Kilohana Domingo on October 21, 2011 at Kalae O Kilohana Bed and Breakfast in Ka'ū. Kilohana is a 1976 graduate of Kamehameha Schools. During his intermediate and high school years, in the 1970s, he gained a deeper passion for Hawaiian cultural practices. He continued his education at the University of Hawai'i at Hilo, which led to a Bachelor of Arts degree in Hawaiian Studies.

Kilohana grew up in Kealahou, Kona. His mother and grandparents were from Ho'okena and his father was a rancher for Amy Greenwell. Kilohana gained most of his featherwork and *lauhala* weaving skills from his mother and grandmother. His sustainable lifestyle is credited to his grandfather, who was a knowledgeable fisherman and rock wall builder, and his father who was a rancher and hunter. For Kilohana, being raised on the ranch and that lifestyle is what intrigued him about Ka'ū. He enjoys the ruralness of South Point, Ka'ū and its likeness to the environment in which he was raised.

When asked about his experiences as a child growing up with these influences he shared that they would feed the fish and then go to the *ko'a*. There were specific times to catch certain fish during certain moon phases. He also shared that they would go hunting to provide for the family from *mauka* to *makai*. They even gathered flora for *lei* and picked 'ie 'ie to make fishtraps, *mahiolo*, and baskets. He noted that knowing when and where to gather was part of their sustainable lifestyle and in order to take care of the natural resources, the key is to not always go to the same place. He also shared that his father always took them *holoholo* to look at caves, lava tubes, birds, and plants.

Concerns and Recommendations

With regard to the Ka'ū Forest Reserve Management Plan, Kilohana is mainly concerned about access to gather and how access will be monitored. When asked about his knowledge of the plants in the Reserve he was unfamiliar with the area because of the inability to gain access. Kilohana suggested that the State work with cultural practitioners to find permanent solutions such as longer permit periods, particularly for those wanting to practice cultural gathering rights. His concern is that requiring permits to gather is setting people up to break the law, therefore endangering them for the sake of cultural practices.

He also mentioned that many of his guests at Kalae O Kilohana are interested in being part of the solution. For example, through education, people can better understand why things are done a certain way and therefore are willing to share in that responsibility. He notes that since people are

willing to share in this responsibility, why not incorporate a way to do volunteer work or “give back” to the community of which they have been educated by.

Keola Awong, Laura Schuster, Lora Gale, and Helen Wong-Smith, Hawai‘i Volcanoes National Park

Representatives from Keala Pono met with Keola Awong, Helen Wong-Smith, Laura Schuster, and Lora Gale from the Hawai‘i Volcanoes National Park (HAVO) on October 25, 2011 at the HAVO archives and library. Currently, the HAVO is part of the Three Mountain Alliance, a partnership of nine large land owners (including DLNR-DOFAW) who own lands around the Kīlauea, Mauna Loa, and Hualālai mountain regions. The goal of the Alliance is to sustain the variety of ecosystems around these mountains by responsibly managing the watersheds, native habitats and species, and natural and cultural resources so the land and its people remain vibrant and healthy. The HAVO staff were very helpful in providing us with maps, archival resources, and referrals to *kūpuna* and *kama‘āina* that are connected to the Ka‘ū forest.

Kūpuna/Cultural Consultation Group

During our visit, the HAVO staff openly shared the methods and processes they have been using to consult with the community about the general management plan they are currently developing for the Park. The HAVO staff, in particular the cultural resources division, have been working with a *kūpuna* consultation group that includes knowledgeable and esteemed *kūpuna* from the Puna and Ka‘ū regions. This informal group gets together about once a month so the Park can keep them up to date on projects and future plans, and to also ask them for suggestions and recommendations, and about any concerns they might have. From these meetings, the staff gets to learn about the history of the volcano region, what types of cultural practices occur here, and the connection people have to this place. This information helps the Park staff gain the trust of the community and make informed decisions about their management practices. This method has worked positively for the Park, and it was suggested that DOFAW also establish a cultural working group to help with the management and stewardship of the Ka‘ū Forest Reserve.

‘Alalā

It was shared that some hunters have seen the *‘alalā* in the Ka‘ū Forest. The *‘alalā* is known to make loud noises when they see pigs or hunters, and this has affected the hunter’s ability to catch pigs, and some hunters have been known to shoot the *‘alalā* because of this issue. Laura Schuster has also spoke with local residents about the *‘alalā*. She remembers Rally Greenwell and Freddy Rice talking about how they used to see the *‘alalā* in the Ka‘ū forest in the 1930s.

Management Recommendations

The HAVO staff shared some insights about their planning process for the general management plan that they are currently creating. The staff suggested that DOFAW look at the Park plan, and possibly adapt some of their methods, content, and process into the Ka‘ū Forest Reserve management plan. The one recommendation that the HAVO staff emphasized was to take time developing the plan and to not rush the consultation process. HAVO has been working on their management plan for more than two years, and they admitted that it is a lengthy process that cannot be rushed, and it was important to consult with all the necessary individuals and groups.

Other than this recommendation, the HAVO staff is glad that DOFAW is completing a management plan for the Ka‘ū forest because it will also help them better manage their lands since they are intimately connected. The HAVO staff stressed that the current partnerships that they

maintain under the Three Mountain Alliance have been very positive and beneficial for all, and that they hope these partnerships can continue to be productive and strengthened in the future.

Thomas Kaniho

Representatives from Keala Pono – Kelley Uyeoka (KU), DOFAW – Nohea Ka‘awa (NK), and TNC - John Replogle (JP) met with Uncle Tommy Kaniho (TK) on October 27, 2011 at his home in South Point, Ka‘ū (Figure 25). Uncle Tommy was born in Kamuela to Will Kaniho and Daisy Awa‘a. His mother passed away when he was four years old, and when his father remarried a Martinson, they moved to Kahuku Ranch where the Martinson’s worked. Uncle Tommy was raised on Kahuku Ranch, and at the young age of 12, he began to work for Parker Ranch, where he would make one dollar a day. Uncle Tommy’s home is located on 25 acres of Hawaiian Homelands in Ka Lae. He also leases 1,500 acres in Ka Lae for his ranch where he raises cows and horses. Uncle Tommy has lived an exceptional life in Ka‘ū and was kind enough to share some of his stories and memories with us for this study.

TK: I was raised in Kahuku; I can talk about Kahuku to Kapapala right up to Kilohana. Actually I was born in Waiki‘i. My mother died when I was four years old, and my father married again, and when he married he married into the Martinson family. Kahuku used to be owned by Parker Ranch, so he was the manager for Kahuku. My dad had 15 children. The first two were the boys and the rest were all girls. So I moved into Ka‘ū when I was four years old, and the Martinsons raised me. They raised me up at the ranch.

In 1947 Glover bought Kahuku Ranch, and he made a lumber mill up there. He fixed the road that went up to the barracks way up at Punalu‘u Kahawai. They call it Punalu‘u Kahawai because the water goes all the way up to the forest. There is a big cave half a mile down there, and there is a big opening from the fence line. I went over there with Rangers Carol and Brian. We walked there all the way through the forest and came out through the mountain house, I didn’t know anything of that place, but you could hear water running. I walked over there and the two of them started to yell at me. They told me to get out of there, so I ran back and asked what was wrong. He said, “that area just drops, so we not going be able to find you.” I asked why and he said, “There is no shelf, it just over laps like that, so anything can happen and drop off.” After, we walked all the way down and came out at the mountain house and they picked us up and brought the horses.

The improvements at Kahuku were actually made by Freddy Rice and Damon. They sold Ocean View to a developer, but it was part of Kahuku before. They sold the land to get money to help improve the Ranch. The developed as far as the 1868 lava flow. I left Kahuku in 1948 and went to work for C. Brewer.

It is a nice place up there it is all open it goes all the way to Kilohana, and then from Kilohana it goes down to Pakakau and comes out by Kapāpala. On a clear day you can see the cars on the road going by and coming from volcano, but it has to be a clear day. Because usually the fogs comes in at about 9 to 10 o’clock then you can hardly see anything. Then the cabin was built, I think in the early 30’s or late 20’s.

NK: Which cabin?

TK: On Mauna Loa, there is a cabin up there. It is still there.



Figure 25. Uncle Tommy Kaniho (far right) at his house in Ka Lae, with John Replogle of TNC and Nohea Ka'awa of DOFAW.

JR: Oh, on the submit

TK: Yes, they still have that cabin that was built by the Parker Ranch. All the lumber was hauled up by mules. There was no road before, so all the lumber was taken up there by mules. Kilohana had two tanks, and Punalu'u Kahawai had 2 tanks, and all the materials were hauled by mules. They had a fork saddle, and it was mounted on the mules. To haul the lumber what they do, there was 60 ft, and some was longer, they would hang it on the side. Then they put five or four pieces lumber on each side, and they would put it on two mules. They used two mules; one in front and one in back, and in between they put on four or five iron roofs. It was a long trip, and it would usually take all day. They would leave in the morning while it was still dark and they would reach up there just before dark. You got to watch how you go, cause the mules cannot make sharp turns. You have to make wide turns, if not the back mule is going to fall. So, that is why it takes so long going up. And when we get up there, we unload everything and build the tank. I was young boy when they did this, and I used to go with my grandfather.

NK: How old were you when you started to go up there?

TK: I was 10 years old when I would go with my grandfather. We had one mule with everything on it and we would go up there.

NK: So who was your grandfather?

TK: Martinson, Martin Martinson. He was the one who really took me all over there. He raised me, and that is how I got to go up there. Then during the depression in 1930's, they had the CC [Conservation Core]. The CC put in all the fences, the boundary fences. I tell

you, that's a lot of work. I give those people credit. You know why, because it is cold up there, and everyday it rains. What they do is cut the trees that are close by the fence line, and they dug the holes by hand, cause the mules no can go in there, because it's too swampy, and the mules cannot stand up. They did it all the way to Kilohana at the Kahuku boundary and it goes up, and then it goes down to Kapāpala.

When they had the CC up there, the Ranch furnished the beef and all the food and stuff, and we hauled it up with the mules. We go up to Punalu'u Kahawai, and then go to the end of the boundary line. There was also another group there, and they come from Kapāpala side and go up. We take Booth side and they take Kapāpala side. On the weekends they all go home. And at that time they never have cars, so they would walk. On Friday afternoons, as soon as they pau work, they walked down the mountain.

JR: Down Mountain House or down the old?

TK: They walked down Kapāpala side, the ones that are on that side, and they were picked up over there. The other ones walked down by Kahuku, you know where there used to be one tank over there. They walked until there and then their families would pick them up. Then on Sunday afternoon, they dropped them off, and then they walked back up. Ho, I tell you, you feel sorry for them!

KU: Where were they from? Were they from here or other places?

TK: From here, cause never have jobs it was the depression, yeah. So, what Parker Ranch did take them and give them food, and pay them so much. So, at least they had some income coming in.

NK: What was some of the names that were associated with these workers? Do you remember their names?

TK: Oh no, I was still young. I was only 12 years old. I know the cook he was a Chinese guy. Oh, the hard life they had.

KU: Did they build the cabins too? Or was it Parker Ranch that built the Kahuku cabins?

TK: Parker Ranch built those cabins. They re-modeled it when Freddy Rice came. When Glover came he only did a little bit.

I made the road all the way up to Kilohana. I was 15 or 16 years old. I started working for the Parker Ranch at 13 years old. I used to milk cows and deliver the milk for 50 cents in those days, and then I started to cowboy and all kind jobs.

When we went up the mountain to work, we had hard *poi*. I don't know if you know what that's like, but it's just like mashed potatoes. It is not soft it is kind of hard, and it's packed in a ti leaf. Then we had beef and everything is salty. In those days never have ice box, but on Mauna Loa is cold, so what they do, is hang it outside in the open to keep it fresh, and then they cook it.

All the men that were working up there had all kind different nationalities. There was Portuguese and Hawaiian. But the depression is what got the fence built; they made it right up to the bunker.

When Glover took over the Ranch he wanted to make one road. I was the front guy. I made the lineup because I knew the place. You cannot go to close to the forest, cause you

going get stuck. You got to stay away from the forestland, cause it is too swampy. It was a rough road. Those days they had the bulldozer, but never have the ripper. So, what you got to do was, you got to cinder from the side, and bring it into the hollow field and build it up.

I worked for Glover for five years. Actually, what happened I left Parker Ranch, and I worked for Glover. You know the Pahala road, the road that goes to Hilo now, I worked on that road. I started off as a laborer. My grandfather told Glover that he wanted me to go back to the ranch. But, I did not want to go back to the ranch. Glover was the guy that was paying the money, so Glover told me that he was going to send me back to the ranch, so I had no choice. I was a young boy and I needed the money too. From Parker Ranch where I was making \$1 a day to making \$1.25 when I was working for Glover.

So I went back to the Ranch and they wanted to make road, and they had a big lumber mill up there. Then we made a road going up to Mauna Loa. Then he built an orchard way up Kilohana at the corner. He planted plums and apples to see if they would grow. The orchard when work all right. Then he passed away, he died of a heart attack. He had the Ranch for about four or five years. He had two children, one son, and one daughter. They inherited everything, but could not make, so they sold the ranch.

Damon bought the ranch in 1950s. Then Freddy Rice made the improvements up there. Even today when you go up there, there is so much grass. I told them I seen Kahuku dry. You know when there's the Kona wind, and it no rain, that is the first place to dry. If there's a fire, it will burn everything down. It is a hazard that place. But now the grass is beautiful up there. They [National Park Service] don't have money to make restrooms and stuff like that. You can only go so far, only can go up to the reservoir.

NK: What was your favorite memories or feeling about Kahuku, living up there?

TK: In those days everything was hard. I started young. I milked the cows after school, and delivered the milk to the houses. I think everybody was getting a \$1 something an hour at the most, per day, and they had big families. The ranch gives them meat, and they had a free doctor. They get 30 pounds of *poi* a week. The *poi* came from Waipi'o. The meal car would bring the *poi* over, and drop it off. The meal car goes back and forth, and that is the only car that traveled on the road. If you go to Kona or Waimea you might see one or two cars. That was the first car I learned how to drive was from one lady. In those days it was hard, it was really hard. Never have time to play, and had plenty chores to do. Everyone made a garden.

KU: What kind of food did everyone plant in the gardens?

TK: They had carrots, lettuce, onion, and everything. Everyone had a small little garden, cause that was the only way you could get vegetables. Cause you go in the store the no sell vegetables, they would only sell can goods. Can goods are expensive, and for people with a big family that is expensive. If you no like 30 pounds of *poi* then you could get 25 pounds of rice. Then when the families buy, they would buy in bulk. everything was 50 to 60 cents, so 10 dollars goes a long way. Everything was cheap, not like today. Today no can, everything so expensive.

For Kahuku, Freddy Rice really built that place up. He was the guy that did it. For Kapāpala side, only now they are improving. Because get that daughter stay running the ranch now. They are improving it and at least they doing something. Because when I worked up there you have to plow through the bushes and everything. That is why they

had so much wild cattle up there. That place was all tied up with guava, silver oak, and Christmas berries.

NK: You had kids?

TK: Yeah.

NK: And you raised them on the ranch too?

TK: No, I worked for C. Brewer. January the 2nd 1949 is when I started working for C. Brewer. I was hired as a horse breaker. Then I married the foreman's daughter. I have four children - three girls and one boy. The oldest daughter is in Texas, and my son has the house in Oimi, one daughter in Kona, and Mariah. I raised them here.

I worked for C. Brewer 26 years, then they sold the place to Parker Ranch. Parker Ranch, bought it for 150 dollars for a cow and calf per head. That is how they sold it. Then the market stopped, and it went for \$250. That is why I first came cause I was taking inventory. They brought their own men over, but it made it hard, cause the cowboys didn't know the place. So, all the cowboys went to the sugar company instead.

KU: What did they do over there?

TK: They found some kind of job cause it was the same company. They all went there, and left only me, Galimba and Truman. Galimba was running the dairy. So, they left Truman, Galimba, and me for driving. The manager came from Parker Ranch Waimea, and he said we need thirty days to get this thing all done. I said, you mean to tell me that you are going to need thirty days to do the inventory. I said that will be the day, and I told him I need one year to finish. I did not want to lose my years of service with C. Brewer, so I worked with the Sugar Company. I did not know anything about sugar. The sugar has different seeds for different elevations. I had hard time, but this guy, the assistant manager gave me a book to study. I stayed with the Sugar Plantation for one year, and then they started to layoff. I was one of the first supervisors that got laid off. Then they found a job for me. They told me to go Kea'au and to work there cause they had opening over there. But, Charley Kimura came over and asked for me. The manager said I have a job for you, and it is right down your ally. The Parker Ranch wants to hire you. I told them, Okay. Charley Kimura was all right, but he could not talk to his men. They were running the show. Charley's foreman and me were always getting into arguments. He made it so hard to work cattle. I went as far as Keauhou, below Na'alehu. Then after one year I had to go back to the plantation. Alfred took over Na'alehu side from Waikapuna down to here [Ka Lae], and he took the inventory. Then after that I was working on the plantation.

NK: What kind of things did you use from the forest?

TK: In those days everything was all open and had wild cattle. Sometimes we went up there and shot them, and use it to feed the men up there. And, that is how they made the fence during the depression.

I can tell you about the Mountain House. That was there, the water was coming from up Kahuku. I don't know how, but the water goes through a cave. That is why Kāwā and Punalu'u have fresh water springs, it comes from underground. That is why they named that place Punalu'u Kahawai, up *mauka* where the house is. They named it after Punalu'u, the water.

Before they never had Na‘alehu town. They only had Hono‘apo and Hīlea, The only towns they had were Honu‘apo and Wai‘ōhinu. In the late 1940s or 1930s they started to move the houses to Na‘alehu, and made the store and everything. The main town was Wai‘ōhinu, they had horse fill and everything there.

NK: So where was your family?

TK: Na‘alehu, I was working for C. Brewer. I raised my family there. One thing I can say, we were the highest paid cowboys, cause we had unions. Compared to other places we were getting paid hourly, not by salary.

JR: What was that hole you were talking about that did not have the shelf underneath where was that?

TK: You know where Punalu‘u Kahawai is, where you walk down and hit the forest range? When you hit the forest range, go Hilo side on the corner. From there you walk down half a mile. It was a big opening and you can hear the water running, but you don’t see the water, and don’t know where the water is coming from. That is why they yelled at me and told me to get away from there, cause there’s no more shelf to hold anything up. So, I go tie a rope to the tree, and then I go walk on top. You only can hear the water, but no can see the water. They say that the water goes to Punalu‘u Kahawai and Mountain house, and then goes all the way to Kāwā and Punalu‘u. So the water is going underground. It is fresh water.

JR: The Mountain House probably tapped into that water.

TK: That is why I say, when you go mountain house that tunnel is pretty big. But I don’t know how it is now.

JR: Oh, it is still going, something like 500 gallons a minute during a drought. When it is dry it is going 500 gallons a minutes. Alili, a water spring, would go down to 86 gallons a minute. That is why in Pahala they were had restrictions in 2000.

TK: Because that is the same water coming down here all the way to South Point.

KU: So that is the same water coming down from the watershed in the Ka‘ū forest?

TK: It comes from Kahuku side, but the thing is there is no river. We don’t know where it is coming from. It is all underground.

KU: When you guys were up *mauka* how did you get water?

TK: Catchment, we had catchment. They had the tank up there. Every day it rains up there so we had two 50,000 gallon water tanks, and those things fill up. It was all catchment, and all the materials were hauled up by mules.

NK: You know when you traveled up that area have you ever seen the ‘*alalā*’?

TK: The black crow, Ocean View used to have a lot. It was loaded. Now, you no see any.

NK: Where in Ocean View? Up top?

TK: No way down by the main road. We used to have a corral down by the road. You know the road going up King Kam. We had a tank, and the county water goes right there.

NK: Where else did you see the ‘*alalā*’?

TK: Ocean View, Kahuku. If you go by Miloli‘i side up *mauka* there was plenty. But, I don’t know what happened. The thing just disappeared.

NK: What about Kapāpala side?

TK: Yeah, before. Even if you go up Punalu‘u Kahawai.

NK: Do you remember what they use to eat?

TK: ‘*Ōhelo*, and get plenty of ‘*ōhelo*. Even the pigs used to eat ‘*ōhelo*. Up in Kahuku used to have plenty pigs.

NK: You use to hunt plenty up there?

TK: Oh yeah! When you go up there, no need dogs. Just go over there and shoot them, more easy. Just go with the gun and walk slowly. The pigs they just stay right in the open. You go Mauna Loa side at the shake, and you plant seed or something the pigs they will dig it right up. There was a lot of things that they did over there.

NK: When you traveled that same area did you ever came across cultural sites?

TK: Up there no more *heiau*. The only place you see *heiau* is in the lower portion. Get on big *heiau* below Kahuku Ranch, right outside. It is big, that one there that the goats took over it.

NK: Do you remember the name or what they used to call that area?

TK: No.

JR: Is that on the lava flow?

TK: Yeah, yeah. You know where get the stone wall when you go down Kahuku, and there is a gate and it goes out. That stone wall goes way out, then it goes down toward the red cinder hill, and right at that corner is the *heiau*. This guy used to go down there all the time, Maniki. You now the old man Maniki, he would go every time and walk over there on a trail. One guy bought that place.

JR: Who?

TK: That place used to be owned by old man Batell. He used to own that, and he use to plant pigeon peas to raise cattle. He died in the field, and they buried him right there in the field. There is a grave there.

JR: Do you know about that cave right above Waibara?

TK: Oh that was there for years.

JR: Yeah, Yeah. Did the plantation cover it, or what?

TK: Oh that I don’t know. It was a big cave. Billy Time might have covered it, cause it was a hazard.

TK: There was that school at Na‘alehu and before it was at Wai‘ōhinu. Then there were camps made at Kalaiki, Waibara, Pu‘umoa Wailau, Makanau, and Kaiholena and people were living all in there. Kaiholena has a lot of graveyards down side the road. The ‘Omeke family, up there.

NK: Where is Pu‘umoa?

TK: Right above Honu‘apo. Right when you go pass Honu‘apo there is a corral inside there. The road goes inside, and it turns up towards the mountain side. If, you go over there you see the mango tree, that is Pu‘umoa.

NK: Is that where Hapi use to live?

TK: No, he lived Makanau, right bellow there. They had a town. They had Kalaiki, Waibara, Pu‘umoa, Wailau, and Hīlea. Hīlea was a main one, they had a school and everything. That use to be a big town. But that place disappeared cause of a man named Surley. He was the manager over there. The Hawaiians used to look for Makanau, because there was a big rock there, and they used to worship that rock. They say that it was the rain god. Surley did not believe that, so he went up there and shot the rock. He went back home, and they were carrying his wife out. Then the water came down and wiped out the whole town, the school, and all.

NK: Oh, that is what happened to the town.

TK: Yeah.

NK: What was the name?

TK: Surley, and his first name was Eddie. He used to be the manager. That is why his son Gilbert Surley, he had land up at Wailau. He owned land down Punalu‘u, but he exchanged it with the plantation. So, that is how the plantation got all that land down at Punalu‘u, he exchanged land for up at Wailau.

One day I went to the forest to go hunting and we heard the dogs bark. I told my boy to take the gun and go check it out. I told my son, if the pig is fat shoot it, and if it’s not, let it go. So, he went over there and all of sudden I see him come running out. I said, “What is a matter?” My son said, “Daddy the dog stay barking at the grave yard.” So I went over there and there was oven, and the pig was inside of the oven. My son thought it was a grave yard. I told him, that is not grave yard, it is a oven. He asked where the pig was and I told him it must be inside the oven. I told him to give me the gun and I looked inside. I couldn’t see cause it was dark and the pig was way inside. So, I told my son to hold the dogs so they don’t bark. Then the pig came out and showed his head and then, bingo!

TK: For the Kapāpala side the only thing I can say is that area up there you cannot go through. I don’t know much about Kapāpala forest, but we used to drive cattle from Kahuku all the way to Volcano, and all the way up Keauhou, then right over to Saddle Road. From there Parker Ranch would met us over there then they would take over. It was about 1,500 head. It would take us about one week from here to Keauhou. One day from Kahuku all the way to Pahala. The next day we drive all the way up to Kapāpala, then we sleep over there. We would stay because the wagon would bring us food. We would eat hard *poi*, and salted pig. If you wanted vegetables you got onion and chili pepper. In the morning you get crackers and coffee.

Keauhou I know. One time these people took me back up there, because they wanted to know about a trail. There is a trail up Keauhou, The trail that goes across the lava flow.

KU: What trail is that? Is it the Pu'u O'o trail?

TK: Yeah, It goes up, and then goes across the lava flow, that is Saddle road. It goes to Humu'ula the sheep ranch, and that is where it comes out. I used to go up there. There was this boy, Take, and old man Carter worshiped that boy. He treated him like he was his son. That boy knew that place just like his five fingers. I don't care how thick the fog was, we would reach home, and that's how good he was. The boy never went to school, his parents taught him. That boy stayed there until he died. When he retired from the ranch, he moved to Kaumana. He was a good cowboy.

KU: So what are your thoughts about the project that the state is planning on doing up at the Forest Reserve?

TK: They are putting fence for the mouflon?

JR: Yeah, at the top. The Park is rebuilding the lines that CC built. But, they are making it so that mouflon, pigs, and cows cannot move through it.

KU: Do you think that is a good idea?

TK: Oh, but by the time you start building the fence up top, the bottom is already getting rotten. Then you have go back and start again. There is no end to that, putting up fence.

Now, Kahuku get deer too. The deer can swim. I'd rather eat mouflon than deer. The mouflon is more tasty than deer. You know what is good is donkey. Old man Frank used to shoot the donkeys, but the donkey should not run. Once the donkey would run then *pau*, cause then the odor is strong. He would make jerk meat.

NK: What kind of fish did you used to catch at Kahuku?

TK: '*Aholehole, moi*, all good kind fish. Get a good fishing ground over there. We used to go down Friday afternoon after work. We'd go down with the bamboo. Never have ice box, so we would dry, salt, and dry everything. Friday we start throwing net, and clean it, and then salt it. Then the next morning we dry.

There is a cave down there at Kahuku beach. The opening was built up by a stone wall. My grandfather told me don't mess around with that place. Until today, it is still there. The last time we went down someone said we go take off the wall. I said, "I don't want to get involved with that because my grandfather told me no touch it, so I am not going to touch it. If you guys like take it let me go home first. I no like mess around with that."

NK: What kind of trees you use to grow up at Kahuku?

TK: '*Ōhi'a*, koa.

KU: Did you guys ever gather *maile*, or any other plants.

TK: Yeah, *maile*. When we would get down to the corral there would be a lot of *maile*. It is easy to pick it from the tree, then you would break it, and twist it. Kahuku had a lot of *maile*.

NK: Did you guys pick anything for medicine or food?

TK: No, medicine was usually gathered down by the ocean side. For instance I got piles [hemorrhoids] and I did not go to the doctor cause my grandmother fixed me up. She went down the beach, and got this slimy thing called *loli*. Then she put it on me, and then she would push it back in. I could not eat hard food only soft food or soup. She put it back, then it healed.

When I was in Honolulu before I retired I took a physical examination and the doctor told me that he thought I had cancer. I went back and he asked if I ever had operation. I said, no. Then he asked if I ever had piles before. I told him, yeah. He asked who operated and I told him no one. He said, "Someone had to operate on you to put it back in." I told him my grandmother did it. He asked how she did it and I said, "she got stuff from the beach, and the *loli*, and put it on me, and put it back in, and I could not eat hard food." I told him I ride horse and tractor and it never happened to me again. I told him that it was a miracle.

One day I broke my hip cause the horse bucked me off. I landed on the stone wall and broke my hip. Same thing, I did not go to the doctor. Every night my grandmother brought me some kind of Hawaiian medicine. The thing would burn, it was hot. She would get it from the beach. She would take the root and take the skin out and pound it with Hawaiian salt, and it was hot. The heat is so terrific, it released the pain. But you got to take it off because if you do not take it off, it would make a blister. My grandmother made that, and it made me better.

NK: Do you remember what the plant looked like?

TK: It was a tree like with white flower, at the beach. The only one I know that used that on me again was old man Shumisu. He used that medicine and picked it down South Point.

NK: You know where at South Point?

TK: Going towards Kaulana by Green Sand, on the lava flow. On the lava flow the plant grows.

JR: Maiapilo?

TK: That is it.

NK: What did they use for cold or nasal congestion.

TK: They would give us *pōpōlo* leaf. They would make juice. They would pound the leaf and use the juice. That was the only cough medicine. You can make salad with *pōpōlo* leaf too. You have boil it with salt and add kim chee and it's good. We used to eat potato leaf too. We prepared it with the Filipino sauce, patici, and chili pepper and that's good too.

NK: What about earaches?

TK: My grandfather would spit inside the ear, and he would chew tobacco.

NK: Do you know the meaning of any of the place names?

TK: Wai'ōhinu, the meaning of that place is shining waters. I don't know how they got that name. Kahuku has different place like Mountain House Road, Charlie Stone Camp, Kipuka Nene, that's where the *nene's* used to stay, so that's why they call it that. Keapohina, that's where the 1950 flow went over the 1868 flow. She went down into the forest and then stopped.

KU: Was there names for the trails that you used?

TK: It's mainly one trail but they have different names. Mountain House trail. If you start down from the 1868 flow, then the first opening you come to going *mauka* is Kipuka Nene. That's where they get silverswords there in that *kipuka*. Then you come to Mountain House and that trail goes straight down to Mountain House. And then you come to Keapohina, it's the 1868 flow, but the 1950 flow went over that flow and went down into the forest and stopped. Then next you reach Punalu'u Kahawai. Then next going *mauka* you reach Charlie Stone camp, and I don't know why they call it that. And then you reach Kilohana, and that's the last stop before the boundary. Then next is the Forest Reserve and then Kapāpala Ranch.

NK: Where there any other places you can remember in or around the Forest Reserve?

TK: There is Akihi crater. At Akihi Pu'u, the crater, you can feel the wind over there inside the crater. And there is the Kalopake taro patch. Kalopake is the Chinese taro. It grows by the red cinder road going up *mauka*. We used to pick the taro over there to eat. We would pick the shoots. It's located above Lorenzo Road inside the forest. It's not on the ranch lands. I know people go through there to go hunting still today. People tell me that they still walk all the way up to the 1868 flow, all the way to the boundary and the water reservoir.

KU: Do you have any other memories of times in the forest?

TK: One time I had to spend the night in Keauhou forest. We went hunting and it was getting dark already. There was three of us and we walked all the way in we almost reached Kulani. So I told the guys I was with that we are too far in and but they wanted to keep hunting. So when we finally caught one pig, I knew that was going to jam us up, cause there was no way we could carry the pig and get out before dark. But they tell me that we can. So after a while I told them, ok we got to stop. So I started cutting *hapu'u* leaves to use for a mattress to sleep on. So they asked me how I was going to make that and I told them we got to get all the dry *hapu'u* and line them up and lay them down flat with the dry leaves on the bottom and the green leaves on top. Then when it comes cold, I light the *hapu'u* and sit on top of the green leaves. So the dry ones burn, but the green ones don't burn, so it's like one heater.

So 5:30 in the morning, the whistle blows at Kulani Prison, and they were all shocked that we were that far in, but I was telling those guys. So I climbed up one *hapu'u* tree to see where we stay, and I saw we only about 10-15 minutes from the fence. So when we get to the fence everyone was all happy!

But like I say, when you go into the forest and you get lost, the best thing is to wait till day break then you can see how the sun rises and the sun sets, so you can find your way out. Don't panic, cause then you come more worse and you start heading the wrong way. Just remember to see where the sun rises and sets, then you can find your way out. Or you can try and climb a tree to see more or less where you're at. If you know the place, that helps too.

Kama Dancil, Kamehameha Schools

Representatives from Keala Pono met with Kama Dancil on November 11, 2011 at the Kamehameha Schools (KS) Keauhou, Ka‘ū office in Volcano. Kama is a land manager for Kamehameha Schools Land Assets Division and helps take care of KS’ landholdings in the Kona and Ka‘ū regions on Hawai‘i Island. Kamehameha Schools is a partner in the Three Mountain Alliance, which includes eight other large land owners that own land around Hualālai, Mauna Loa, and Kīlauea mountain areas. The purpose and goal of the Three Mountain Alliance is to work collectively as responsible land owners to maintain the health of the watershed, natural and cultural resources, and native habitats in this area. Kamehameha Schools owns land that borders the Ka‘ū Forest Reserve, including lands in the *ahupua‘a* of Punalu‘u, Hianamoa, and Pa‘au‘au.

Management Concerns and Recommendations

As a KS land manager for the Ka‘ū region, Kama has worked with many *kama‘āina* from Ka‘ū and is familiar with many of the concerns and issues that the community has with managing the *mauka* lands in Ka‘ū. In addition, since he lives in Ka‘ū and has worked there for years, he maintains concerns of his own. One of the main worries that Kama expressed during the interview was that he is concerned that access into the Ka‘ū Forest Reserve is open to anyone. While reviewing DOFAW’s purpose and needs statement for this project, Kama noticed that it states that there is a need to “provide for continued and expanded public use...” Kama expressed concern with this statement because he believes there is a big difference between “public use/access” and “community use/access.” He is worried that with expanded public access more people from outside the Ka‘ū community will access these areas and this trend will continue to increase over the years. Kama has seen first hand some of the impacts that public access has had on the Ka‘ū Forest. For instance he is aware of *maile* being overharvested and inappropriately picked in Wood Valley by people who are not from Ka‘ū.

Currently, Kamehameha Schools is dealing with access issues of their own on their Ka‘ū lands. In the *ahupua‘a* of Pa‘au‘au, the Ventura Trail, which is meant to be a foot trail, is being used by people riding ATVs to hunt mouflon. However, Kama noted that this land is leased by KS, so the leasee remains liable for people accessing this area.

Fencing Alternatives

When asked how he feels about the proposed fencing in the Reserve, Kama shared that he supports the idea of fencing. When we showed him the four different fencing options, Kama expressed that if there is a fenceline, it should be constructed for the entire boundary of the Reserve. And if that cannot happen, then there should be no fenceline at all. He did not think it made sense to just build fences in one area since it would just push the ungulates and invasive species to other areas of the Reserve.

Water Resources

Overall, Kama considers *wai*, or water, as the most important component of the management of the Ka‘ū forest. Proper management of the waterways and watersheds are integral for not only the health of the forest, but for the health of all living creatures, including the humans that live below. Kama truly understands the value of Ka‘ū’s water resources, as he personally collects *wai a Kāne* from springs found up *mauka* in the forest. Gathering *wai* remains a significant cultural practice for Kama, and he hopes that he will continue to maintain this practice in the future and that the water resources will remain healthy and abundant for generations to come.

Iwikauikaua Joaquin, Keauhou Bird Conservation Center

Representatives from Keala Pono met with Iwikauikaua (Iwi) Joaquin on November 11, 2011 at the Keauhou Bird Conservation Center (KBCC) located in the Keauhou Ahupua'a (Figure 26). Iwi is the Keauhou, Ka'ū caretaker for Kamehameha Schools, and is responsible for leading educational tours through KBCC with various groups. Iwi is very passionate about teaching the future generations about Hawai'i's native resources and their importance in Hawaiian culture and frame of mind.

Keauhou Bird Conservation Center

KBCC is an endangered Hawaiian bird propagation center that focuses on preserving and building a sustainable population of several Hawaiian bird species. Here, the birds are bred in captivity, hand raised, and released to supplement wild populations. Functioning to recover Hawaiian endangered species, KBCC is also part of the Endangered Bird Conservation Program, in partnership with the U.S. Fish and Wildlife Services, State of Hawaii Division of Forestry and Wildlife, The Zoological Society of San Diego, Kamehameha Schools, and USGS-Biological Research Division.

The San Diego Zoo is the land lessee of a 150 acre parcel under the Kamehameha Schools Land Assets Division. The Kamehameha Schools Land Assets Division has contracted Iwi to be the caretaker for this area. Iwi took us on a tour of the facilities and shared a glimpse of the educational tours he conducts for visiting groups. We began our tour with Iwi at the visitor's room. There is a beautiful mural drawn by Kathleen Kam of which Iwi uses as a storyboard to explain the many plants and animals that have influenced changes in the landscape and Hawai'i's native forests. Following the visitor's room we moved on to the Educational Library, which contains a mural of an *'alalā* flock also drawn by Kathleen Kam. Other rooms we visited included the monitoring room, which is used to keep data of bird behavior, breeding, nesting and eating instincts, the kitchen where meals are prepared for the birds, and the Forest Bird Aviary where the forests birds, such as the *palila*, Maui parrotbill, and *puaiohi* are kept.

'Alalā

Currently there are 95 *'alalā* between the Keauhou and Maui Bird Conservation Centers (Figure 27). In 2011 there were 19 *'alalā* chicks hatched, which has been the most successful season yet. Iwi shared with us that 27 *'alalā* were released from 1993–1994 and 1996–1998 in South Kona. He shared that some of them died from avian disease, some were eaten by the Hawaiian hawk, eight were recovered, and a few of them were never recovered. He mentioned that prior to the arrival of cattle, sheep, and goats to the islands, the forest was very intact with all its different layers. The *ali'i* put a *kapu* upon those animals, leaving them to go uncontrolled and unchecked throughout the forests. Today, as a result of those actions, the forest has been depleted of its thickness of layers leaving the *'alalā* with limited protection from the Hawaiian hawk, its only predator.

In the Education Library behind the mural of the *'alalā* flock, tour groups get to see Leomana, a male, and Lilinoe, a female *'alalā*. These *'alalā* are in the Education Aviary because they are a pair that can no longer reproduce. Lilinoe produced seven offspring in three years before she became "eggbound." This is when the eggs become stuck in the oviducts and the reproductive organs have to be removed to ensure her survival. Leomana is placed near Lilinoe because he is her mate; crows are known to be monogamous, having only one mate their entire life.



Figure 26. Iwikauikaua Joaquin at the Keauhou Bird Conservation Center.



Figure 27. One of the 'alalā at the Keauhou Bird Conservation Center.

Suggestions for ‘*Alalā* Release

Iwi shared ideas about two different types of possible release methods for the ‘*alalā* – a hard release and a soft release. A hard release is a direct release into the wild without continuous support or feeding. A soft release is when an aviary is built in their wild habitat and food is supplied to help slowly wean the ‘*alalā* from their captive environment. Slowly they eat all the food provided for them, and eventually figure out that they need to forage in order to survive. Iwi believes that a soft release would be ideal. He explains that a soft release would have an on-site aviary of which would be similar and familiar to their current aviary conditions but still allow them freedom to come and go as they please. Iwi believes that over time the ‘*alalā* will become independent and eventually no longer rely on the enclosure for their survival.

Summary of Ethnographic Survey

A total of 11 ethnographic interviews were conducted with individuals knowledgeable about Ka‘ū. Community participants consisted of *kūpuna* and *kama‘āina* who are lifetime or long-time residents of Ka‘ū, lineal and cultural descendants who trace their ancestry to the lands of Ka‘ū, as well as cultural practitioners who are connected to and frequent the area. The most common and significant topics of discussion included *wahi pana* and cultural resources in the district, the natural landscape of Ka‘ū including the trees, plants, birds, and water resources, cultural practices that occurred in the past and some that continue today such as gathering of natural resources and hunting, and access and fencing concerns and suggestions. A more detailed summary of the community participant’s connections, memories, and practices of Ka‘ū are presented in the following Cultural Landscape section.

CULTURAL LANDSCAPE OF THE PROJECT AREA

Discussions of specific aspects of traditional Hawaiian culture as they may relate to the project area are presented below. This section examines cultural resources and practices identified within or in proximity to the subject project area in the broader context of the encompassing Ka'ū Forest Reserve. The discussions are based on information from historic documentation, archaeological investigations, and oral history information gathered for this cultural assessment.

Traditional cultural practices are based on a profound awareness concerning harmony between man and our natural resources. The Hawaiians of old depended on these cultural practices for survival. Based on their familiarity with specific places and through much trial and error, Hawaiian communities were able to devise systems that fostered sustainable use of natural resources. Many of these cultural practices have been passed down from generation to generation and are still practiced in some of Hawai'i's communities, including Ka'ū, today.

Hawaiian Agriculture

While talking story with the community members from Ka'ū, many of our participants had an abundance of information of the past agricultural practices in Ka'ū. Many of them mentioned the prevalence of native trees and species in these forests and how these plants were utilized.

Ernest Breithaupt, also known as Uncle Peewee, shared that *'ākala*, *kī*, *olonā*, plum trees, *loulou* palms and *'ualakahiki* (Irish potatoes) are present in the Ka'ū Forest Reserve. Kalani Decoito and Larry Galban shared that they would pick *pako* (Piko) for food, *māmaki* for tea, and *maile* for *lei*. Both, Uncle Kalani and Uncle Larry recalled that in an area known as Waterfalls there are roses, beetlenut, palm trees, and other planted trees. Uncle Kalani recalls this area as being very quiet.

In the areas just below the reserve are many *lo'i*, or wetland taro patches, that are fed by the Hā'ao Springs. These lands made for ideal agricultural conditions for taro as well as *mai'a* (banana), *kō* (sugarcane), *ti*, *'uala* (sweet potatoes), *'ipu* (gourds), *niu* (coconut), *kukui* and *kou* trees.

Aunty Pele Hanoa shared that when they stayed up *mauka* at their family homestead by Wailau, they would grow taro there. Aunty Pele recalls that Wai'ōhinu used to be very productive and Hawaiians would grow banana, *'ulu*, the sweet and soft Hawaiian cane, mountain apples, and other types of food. Aunty Mabel Kaipo also remembers the rich agricultural grounds in Wai'ōhinu because she grew up in this area. As a child, Aunty Mabel would often frequent the forest of Wai'ōhinu, and she remembers seeing mangoes and coffee trees and taro that her uncle used to plant. According to Aunty Mabel, it used to be all forest in the back of Wai'ōhinu.

Uncle Tommy Kaniho remembers an orchard above Kilohana where plums and apples were grown. He came across this orchard while building the road up to Mauna Loa. Uncle Tommy also spoke of Kalopake taro patch that is located above Lorenzo Road, inside the forest, by the red cinder road going up *mauka*. Uncle Tommy used to pick and eat Kalopake, or what he calls Chinese taro.

Gathering of Plant Resources

Hawaiians utilized upland resources for a multitude of purposes. Forest resources were gathered not only for the basic needs of food and clothing but for tools, weapons, canoe building, house construction, dyes, adornments, *hula*, and medicinal and religious purposes. Plants that were

gathered in the Ka‘ū Forest Reserve by the community participants include *maile*, *māmaki*, *olonā*, *palapalai*, and ‘a‘ali‘i.

Uncle Peewee Breithaupt, recalls using a particular plant, the ‘*ākala* raspberries, to make wine and continues to utilize the root of ti plants to make ‘*ōkolehao*, or as he refers to as *kulu* because of the drips of the liquid when making the beverage. The people in the Ka‘ū community used to harvest the roots of ti that grew along the edge of Makaanau. Some of the roots weighed up to 2,000 lbs. and everyone would work together to roll them into the back of the truck. Uncle Peewee’s great-grandfather would make ‘*ōkolehao* to trade with other people in his community. He further mentioned that they would use the *iholena* banana trunk as a flume to divert the spring water to make ‘*ōkolehao*. Other plants that Uncle Peewee spoke of were plum trees along a fence line in the forest, *loulou* palms that were stolen from the mountain house, and Irish potatoes that he found growing at Kīpuka Nēnē. He collected a few vines of the potato from Kīpuka Nēnē and grew them at Kiolaka‘a.

Uncle Kalani Decoito mentioned that they pick *maile* in the Forest Reserve for *lei* that are given out for special occasions in the community. He also commented that a lot of outsiders come to Ka‘ū and over-harvest *maile* and pick it wrong. If picked properly, like they were taught, the plant can regenerate. Uncle Kalani and Uncle Larry mentioned that people still go up into the forest and know what to pick for certain kinds of medicines. A protocol that they live by while collecting is to “only pick what you eat.” If there is extra, community members will give to each other so that nothing is wasted. Other resources that they collect from the forest include, *piko* “*pako*” for food and a very dark purple *māmaki* to make tea.

Aunty Pele Hanoa shared that she gathers a variety of plants from the forest to make *lei*. She gathers *palapalai* and uses this fern to wrap around the *wili* or string so you do not see it in the *lei*. She also gathers *maile* from the forest because it is abundant in Ka‘ū. Another plant she gathers for *lei* is ‘a‘ali‘i. Uncle Tommy Kaniho would also gather *maile* in the forest, and he shared that when they would get down to the corral there would be a lot of *maile*, and Kahuku had lots of *maile* too.

‘*Olonā*, a rare native plant species today, was known to have been abundant on the top of Kūmauna, according to Uncle Peewee. Aunty Mabel Kaipō was also familiar with this plant and learned how to make fiber from ‘*olonā*.

Aunty Susan Pua recalls picking ‘*ohelo* to make jam. She also would pick the shoots of the ‘*ohelo*, and boil it to drink for medicine. She explained that the remedy would help strengthen her kidneys. Aunty Susan also picked *pōpolo*, and *kukui* for medicine, and she sadly expressed that she cannot remember the names of some of the plants that she collected for medicine in the forest.

Fresh Water Resources

In traditional Hawaiian times the inhabitants of Ka‘ū utilized a unique feature of their landscape that was highly prized, the springs above Wai‘ōhinu known as the Puna-wai-o-Hā‘ao. They consist of five separate springs, three of which are close together at the head of the stream that flows to Wai‘ōhinu, Wai-a-ka-‘ilio, Hā‘ao, and Wai-a-kahoali‘i (or Wai-a-Kamohoalii). The fourth and fifth springs were called Mau‘oli‘oli, located to the east of the three springs, and Kapuna also located east of the other springs, which empties into a small gulch. These springs represented wealth for the *ali‘i* and the community of which it provided for. The springs provided water to wetland taro plantations of Wai‘ōhinu, as well as water for drinking, cooking, and irrigation of gardens (Handy et al 1991:589). In addition, Uncle Peewee Breithaupt shared that the people from Kama‘oa would travel to the Kiolaka‘a, uplands of Wai‘ōhinu on donkeys and bring their calabashes to fill them up with water. He said that the Kama‘oa trails had caves along the side that

people could stay in and collect water from as they traveled. However, according to Uncle Peewee, when the county made the roads they destroyed the caves within Kiolaka'a.

The names of the springs provide insight to the area and its importance to traditional Hawaiian culture and beliefs. Generally, Hā'ao was the name for all the springs but it is a name for the main spring. Its name comes from a reptile goddess, which is mostly identified with a spring, pool, or pond. Wai-a-ka-'ilio (Water belonging to the dog) was named because of a dog's quest to sate his thirst by scratching in to the ground and discovering the spring. The dog, though not mentioned by name in any *mo'olelo*, is believed to be a *kupua* (form of a god) of Kūmauna (Handy et al 1991:591). Uncle Peewee explained that these two springs near Hā'ao, Kapuna and Mau'uli'uli, would come down under a swamp area and further down to supply water to Wai'ōhinu.

The spring Wai-a-Kahoali'i (also known as Wai-a-Kamohoali'i) was named after the goddess Pele's older brother. Kamohoali'i would take the form of a shark, which was, along with *mo'o*, associated with pools in ancient times. Linguistically, other ways of saying this name is Wai-a-kamo'o-hali'i, which means the spreading of the water below the spring. However, there are no sources explaining the names of the other two springs, Mau'uli'uli and Kapuna. According to Uncle Peewee, Kapuna is located above the waterfall on Kūmauna. Another spring he mentioned not included with the five springs of Hā'ao is the spring in Kahuku forest, as he refers to as Kahuku Spring. He explained that water from Kahuku Spring used to run almost down to Kalae.

According to John Replogle, a place called Portuguese Springs is located at Kāhilipali. John shared that when it rained up there a river formed and went through Wai'ōhinu, where there was a large agricultural area. The plantation constructed a concrete dam and put in flumes to divert the water. John mentioned that the grade they made to bring water down can still be seen today, as well as some of the old flumes in the forest. Aunty Mabel Kaipō shared that her uncle told her that the name of the river in Wai'ōhinu is called Na'u-ke-po'o, which meant, "take off the flea and smash." She recalls that this river was still flowing in the 1940s until the plantation diverted it for the cane field.

Uncle Tommy Kaniho recalls that Kilohana and Punalu'u Kahawai had two catchment tanks, and all the materials to construct them were hauled up the mountain by mules. Uncle Tommy also shared his knowledge about Punalu'u Kahawai, explaining that there is a big opening about a half of a mile from Punalu'u Kahawai where you can hear the water running but you cannot see it. He was told that the water runs from Punalu'u Kahawai and Mountain House all the way to Kāwā and Punalu'u, and that is why there are fresh water springs at Kāwā and Punalu'u beaches because the water is running underground.

Kama Dancil collects *wai a Kāne* from springs found up *mauka* in the forest. Gathering *wai* remains a significant cultural practice for Kama, and he hopes that he will continue to maintain this practice in the future and that the water resources will remain healthy and abundant for generations to come.

Wahi Pana and Cultural Resources

There are many *wahi pana*, or legendary and storied places, in Ka'ū as illustrated in the numerous *mo'olelo*, *'ōlelo no'eau* and *mele* that were presented earlier in this study. Particular *wahi pana* were also shared by some of our community participants. For instance both Aunty Pele Hanoa and Aunty Mabel Kaipō mentioned the significance of Pu'u Enuhe, the home of the distinguished caterpillars of Ka'ū. Aunty Pele further shared that she would be sure not to ever kill a caterpillar because they are revered in Ka'ū as an *'aumākua*.

Aunty Susan Pua mentioned another wahi pana in the *ahupua'a* of Kahuku that was known for sinking *pōhaku*. She visited the location once, but could not remember the name of the place at the time of the interview.

The forest area is known to have been used for traditional practices such as bird hunting, harvesting timber for canoe-making and gathering forest plants for medicinal and cultural practices. However, most of the Ka'ū Forest Reserve has not been surveyed for cultural and historical sites. Potential pre-contact features within and immediately adjacent to the Forest Reserve could include *ahu*, ancient trails, habitation and agriculture features, boundary walls, burial caves, and lava tubes. Potential historical features located within or adjacent to the reserve could include ranching features associated with the large ranches at Kahuku and Kapāpala; tunnels and infrastructure from old water systems which would likely be located within the lower elevations of the Reserve associated with the sugar industry developments; historic habitation and agricultural features associated with the former sugar plantations and camps also located in the lower portions of the Reserve; and historic trails such as the Kahuku-Ainapō Trail located on the drier lava fields above the Reserve and the Mountain House Trail located in the southern portion of the Reserve (Tuggle and Tomonari-Tuggle 2008, Burrell 2009, Quiseng 2008).

Most of the participants that were interviewed did not recall seeing any cultural sites in the Forest Reserve, except for historic ranching walls along the edges of the Reserve. Uncle Tommy shared that he never saw any *heiau* or other traditional Hawaiian sites in the forest when he used to travel through there. He noted that *heiau* are only found in the lower portions of Ka'ū District. One ancient site that Uncle Tommy did remember was on Makaanau Hill. He told a story of a big rock that was located on Makaanau that Hawaiians used to worship as a rain god. However, the man that owned that area, Mr. Sherrill, shot the rock and this caused a large flood to wipe out the entire town.

A well-known cultural site located up *mauka*, but not in the Reserve, is Kohāikalani Heiau, located on Makaanau Hill, above Punalu'u. Aunty Pele shared that this *heiau* is associated with Punalu'u Nui Heiau which is located on the coast by Punalu'u Bay, and Ke'ekū Heiau which is located on the coast in Kāwā. According to Aunty Pele, all three *heiau* are *luakini heiau*, and Kohāikalani is the *piko* or center of the triangle formed by the three *heiau*. According to the stories, this *heiau* was built with stones from Koloa Beach that were passed up the hill by men standing in a chain. Today, only remnants of the *heiau* remain, and Aunty Pele shared that C. Brewer demolished portions of the *heiau* when they planted sugarcane on top of Makaanau Pu'u.

According to Uncle Peewee Breithaupt there is an *ahu* located on the corner boundary of the Keanakolu Trail and Aunty Mabel Kaipo also recalled that there was an *ahu* in Wai'ōhinu area, which was used by the *ali'i* to collect taxes. Aunty Mabel spoke of a large Hawaiian *heiau* at Discovery Harbor that had impressive terraces. She remembers that the large terraced *heiau* was on McCumber land and got bulldozed, but there is still a *kukui* tree marker where the *heiau* once stood. Across from this large *heiau*, Aunty Mabel shared that her family has plots located next to another smaller *heiau* called Palauhulu.

Trails and Access

In traditional times, trails served to connect the various settlements throughout the *ahupua'a* and districts of Hawai'i Island. One of the prevalent trails, adjacent to the Ka'ū Forest Reserve, is the 'Ainapō Trail. This historic trail was nominated to the National Register of Historic Places. Located in Kapāpala it is currently used by the public to access the western side of the Ka'ū Forest Reserve and to access Mauna Loa. Ancient Hawaiians and foreigners also traditionally used it, as early as 1790. In an interview with Uncle Peewee Breithaupt, he shared that he would often ride

horse along the trails in the forest and would travel the 'Ainapō Trail to the Punalu'u-Kahawai Trail to check the rain gauge at the cabin at Kapāpala.

The Kahuku Trail connects to the 'Ainapō Trail, also known as the historic Kahuku-'Ainapō Trail. This trail is located primarily above the Reserve in the Kahuku section of Hawai'i Volcanoes National Park; however portions of the trail are within the Reserve. Old maps also show a trail from Mountain House to Kahuku as well as numerous trails from the bottom of the Reserve boundary leading to tunnel systems within the Reserve.

Uncle Tommy Kaniho spoke of the Pu'u O'o Trail which he said goes up *mauka*, then across the lava flow which is now Saddle Road, and continues on all the way to Humu'ula, where a sheep ranch is located.

Uncle Tommy shared his knowledge about the Mountain House trail in Ka'u that starts off at the bottom of the 1868 lava flow, then goes *mauka* to Kīpuka Nēnē, then continues on to the Mountain House, then to Keapohina, where the 1868 and 1950 flows are located. The next stop is Punalu'u Kahawai, followed by the Charlie Stone camp, and the last location on the trail is Kilohana before you hit the Forest Reserve Boundary and further on to Kapāpala Ranch.

'Alalā

The *'alalā*, Hawai'i's native crow, are considered to be *'aumākua* (ancestral/spiritual guardians) to the Hawaiian people. Their feathers were utilized for many traditional cultural practices and were caught by means of poles or snares. The feathers were used for *kahili* and the flesh was eaten (Handy et al 1991:257).

In Uncle Peewee's opinion, the *'alalā* are intelligent birds. The last time that he saw *'alalā* in the forest was in the 1960s. He would see most of the *'alalā* above Hā'ao Spring. He also mentioned that there were *'alalā* at Manukā and in the uplands of Hōnaunau in Kona. He remembered that they would sit way up in the *'ōhi'a* trees and when people or pigs came around, they would make a lot of noise. According to Uncle Larry, there were some *'alalā* in the Ka'u forest and years ago were mostly in the slopes way up in the mountains. Uncle Tommy Kaniho also remembers seeing the *'alalā* at Punalu'u Kahawai in the Reserve, at Ocean View by the main road, in Kahuku, and in the uplands of Miloli'i. He mentioned that there used to be so many around, but then they just disappeared, and he no longer sees them. He shared that the *'alalā* eat *'ōhelo* berry. Laura Schuster remembers Rally Greenwell and Freddy Rice talking about how they would see the *'alalā* in the Ka'u forest in the 1930s.

Aunty Mabel recalled that when she was younger, she would walk up a trail that had a lot of *'ōhi'a*, and *'alalā* could be heard and seen there. Today, this area is pastureland and sadly she no longer sees the *'alalā*. She would also see *'i'iwi* birds, and she remembers a tree with red blossoms that grew on the hillside of Wai'ōhinu which represents the *'i'iwi* bird.

In conversation with some of the participants, it was shared that some hunters have seen the *'alalā* in the Ka'u Forest but did not reveal exactly where. It was also shared that some hunters have been known to shoot the *'alalā* because they make loud noises when they see pigs or hunters, and this has affected the hunter's ability to catch pigs.

According to Iwikauikaua Joaquin, today the *'alalā* have a small gene pool because the entire flock come from several *'alalā* that were the last survivors of the wild. Iwi explained that they are natural predators and very social animals. They roost in groups to protect themselves from enemies and they have a very distinct call, which is often used to signal distress. Their call is so distinct it

leads other crows to their aid, as crows will defend unrelated crows. They are known to be monogamous, having only one partner their entire life. According to Iwikauikaua Joaquin, the survival of the *'alalā* is dependent on numbers. He believes that because of their decreased numbers in the wild there may not have been enough *'alalā* to provide protection for each other and they risked extinction. The decline of *'alalā* was due to the birds' susceptibility to other predators along with other factors such as bird malaria.

Hunting

Most of the community participants we spoke with either hunt themselves, or have a husband or family member that hunts food for them. In Ka'ū hunting is a way of life. As Uncle Kalani Decoito emphasized, people in Ka'ū depend on hunting for food, to save money, and is just part of their lifestyle. According to Uncle Kalani, Aunty Susan Pua, Uncle Larry Galban, and Uncle Peewee Breithaupt, among others, hunting is not a sport, but a means of subsistence, and they only take what they need.

Ka'ū is well known for its rich hunting grounds. When Uncle Tommy Kaniho would go up into the Reserve to hunt he did not even need to bring dogs with him because the pigs were just out in the open. He shared that it was actually easier to just walk up slowly to them and shoot them with a gun then have dogs chase them down.

Uncle Kalani Decoito and other hunters respect the *pua'a* and value its place in the local ecosystem. According to Uncle Kalani, during the summer, the pigs go higher up into the mountains to cool down and breed. Then during the winter months, when the mountains get colder, the pigs come down and give birth. His great-grandfather was a caretaker of forest areas in Hilo, and told him that the birds spread more seeds than the pigs. He explained that the pigs help to cultivate the forest by creating compost out of plant material such as the *hāpu'u*.

While the issue of whether hunting *pua'a* is a traditional cultural practice was not specifically brought up in the consultation process, it should be briefly mentioned here, as there continues to be differing opinions on whether or not hunting for pigs is considered a traditional cultural practice. As evident in the *mana'o* provided by the community participants of Ka'ū, all of them stated that they rely on hunting for subsistence, and some of them also believe that the *pua'a* is an integral component of a healthy, balanced forest. Furthermore, it was stated that hunting has occurred for generations in Ka'ū, and the knowledge of this practice has also been passed on.

However, some cultural practitioners, scientists and historians, such as Dr. Charles Burrows, Kepa Maly, and Charles Isaacs Jr. have researched and presented materials indicating that pigs were never hunted game for ancient Hawaiians (2007). Rather, Hawaiians had domesticated pigs and never had the need to hunt them. Furthermore, Burrows et al. (2007) state that the only reference to hunting in the archival resources and from traditional knowledge sources that they reviewed was to hunting rats with bows and arrows. While they admit that the *pua'a* did play an important role in Hawaiian history because of its function as a food source and cultural symbol, they were never utilized for recreational or subsistence hunting.

According to Burrows et al. (2007), pigs continue to harm the native ecosystems of Hawai'i, and are endangering the survival or Hawai'i's unique and fragile natural and cultural resources. As stated in their article:

Today we face the continued destruction of native forest, and risk losing an irreplaceable natural and cultural resource to uncontrolled feral animals...*Pua'a* were valuable cultural resources, but in ancient times were kept away from the *wao akua*, which held so much

more value to Hawaiians than a single species such as a pig. As we strive to strike a balance between protecting native Hawaiian plants and animals and our dwindling native forests and the more recent practice of game hunting, we need to reassert the value represented by the *wao akua* to protect it and the *kini akua* for the future generations. (Burrows et al. 2007)

Burials

No burial sites have been documented within the Ka‘ū Forest Reserve, however with the existence of lava tubes and caves in the forest, burials are possible. Future archaeological work will help establish if burial caves are located in the Reserve. Interviews with community participants also did not identify any burial sites specifically within the project area.

SUMMARY AND CONCLUSION

According to the community participants, the Ka'ū Forest Reserve is a unique and special place, still very much undisturbed by the outside world, which thereby presents many opportunities. With one of the largest remaining endemic forests in the State, the Reserve is a prime location for the community to gain a deeper understanding of the natural and cultural resources in the forest and to help with the proper stewardship of this place. However, the Ka'ū Forest Reserve is not immune to change and has been affected by invasive species, the collection of its resources by uninformed local residents and visitors, and the growing demands of the modern world. Though, with continued education and outreach efforts, the Reserve has great potential to serve as an outdoor classroom, teaching lessons of sustainability, resource management and perpetuation of traditional cultural practices.

Cultural Resources, Practices, and Beliefs Identified

Based on current archival research and available reports that discuss the cultural history of the upland regions of Hawai'i Island, it is suggested that the forested *mauka* regions of the Ka'ū Forest Reserve were most commonly used for specialized resource procurement activities. These activities were likely centralized in specific areas that contained important resources for catching/collecting birds, harvesting hardwoods for crafts and other uses, collecting medicinal plants, and spiritual practices.

The sources consulted during this study indicate that *mauka* Ka'ū was a place where people generally did not permanently reside. Nevertheless, with the diversity of plants and animals present, the area was likely frequented by Hawaiian cultural practitioners such as *kumu hula*, bird catchers, canoe builders and *kāhuna lā'au lapa'au*, among others. Pre-Contact visitation to the heights of the Ka'ū Forest can also be seen through historic trails adjacent to and above the Reserve. The Reserve's post-Contact history includes remains of historic sites along the boundaries and lower elevations of the Reserve. Some of these historic sites include various walls, tunnels, water tanks, flumes, bridges, and historic cabin sites.

Today, cultural practices continue to be perpetuated within the Reserve as illustrated in the Traditional Cultural Landscape section of this study. Notably, the Reserve is used for gathering plants, such as *maile*, *māmaki*, *palapalai*, *'a'ali'i*, and *'olonā*. *Wai* is also collected from springs up *mauka*, which is used for ceremonial purposes. Additionally, hunters continue to use this area as a means of subsistence.

Community Concerns of the Proposed Project

Projects proposed by DOFAW in the Ka'ū Forest Reserve include maintaining the watershed, constructing fences, removing invasive species and ungulates, replanting native species, potentially releasing the *'alalā* back into its native habitat, increasing public access, and establishing educational opportunities. These projects should have little impact on the known cultural resources, practices, and beliefs of Ka'ū, and several have the potential to benefit the cultural resources of the Reserve (e.g., invasive weed suppression, etc.). However, the cultural resources, and consequently the practices and beliefs, of Ka'ū are at risk of being impacted by uninformed and uncaring local residents and visitors. While most of the participants are supportive of the efforts proposed by DOFAW to preserve and protect the cultural and natural resources of the forest, there were some concerns expressed regarding lifestyle changes, access for gathering and hunting, watershed management, fencing locations, and the planning process that relates to the proposed project (Table 6).

Table 6. Summary of Concerns and Recommendations

<p>Potential Impacts and Community Concerns</p>	<p>Community consultation yielded the following:</p> <ol style="list-style-type: none"> 1. Lifestyle Changes: The general sentiment of the individuals that participated in this study was that they love their home of Ka‘ū because it is like no other place in Hawai‘i. The unique cultural makeup, environmental makeup, and community makeup of Ka‘ū is what makes this place special, and locals do not want to see their country lifestyle significantly change. 2. Restricted Access: Many Ka‘ū locals continue to access the forest for practices such as plant gathering, hunting, protocols, and education. Some participants expressed concerns that fences would restrict access. While many participants acknowledged the need to <i>mālama</i> the forest, they also shared that they rely on the forest for food and other resources. However, DOFAW has stated that this project will actually increase access routes to the forest, which will help preserve and perpetuate certain practices in Ka‘ū. 3. Watershed Management: Many of the Ka‘ū community participants recognize how important the Ka‘ū watershed is for the forest and for their community and they expressed concern that this project does not negatively impact the watershed. However, this project proposes to restore the watershed by removing ungulates and native plants that effect the health of the forest and the watershed, and restore native plants that help reduce flooding and erosion.
<p>Recommendation and Mitigation Measures</p>	<p>Based on the information gathered from the community consultation phase, Keala Pono has three recommendations to minimize the concerns that were expressed by the community. A good faith effort to address these recommendations may help mitigate the potentially adverse effects that the proposed project may have on Hawaiian cultural practices, beliefs and resources in and near the project area.</p> <ol style="list-style-type: none"> 1. Keep Ka‘ū, Ka‘ū. While the proposed project does not seem like it will have a negative impact on the lifestyle of Ka‘ū, it must be clearly recognized that maintaining Ka‘ū’s special charm and character are important to the community. 2. Access needs to remain open so the people of Ka‘ū can continue to perpetuate their lifestyle practices. This recommendation is addressed in DOFAWs proposed actions of continuing to maintain existing public access; to increase access; to continue to facilitate public hunting; and to develop trails and recreational amenities within the Reserve. 3. The Ka‘ū watershed is a significant resource that needs to be managed properly. This recommendation is also already addressed in DOFAWs proposed actions of fencing areas and removing introduced ungulates; removing invasive weeds; and propagating native plants.

Lifestyle Changes

Many of the community participants that were involved in this study have lived in Ka‘ū for more than 50 years and have seen many changes over those years. They expressed concerns that the lifestyle of Ka‘ū is drastically different from when they were growing up. While it was acknowledged that some of the changes were necessary, the fact that there are few jobs and not a lot of educational opportunities in their town concerns them. They continue to witness many of

their children and grandchildren leaving Ka‘ū today for education and job opportunities elsewhere. And in return, more and more outsiders are coming to Ka‘ū to buy land and houses, which is affecting the entire make up and feel of the place.

Aunty Mabel Kaipo is in agreement with the main goals and objectives of the Ka‘ū Forest Reserve management plan, as long as it does not negatively affect the Ka‘ū community. She expressed the importance of keeping Ka‘ū, Ka‘ū and does not want Ka‘ū to become overdeveloped. Uncle Kalani Decoito and Uncle Larry Galban expressed concerns that the proposed project for the Ka‘ū Forest Reserve management plan will impact the Ka‘ū “way of life.”

Access for Gathering and Hunting

Access issues were the most frequently expressed concerns during our consultation process. Community participants shared that they continue to access the forest for gathering practices, however, it was a concern that outside visitors take advantage of the open access and gather excessive amounts of plants, in particular *maile*—instead of being responsible stewards. A few participants shared that they have witnessed outsider’s come to Ka‘ū and impact the health of the forest by over harvesting *maile* to make money, and not picking it correctly.

With regard to the Ka‘ū Forest Reserve Management Plan, Kilohana Domingo is mainly concerned about access to gather and how access will be monitored. When asked about his knowledge of the plants in the Reserve he was unfamiliar with the area because of the inability to gain access there. Kilohana suggested that the State work with cultural practitioners to find permanent solutions such as longer permit periods, particularly for those wanting to practice cultural gathering rights. His concern is that requiring permits to gather is setting people up to break the law, therefore endangering them for the sake of perpetuating their cultural practices.

Uncle Kalani and Uncle Larry both commented that restricted access into the forest due to private landownership is a big problem. They are concerned that this project will propose additional restrictions on access routes and hunting in the forest. They further stated that the forest is a resource that is utilized for gathering, for water sources, and for living off the grid, so to deny access would ultimately affect their livelihood. However, they also believe that open public access can also create problems such as outsiders coming in to the forest without having an intimate understanding of the place and overharvesting plants and animals.

While most participants expressed that access into the forest is too limited, others commented that access is too open, and needs to be better monitored. Kama Dancil is concerned that access into the Ka‘ū Forest Reserve is open to anyone. While reviewing DOFAW’s purpose and needs statement for this project, Kama noticed that it states that there is a need to “provide for continued and expanded public use...” Kama expressed concern with this statement because he believes there is a big difference between “public use/access” and “community use/access.” He is worried that with expanded public access more people from outside the Ka‘ū community will access these areas and this trend will continue to increase over the years. Kama has seen first-hand some of the impacts that public access has had on the Ka‘ū Forest. For instance, he is aware of *maile* being overharvested and inappropriately picked in Wood Valley by people who are not from Ka‘ū.

Watershed Management

Uncle Peewee regards the Ka‘ū forest as a very fragile ecosystem because of its water resources. He stated that developing even one road in the forest would change the water table and he does not want that to happen. Additionally, Kama considers water as the most important component of the management of the Ka‘ū forest. He stated that proper management of the waterways and

watersheds are integral not only for the health of the forest, but for the health of all living things that rely on it. Auntie Susan also stated that water is essential, and that something must be done to help and protect the watershed in Ka'ū.

Planning Process

During the consultation process the Hawai'i Volcanoes National Park (HAVO) staff shared some insights about the planning process they have undertaken for HAVO's general management plan. The staff suggested that DOFAW review HAVO's plan, and possibly adapt some of their methods, content, and processes into the Ka'ū Forest Reserve management plan. Some of the HAVO staff felt that DOFAW was moving through the planning and environmental review process too quickly, and that they should make sure they have all their bases covered by consulting with all the necessary individuals and groups. The HAVO staff recommended that DOFAW take their time developing the management plan and not rush the consultation process.

Recommendations/Mitigations

The following recommendations are based on the information gathered from the community consultation efforts (see Table 6). A good faith effort to address these recommendations may help mitigate the potentially adverse effects the proposed project may have on Hawaiian cultural practices, beliefs and resources in and near the project area.

Fencing

During the consultation process for this project, DOFAW and Keala Pono representatives presented the community participants with a list of four different proposed fencing alternatives in order to gather preferred alternative suggestions and recommendations. The following is a list of action alternatives that DOFAW presented to the community as part of the EA process:

Alternative A: Implementation of all management actions, with fencing of southern portion of the Reserve above 4,000–4,500 feet in elevation. This area includes important watershed for Wai'ōhinu and Nā'ālehu. Although it is somewhat more weedy than other areas and contains fewer rare, threatened or endangered species, it was highly ranked by the 'Alalā Recovery Team as a release site due to abundant food plants preferred by the endangered crow, and it is an accessible area for release, monitoring and care of the 'Alalā. Two sides of the proposed fenced unit are already built.

Alternative B: Implementation of all management actions, with fencing of central portion of the Reserve above 4,500–5,000 feet in elevation. This area includes important watershed for Pahāla. This area has high concentrations of rare, threatened and endangered plant and animal species and only limited weeds. It was highly ranked by the 'Alalā Recovery Team as a release site because of good forest canopy but has less abundant preferred food plants. It is less accessible for release, monitoring and care of the 'Alalā, although its remoteness may be beneficial to release owing to less human disturbance and edge effect. One side of the proposed fence has been built, and it is accessible by road.

Alternative C: Implementation of all management actions, with fencing of northern portion of the Reserve above 4,500–5,000 feet in elevation. This area includes important watershed for Wood Valley. Although ranked highly by the 'Alalā Recovery Team as a release site, it has less abundant preferred food and the more open canopy may not be ideal for the release of the crow. The area has high concentrations of rare, threatened and endangered plant and animal species and contains more *koa* than other portions of the

Reserve, due to the drier climate. The National Park is planning additional boundary fencing on one side. This area is accessible to the release team as well as the general public from public roads on the Kapāpala side.

Alternative D: Implementation of all management actions, with fencing of entire area of the Reserve above 4,000–5,000 feet in elevation. This area includes important watershed for Wai‘ōhinu, Nā‘ālehu, Pāhala and Wood Valley. This action would provide fenced protection for the maximum area and would include all proposed release sites in Ka‘ū for the ‘Alalā. However, the costs would be far greater than the amount DOFAW believes will be available for the project over the next 20 years.

While not every community participant provided input on the specific fencing alternatives they support, there were some recommendations gathered:

For instance, of the four fencing alternatives, both Uncle Kalani and Uncle Larry preferred the Kaiholena section (Alternative B). They pointed out that The Nature Conservancy already has a preserve there with management policies in place. Uncle Kalani explained that The Nature Conservancy continues to allow hunters access and that they work with hunters to manage the area with GPS, monitoring invasive species, and collecting pig counts. If the Kaiholena area is chosen to be fenced off, Uncle Kalani and Uncle Larry would like DOFAW to agree that the surrounding areas remain open and would not be fenced off in the future. They also suggested setting up gates on access roads and to open and close them every other year. Uncle Peewee also recommended that the best area for fencing is above Kaiholena (Alternative B). He explained that there are a lot of steep crevices in the area that make it harder for pigs to roam around there so it would not significantly affect their hunting practices.

Kama Dancil expressed that he supports the idea of fencing in the Ka‘ū Forest Reserve, and if DOFAW does put in a fence, it should be constructed for the entire boundary of the Reserve (Alternative D). And if they cannot fence the entire boundary of the Reserve, then there should be no fenceline at all. Kama stated that it does not make sense to just build fences in one area since it would push the ungulates and invasive species to other areas of the Reserve.

In response to DOFAW’s plans to fence certain areas in the Ka‘ū Forest Reserve, TNC believes that the proposal to construct the fenceline around 4,000 ft. elevation would not be an appropriate elevation to place it. They explained that around 4,000 ft. the area is very wet, and the fence would get rusty and deteriorate quickly. Instead, they suggested that the fence should go around the 5,000 ft. elevation where the forest is not as wet, and where the fence could be better maintained. TNC also suggested that when it is time to remove ungulates within the fenced units that DOFAW work with local hunters in Ka‘ū. TNC used this method and within the first month, Ka‘ū hunters took out 33 pigs from their fenced units in Kaiholena. They believe that this method was successful because it got the job done and at the same time it encouraged the local community to feel more involved with the long-term management of the project.

While Uncle Tommy Kaniho did not state what fencing alternative he believes would work the best, he did share that fencing in any area of the forest will be a significant task. He noted that if you start building a fence in the lower slopes of the Reserve, by the time you reach the upper portions, you will have to go back down and rebuild the lower fence because it will already be rotting away. Uncle Tommy understands the constant labor that is required to maintain fences in the forest, and warned that there is no end when it comes to fencing in a wet environment such as the Ka‘ū Forest Reserve.

Access

Some of the community participants noted that they would like to maintain access to the forest for the resources that they have always gathered/hunted, although they suggested that closing portions of the forest for specific amounts of time would help the plant and animal populations reproduce and regenerate. For instance Uncle Kalani and Uncle Larry suggested a stable type of forest management where DOFAW opens and closes certain areas of the Forest Reserve for one year and annually alternates those areas. Uncle Kalani further suggested that DOFAW work with the Ka‘ū locals to put up and monitor access through the gates. He believes this would reassure people in the Ka‘ū community that the gate is for them and that they would have access. In turn, DOFAW would have free security. He added that there is no guarantee that if DOFAW builds the fence without collaborating with the local community, that people would not tear it down. He also recommended the idea of one-way gates that would allow pigs to go into one area, therefore making it easier for hunters.

In terms of public access to the Ka‘ū Forest, TNC believes that there is adequate access for the public to get to the Reserve at Hā‘ao behind Wai‘ōhinu, Lorenzo Road, and Charlie Young Road (Kiolāka‘a Road). They believe that there might be confusion about the access locations and requirements, and suggest that a way to remedy this problem is to educate the public on the various access routes into the forest. In addition, TNC is currently proposing a plan to provide an easement along the Ka‘ū Forest Reserve boundary to offer more public access along five miles of forest.

‘Alalā Habitat

When the idea of reintroducing the ‘*alalā* into the Ka‘ū Forest Reserve was presented to the community participants, most were supportive of this proposal. Many of them remember seeing and hearing ‘*alalā* in Ka‘ū when they were younger, and were supportive of the plan to bring them back to their native habitat. There were some additional recommendations on where and how to release the ‘*alalā* back into the forest. For instance Uncle Larry and Uncle Kalani suggested that DOFAW release the ‘*alalā* into Kahuku because it is already a preservation zone that is enclosed and protected. They also suggested that an area away from hunting zones would be a more suitable relocation site for the ‘*alalā* and for any bird monitoring activities.

Iwikauikaua Joaquin discussed some of his ideas on the release of alala, and he thinks that a soft release, where an aviary is built in the wild and food is supplied to help slowly wean the ‘*alalā* from their captive environment, is an ideal release method. He explained that a soft release would have an on-site aviary which would be similar to the current aviary conditions at the Keauhou Bird Conservation Center, but still allow the birds the freedom to come and go as they please. Iwikauikaua thinks that this method will allow the ‘*alalā* to eventually become fully independent where they will no longer rely on the enclosure for survival.

Native Plant Restoration

The Ka‘ū Forest Reserve comprises one of the largest intact native forests in the State; therefore, it is recommended that DOFAW do everything in their power to maintain the forest’s integrity. As Aunty Pele Hanoa stated, “The Ka‘ū forest is in really good condition compared to other forests around the state, and it must be kept that way!” Aunty Pele recognizes the unique nature of the Ka‘ū Forest and recommends getting rid of the invasive species of plants in the forest, so the native species can grow and flourish. Aunty Mabel Kaipo is also aware that the native plant population in Ka‘ū has decreased over the years. To remedy this problem she suggested establishing native plant nurseries in Ka‘ū so those plants can eventually be replanted in the forest. Aunty Susan Pua also recommended that something must be done to protect the Native Hawaiian birds, animals, and

plants in the Ka'ū forest. She expressed that she does not want the forest to get destroyed because it is worth preserving and taking care of.

Protection of Cultural, Historical, and Archaeological Sites

Based on our background research of the project area, it is recommended that archaeological monitoring of land-altering activities, such as fence construction and maintenance, be implemented. Archeological monitoring will potentially prevent accidental damage to unknown cultural features. In addition, on-site monitors will be able to point out archaeological features in areas of increased visibility due to vegetation clearance during land-altering activities. Land altering activities may uncover cultural resources on the surface or underground. Should historic, cultural, burial sites or artifacts be identified during any ground disturbance, all work should immediately cease and the appropriate agencies should be notified pursuant to applicable law. It is also recommended that DOFAW consider developing a plan to identify and avoid historic and cultural sites, including burials, that may be located in surface or subsurface contexts prior to finalizing any land-altering plans. Specific decisions should be made in consultation with appropriate government agencies (e.g., SHPD, OHA) and Native Hawaiian organizations and individuals.

Education

Several of the participants discussed the importance of responsible stewardship of both the cultural and natural resources in the forest and the benefits of maintaining a healthy forest through outreach and education efforts. Aunty Pele Hanoa expressed concern that there are not enough programs and teachers that educate the children of Ka'ū about the Hawaiian culture and the significance of the natural, cultural, and marine resources located in Ka'ū. She recommends that DOFAW start educational programs in Ka'ū for the children so they can learn more about their environment. Aunty Susan Pua also suggested establishing a youth program where children can experience and learn about the native birds and medicinal plants in the forest. Aunty Mabel Kaipo stressed that there is a need for someone to teach the kids about the various plants in Ka'ū, including information on how they got there and how to use them. She further suggested that this project could be a means to help establish educational opportunities.

Kilohana Domingo shared that his guests at Kalae O Kilohana are interested in taking part in stewarding the forest, so he suggested that there should be more education to teach people about how to get involved and the processes of managing a forest. He also recommended that there should be a way to incorporate volunteer opportunities in the Reserve so people can give back to the land and their communities.

Collaboration

Almost all the participants we spoke with during the course of this study offered suggestions, ideas, and/or personal assistance in helping to protect and perpetuate the health of the Ka'ū Forest. They all recognized that in order to *mālama* such a large forest, a team effort must be undertaken. Additionally some participants suggested that they would like to see DOFAW have more of a presence in Ka'ū so they can get to know the place and the community in order to work together.

Uncle Kalani expressed that Ka'ū community members are the best stewards of the land because they are connected to and deeply care for their backyard. He suggested having individuals from the local community to be a part of the management team for the Forest Reserve. In turn, this would enable DOFAW to get feedback and work more intimately with the Ka'ū community. Uncle Kalani and Uncle Larry are primarily concerned with the health and accessibility to resources that

the Ka‘ū community depends upon. They are willing to work with the State, but want to ensure that the entire Forest Reserve does not get fenced off in the future and that the Ka‘ū people will always have access to the resources so they are passed on to future generations and continue to perpetuate their lifestyle.

The Nature Conservancy has been supportive and very involved with the planning process for DOFAW’s management plan of the Ka‘ū Forest Reserve. The staff at TNC and DOFAW maintain an open and collaborative partnership that ultimately helps both agencies succeed in their individual goals, as well as assisting in the larger effort of protecting and stewarding the Ka‘ū forest. The staff at Hawai‘i Volcanoes National Park have also been very open and willing to collaborate with DOFAW on this project. Since they have been working on the Park’s general management plan for the past two years, they suggested that DOFAW review their management plan process and to take their time with community consultation efforts. They also recommended that DOFAW set up a cultural advisory group, similar to the *kūpuna* consultation group that the Park works with. This method has worked well for HAVO and has helped the Park develop relationships with the community in order to make informed decisions about their management practices.

Future Research

It is recommended that this Cultural Impact Assessment be revisited should the activities of DOFAW in the Ka‘ū Forest Reserve change substantially. Additionally, areas of further study might include complete Hawaiian language translations of texts that provide information on the Reserve, further research on Māhele documents that might yield significant information of traditional land use in Ka‘ū, archaeological investigations of known cultural sites in the Reserve such as ancient trails and historic walls, and archaeological surveys of portions of the Reserve where archaeological sites might be expected but have never been documented.

Confidential Information Withheld

During the course of gathering information for this report, no sensitive or confidential information was discovered in the background literature or communicated by the community participants. All results of this effort are therefore presented without hesitation or withholding.

Conflicting Information

No conflicting information was obvious in analyzing the gathered sources. On the contrary, a number of themes were repeated and information was generally confirmed by independent sources.

GLOSSARY

‘a‘ā	Rough, stony lava. Surface appearance is sharp and broken.
‘a‘ali‘i	<i>Dodonaea viscosa</i> , the fruit of which were used for red dye, the leaves and fruits fashioned into <i>lei</i> , and the hard, heavy wood made into bait sticks and houseposts.
‘ahi	Tuna fish, such as the yellow-fin tuna (<i>Thunnus albacares</i>).
‘aholehole	Young stage of the Hawaiian flagtail fish.
ahu	A shrine or altar.
ahupua‘a	Traditional Hawaiian land division usually extending from the uplands to the sea.
‘āina	Land.
akala	The endemic raspberries (<i>Rubus hawaiiensis</i> and <i>R. macraei</i>); and the thimbleberry (<i>R. rosaefolius</i>); lit. pink.
‘ākepa	The scarlet or yellow green Hawaiian honeycreepers <i>Loxops coccinea</i> .
‘akia pōlā‘au	A sub species of <i>nuku pu‘u</i> honey creeper (<i>Hemignathus wilsoni</i>), found on Hawai‘i island in high elevations.
‘alalā	<i>Corvus tropicus</i> , the endangered Hawaiian crow, formerly found only in forested areas on Hawai‘i Island. Wild birds are extinct and numbers in captivity are low.
ali‘i	Chief, chiefess, monarch.
‘amakihi	<i>Loxops virens</i> , a category of honey creepers endemic to Hawai‘i, known for their yellow and green feathers. Found mainly on the islands of Hawai‘i, Maui, and Kaua‘i.
‘a‘o	The shearwater, or Newell’s puffin, <i>Puffinus puffinis newelli</i> . The species is thought to be the only sea bird endemic to Hawai‘i and the only seabird to breed only in Hawai‘i.
‘apapane	<i>Himatione sanguinea</i> , a species of Hawaiian honey creeper characterized by their black and red feathers. Found throughout the Hawaiian Islands.
‘aumakua	Family or personal gods. The plural form of the word is ‘ <i>aumākua</i> .
‘awa	The shrub <i>Piper methysticum</i> , or <i>kava</i> , the root of which was used as a ceremonial drink throughout the Pacific.
‘elepaio	<i>Chasiempis sandwichensis</i> , an endemic bird part of the flycatcher family.
hale	House.
hāpu‘u	<i>Cibotium splendens</i> , a fern endemic to Hawai‘i; a forest fern to 5 m high.

<i>hau</i>	The indigenous tree <i>Hibiscus tiliaceus</i> , which had many uses in traditional Hawai‘i. Sandals were fashioned from the bark and cordage was made from fibers. Wood was shaped into net floats, canoe booms, and various sports equipment and flowers were used medicinally.
<i>heiau</i>	Place of worship and ritual in traditional Hawai‘i.
<i>heiau luakini</i>	Large temple where human sacrifices were offered.
<i>hō‘io</i>	<i>Diplazium (Athyrium) arnottii</i> , a large native fern that grows at high altitudes. The young fronds are often eaten raw with shrimp or salmon.
<i>holoholo</i>	To go out or go for a walk or ride.
<i>honu</i>	The general name for a turtle or tortoise.
<i>ho‘okupu</i>	Tribute, offering, religious gift.
<i>huli</i>	The top of the <i>kalo</i> used for planting; shoot, as of the <i>wauke</i> .
<i>‘ie‘ie</i>	The vine <i>Freycinetia arborea</i> , an endemic, woody branching climber that grows at altitudes of 300–600m. In ancient Hawai‘i, vines were considered sacred and used in basketry and for ceremonial purposes.
<i>iholena</i>	A common variety of banana with small bunches, thin skin, and pinkish flesh. In traditional Hawai‘i, this was one of the few banana species that women were allowed to eat.
<i>‘i‘iwi, ‘i‘iwi pōlena</i>	<i>Vistiaria coccinea</i> , Hawaiian honey creeper whose red feathers were used in feather work.
<i>‘ike</i>	To see, know, feel; knowledge, awareness, understanding.
<i>ili‘āina</i>	Land area; a land section, next in importance to <i>ahupua‘a</i> and usually a subdivision of an <i>ahupua‘a</i> .
<i>‘ili‘ili</i>	Waterworn cobbles often used in floor paving.
<i>‘ilima</i>	<i>Sida fallax</i> , the native shrub whose flowers were made into <i>lei</i> , and sap was used for medicinal purposes in traditional Hawai‘i.
<i>imu</i>	Underground pit or oven used for cooking.
<i>‘io</i>	The endemic and endangered Hawaiian hawk <i>Buteo solitarius</i> , that resides only on the island of Hawai‘i. The <i>‘io</i> was a sign of royalty in ancient Hawai‘i because of its lofty flight; the gourd (<i>Lagenaria siceraria</i>), round in shape and measures approximately 30 cm in diameter; sometimes called the bottle gourd.
<i>ipu</i>	General name for a vessel or container. Also the bottle gourd <i>Lagenaria siceraria</i> or <i>L. vulgaris</i> , which was used traditionally for containers, hula instruments, and for medicine.

<i>Kahiki</i>	A far away land, sometimes refers to Tahiti.
<i>kāhili</i>	Feather standard; a symbol of royal Hawaiian status.
<i>kahu</i>	Honored attendant, guardian, nurse, keeper, administrator, pastor.
<i>kahuna</i>	An expert in any profession, often referring to a priest, sorcerer, or magician.
<i>kalo</i>	The Polynesian-introduced <i>Colocasia esculenta</i> , or taro, the staple of the traditional Hawaiian diet.
<i>kama‘āina</i>	Native-born.
<i>kanaka</i>	Human, person, man, Hawaiian.
<i>kaona</i>	Hidden meaning in poetry, or concealed reference to a person, place, or thing.
<i>kapa</i>	Tapa cloth.
<i>kauila</i>	The name for two types of buckthorn trees native to Hawai‘i (<i>Alphitonia ponderosa</i> and <i>Colubrina oppositifolia</i>). Produced a hard wood prized for spear and a variety of other tool making.
<i>kawele‘ā</i>	<i>Sphyræna helleri</i> , a small relative of the barracuda.
<i>kimo</i>	A traditional Hawaiian game that is similar to jacks. Players would often chant during the game.
<i>kino lau</i>	The different forms that a supernatural being may take.
<i>kō</i>	The Polynesian introduced <i>Saccharum officinarum</i> , or sugarcane, a large grass traditionally used as a sweetener and for black dye.
<i>ko‘a</i>	Fishing shrine.
<i>koa</i>	<i>Acacia koa</i> , the largest of the native forest trees, prized for its wood, traditionally fashioned into canoes, surfboards, and calabashes.
<i>konohiki</i>	The overseer of an <i>ahupua‘a</i> ranked below a chief; land or fishing rights under control of the <i>konohiki</i> ; such rights are sometimes called <i>konohiki</i> rights.
<i>kou</i>	The flowering tree, <i>Cordia subcordata</i> , either native to Hawai‘i or introduced by Polynesians.
<i>kū‘aha, kua‘aha</i>	Place of worship or altar within a private home.
<i>kukui</i>	The candlenut tree, or <i>Aleurites moluccana</i> , the nuts of which were eaten as a relish and used for lamp fuel in traditional times.
<i>kula</i>	Plain, field, open country, pasture, land with no water rights.
<i>kūlolo</i>	Pudding made of baked or steamed grated taro and coconut cream.

<i>kupua</i>	Demigod, hero, or supernatural being below the level of a full-fledged deity.
<i>kupuna</i>	Grandparent, ancestor; <i>kūpuna</i> is the plural form.
<i>lā‘au lapa‘au</i>	Medicine.
<i>lā‘ī</i>	Ti leaf.
<i>lauhala</i>	Leaf of the <i>hala</i> , or pandanus tree (<i>Pandanus odoratissimus</i>), used for matting and basketry.
<i>laupapa</i>	A broad flat area, such as a coral reef or lava field.
<i>lei haku</i>	A braided lei, usually made with ferns and flowers.
<i>lo‘i, lo‘i kalo</i>	An irrigated terrace or set of terraces for the cultivation of taro.
<i>lo‘li</i>	Sea cucumber, sea slug.
<i>loulou</i>	The fan palm (<i>Pritchardia spp.</i>), endemic to Hawai‘i.
<i>Māhele</i>	The 1848 division of land.
<i>mahi‘ole</i>	Feather helmet.
<i>mai‘a</i>	The banana, or <i>Musa sp.</i> , whose fruit was eaten and leaves used traditionally as a wrapping for cooking food in earth ovens.
<i>maile</i>	<i>Alyxia olivaeformis</i> , a fragrant native shrub used for twining.
<i>makai</i>	Toward the sea.
<i>māmaki</i>	<i>Piptarus spp.</i> , a small native tree. Fiber from its bark was used to make a kind of coarse tapa. Sometimes spelled <i>mamake</i> in old texts.
<i>mana‘o</i>	Thoughts, opinions, ideas.
<i>mānele</i>	The native soapberry trees, <i>Sapindus saponaria f. inaequalis</i> as well as all varieties of <i>Zanthoxylum</i> , also known as <i>a‘e</i> in Hawaiian.
<i>mānienie</i>	<i>Cynodon dactylon</i> , or Bermuda grass, often used in lawns.
<i>mauka</i>	Inland, upland, toward the mountain.
<i>mele</i>	Song, chant, or poem.
<i>menehune</i>	Small people of legend who worked at night to build structures such as fishponds, roads, and <i>heiau</i> .
<i>moa</i>	The green, leafless plants <i>Psilotum nudum</i> and <i>P. complanatum</i> . The spore powder was used medicinally in traditional Hawai‘i and children played a game with the plant.

<i>moi</i>	The threadfish <i>Polydactylus sexfilis</i> , a highly prized food item.
<i>mo‘olelo</i>	A story, myth, history, tradition, legend, or record.
<i>niu</i>	The Polynesian-introduced tree <i>Cocos nucifera</i> , or coconut.
<i>‘ohana</i>	Family.
<i>‘ōhelo</i>	<i>Vaccinium reticulatum</i> , a native shrub with small edible berries. Found in higher altitudes.
<i>‘ōhi‘a</i>	Two kinds of forest trees. See also <i>o ‘ōhi‘a ‘ai</i> and <i>‘ōhi‘a lehua</i> .
<i>‘ōkolehau</i>	A liquor distilled from the <i>kī</i> root.
<i>‘ōlelo no‘eau</i>	Proverb, wise saying, traditional saying.
<i>oli</i>	Chant.
<i>olonā</i>	The native plant <i>Touchardia latifolia</i> , traditionally used for making cordage.
<i>‘ōma‘o</i>	The bird <i>Phaeornis obscurus obscurus</i> , or Hawaiian thrush.
<i>‘ōpelu</i>	Mackerel scad (<i>Decapterus pinnulatus</i> and <i>D. maruadsi</i>).
<i>pāhoehoe</i>	Smooth lava; surface unbroken.
<i>pala</i>	The fern <i>Marattia douglasii</i> , used medicinally, ceremonially, in lei, and eaten in times of famine.
<i>palapalai</i>	<i>Microlepia strigosa</i> , ferns can grow up to 4 to 5 ft in height. Used traditionally to decorate <i>hula</i> altars. Indigenous to Hawai‘i.
<i>pali</i>	Cliff, steep hill.
<i>palila</i>	<i>Psittirostra bailleui</i> , <i>P. kona</i> , an endangered Hawaiian honeycreeper found only on the slopes of Mauna Kea. Feeds on the seeds of the <i>māmane</i> tree giving the two close ecological ties.
<i>pau</i>	Finished.
<i>pia</i>	The Polynesian arrowroot <i>Tacca leontopetaloides</i> , traditionally cultivated for food and medicine.
<i>piko</i>	A common taro with many different varieties. Navel; summit; center.
<i>pili</i>	A native grass, <i>Heteropogon contortus</i> .
<i>pōhaku</i>	Rock, stone.
<i>pōhuehue</i>	The beach morning glory, <i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i> , used medicinally. Vines are also used to drive fish into nets.

<i>pōhuli</i>	Sprout, root, sucker; to sprout, often referring to bananas.
<i>poi</i>	A staple of traditional Hawai‘i, made of cooked and pounded taro mixed with water to form a paste.
<i>pono</i>	Correct, proper, good.
<i>pōpolo</i>	The herb black nightshade (<i>Solanum nigrum</i>), traditionally used for medicine and in ceremony.
<i>pua‘a</i>	Pig.
<i>puaiohi</i>	The small Kaua‘i thrush, <i>Phaeornis palmeri</i> .
<i>pūkiawe</i>	Refers to a variety of native trees and shrubs (<i>Styphelia</i> [<i>Cyathodes</i>]).
<i>pulu</i>	Fern fibers obtained from the <i>hapu‘u pulu</i> (<i>Cibotium glaucum</i>), tree fern.
<i>pūnāwai</i>	Fresh water spring.
<i>ti (kī)</i>	The plant <i>Cordyline terminalis</i> , whose leaves were traditionally used in house thatching, raincoats, sandals, whistles, and as a wrapping for food.
<i>tutu</i>	Grandmother, grandma.
<i>‘uala</i>	The sweet potato, or <i>Ipomoea batatas</i> , a Polynesian introduction.
<i>uhi</i>	The yam <i>Dioscorea alata</i> , commonly grown for food.
<i>‘ukulele</i>	String instrument of the guitar family, originating in 19 th century Hawai‘i. Lit. jumping flea.
<i>ulana</i>	To braid, weave, plait, or knit; plaiting, weaving.
<i>‘ulu</i>	The Polynesian-introduced tree <i>Artocarpus altilis</i> , or breadfruit.
<i>‘ulu maika</i>	Stone used in the <i>maika</i> game, similar to bowling.
<i>wahi pana</i>	Sacred places or legendary places that are not <i>kapu</i> , or taboo.
<i>wai</i>	Water or liquid other than salt water.
<i>wao akua</i>	A distant mountain region believed to be inhabited only by spirits; wilderness, desert.
<i>wauke</i>	The paper mulberry, or <i>Broussonetia papyrifera</i> , which was made into tapa cloth in traditional Hawai‘i.
<i>wili</i>	To wind, twist, crank, or roll up.

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Appendices listed below are available by request:

- Appendix A: Place Names Associated with *Ahupua'a* within the Ka'u Forest Reserve
- Appendix B: The Hawai'i Environmental Council's Guidelines for Assessing Cultural Impacts
- Appendix C: A Bill for Environmental Impact Statements
- Appendix D: Act 50
- Appendix E: Community Contact Letter and Figure
- Appendix F: Agreement to Participate / Informed Consent Form
- Appendix G: Sample Questions
- Appendix H: *Māhele* Awards for *Ahupua'a* along Kā'u Forest Reserve Boundaries

ENVIRONMENTAL ASSESSMENT

Ka'ū Forest Reserve Management Plan

**State of Hawai'i
Department of Land and Natural Resources**

**APPENDIX 3
Public Involvement**

Part 1: Responses to Early Consultation

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William P. Kenoi
Mayor



Darren J. Rosario
Fire Chief

Renwick J. Victorino
Deputy Fire Chief

County of Hawai'i
HAWAII FIRE DEPARTMENT
25 Aupuni Street • Room 2501 • Hilo, Hawai'i 96720
(808) 932-2900 • Fax (808) 932-2928

November 4, 2011

Mr. Ron Terry
Geometrician Associates
PO Box 396
Hilo, HI 96721

**SUBJECT: EARLY CONSULTATION FOR ENVIRONMENTAL ASSESSMENT
FOR KA'U FOREST RESERVE MANAGEMENT PLAN**

We have no comments to offer at this time in reference to the above-mentioned Early Consultation for Environmental Assessment. No final EA is necessary upon its completion.

DARREN J. ROSARIO
Fire Chief

GA:lpc





STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:
EPO-11-232

November 9, 2011

Mr. Ron Terry, Principal
Geometrician Associates, LLC
P.O. Box 396
Hilo, Hawaii 96721

Dear Mr. Terry:

SUBJECT: Early Consultation for Environmental Assessment for Kau Forest Reserve Management Plan, Island of Hawaii

Thank you for allowing us to review and comment on the subject document. The document was routed to the various branches of the Environmental Health Administration. We have no comments at this time, but reserve the right to future comments. We strongly recommend that you review all of the Standard Comments on our website: www.hawaii.gov/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this application should be adhered to.

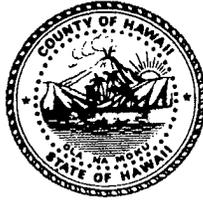
The same website also features a Healthy Community Design Smart Growth Checklist (Checklist). The Hawaii State Department of Health, Built Environment Working Group, recommends that State and county planning departments, developers, planners, engineers and other interested parties apply the healthy built environment principles in the Checklist whenever they plan or review new developments or redevelopments projects. We also ask you to share this list with others to increase community awareness on healthy community design.

If there are any questions about these comments please contact the Environmental Planning Office at 586-4337.

Sincerely,

GENEVIEVE SALMONSON, Acting Manager
Environmental Planning Office

William P. Kenoi
Mayor



Harry S. Kubojiri
Police Chief

Paul K. Ferreira
Deputy Police Chief

County of Hawai'i

POLICE DEPARTMENT
349 Kapi'olani Street • Hilo, Hawai'i 96720-3998
(808) 935-3311 • Fax (808) 961-2389

November 8, 2011

Mr. Ron Terry
Geometrician Associates
P.O. Box 396
Hilo, HI 96721

Dear Mr. Terry:

**Subject: Early Consultation for Environmental Assessment for Ka'ū
Forest Reserve Management Plan, Island of Hawai'i**

The above-referenced environmental assessment has been reviewed, and we have no input or concerns to offer at this time.

Should you have any questions, please contact Captain Andrew Burian, Commander of the Ka'ū District, at (808) 939-2520.

Sincerely,

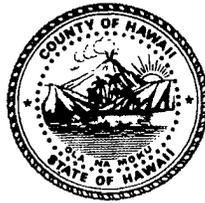
HARRY S. KUBOJIRI
POLICE CHIEF



RAUL H. KEALOHA JR.
ASSISTANT POLICE CHIEF
AREA II OPERATIONS

AB
RS110728

William P. Kenoi
Mayor



BJ Leithead Todd
Director

Margaret K. Masunaga
Deputy

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i
PLANNING DEPARTMENT

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

November 23, 2011

Mr. Ron Terry
Geometrician Associates, LLC
P.O. Box 396
Hilo, HI 96721

Dear Mr. Terry:

**SUBJECT: Early Consultation for Environmental Assessment
Project: Ka'ū Forest Reserve Management Plan
TMK: (3) 9-7-001:001; Ka'ū, Hawai'i**

Thank you for inviting input on the preparation of the subject Environmental Assessment (EA).

Though the subject parcel is State-owned land in the State Conservation District, it is part of several watersheds in Ka'ū. As part of the Ka'ū Community Development Plan (CDP) process, the CDP Steering Committee has adopted several objectives related to the area's watersheds, including:

- Protect, restore, and enhance ecosystems, including mauka forests and the shorelines, while assuring responsible access for residents and for visitors
- Encourage community-based management plans to assure that human activity doesn't degrade the quality of Ka'ū's unique natural and cultural landscape
- Establish a rural transportation network, including...a regional trail system....
- Preserve and greatly enhance nā 'ohana economy (this is a reference to the importance of the subsistence and sharing system prevalent in Ka'ū, which depends on gathering, hunting, fishing, and small scale agriculture)
- Increase the number and diversity of income sources for residents, including jobs and entrepreneurial opportunities that complement Ka'ū's ecology, culture and evolving demographics.

Mr. Ron Terry
Geometrician Associates, LLC
November 23, 2011
Page 2

Similarly, though alternative CDP strategies are still under development, several relate to and/or complement management actions being considered in the subject EA, including:

- Protecting and enhancing a “green infrastructure” network of existing and proposed protected areas, hubs (e.g., recreational, natural, geological, cultural sites), and linkages (e.g., trails, scenic byway)
- Collaborative, community-based management of cultural resources, trails, and shoreline and forest access and use
- Developing watershed management plans for priority watersheds
- Securing community credits and income for protected and enhanced ecosystem services
- Establishing Ka‘ū as an ag/ eco/ geo-tourism gateway community.

All of these strategies will require collaboration with various public and private entities. We particularly appreciate, therefore, your efforts to reach out to community stakeholders while drafting the EA. We also look forward to collaborating with DOFAW and other members of the Three Mountain Alliance watershed partnership during implementation of the Ka‘ū Forest Reserve Management Plan and the CDP.

Please continue to keep us apprised of activities related to the EA, and provide us a copy of the Draft EA when it is published for public review.

In the interim, if you have any questions, please feel free to contact Ron Whitmore of our office at 961-8137.

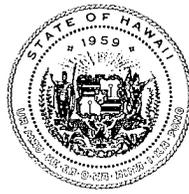
Sincerely,



BJ LEITHEAD TODD
Planning Director

RW:cs

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

IN REPLY REFER TO:
HWY-PS
2.0341

December 12, 2011

Mr. Ron Terry, Principal
Geometrician Associates, LLC
P. O. Box 396
Hilo, Hawaii 96721

Dear Mr. Terry:

Subject: Early Consultation for Environmental Assessment (EA)
Kau Forest Reserve Management Plan
State Route No. 11, Mamalahoa Highway
Hawaii, Kau TMK: (3) 9-7-01:various

Thank you for the opportunity to participate in the review of your early consultation letter dated October 31, 2011 as part of the process in preparing an EA for the subject project.

The State of Hawaii Department of Transportation (HDOT) understands that the Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife has management responsibility of the 61,641-acre Kau Forest Reserve and is preparing a Kau Forest Reserve Management Plan to protect and restore the natural and cultural resources of the area, as well as to enhance public access to the Kau Forest Reserve.

To fully understand the transportation impacts of the proposed Kau Forest Reserve Management Plan the following items need to be addressed within the EA:

1. The EA must provide an assessment of both the current and proposed traffic operations in the vicinity of the project area. The assessment shall also include discussion of any existing or proposed vehicular access point(s) on State highway facilities that provide access to the improvements in the Kau Forest Reserve Management Plan.
2. The proposed project shall not adversely impact the safety and operations of the State highway system. The proposed plan shall not cause the Level-of-Service (LOS) of the State roadway to degrade below a LOS D. If the initial assessment determines that there will be significant impacts to the State highway system, a full Traffic Impact Analysis Report or Traffic Assessment will be required to provide a thorough analysis of the traffic impacts and provide appropriate recommendations for infrastructure improvements to mitigate the project related traffic impacts.

3. A phasing plan for the implementation of recommended transportation infrastructure improvements shall be provided in relation to the proposed improvements of the 10 to 20 year period of the proposed management plan.
4. All required transportation related infrastructure improvements identified in the traffic report will be the responsibility of the applicant and shall be constructed at no cost to the HDOT.

The HDOT withholds further comments until such time that the EA can be reviewed. When the EA is available, we request four (4) copies be provided to our Department for our review.

If you have any questions, please contact Mr. Gary Ashikawa, Systems Planning Manager, Highways Division, Planning Branch at (808) 587-6336.

Very truly yours,



GLENN M. OKIMOTO, Ph.D.
Director of Transportation

Ka 'Ohana O Honu'apo

a non-profit corporation

PO BOX 903 • NA'ALEHU, HI 96772 • PHONE (808) 929-9891 • WWW.HONUAFOPARK.ORG

February 23, 2012

LEHUA LOPEZ-MAU
EXECUTIVE DIRECTOR

KEN SUGAI
PRESIDENT

WENDY SCOTT-VANCE
VICE PRESIDENT

MEGAN LAMSON
SECRETARY/
TREASURER

MICHELLE GALIMBA
DIRECTOR

CHRIS MANFREDI
DIRECTOR

Mr. William Aila, Chairman
Hawai'i Department of Land and Natural Resources,
Division of Forestry and Wildlife
c/o: Tanya Rubenstein
cc: Ron Terry, Geometrician Associates, LLC
Via email: tanya.rubenstein@hawaii.gov

Ka 'Ohana O Honu'apo (Ka 'Ohana) supports the Division of Forestry and Wildlife's (DOFAW) efforts to prepare a Ka'u Forest Reserve Management Plan for the 61,641-acre Ka'u Forest Reserve. A well-written management plan for this critical watershed area, taking into consideration all the concerns of Ka'u residents who visit, use, and hunt in the reserve, is necessary to protect, manage, restore, and monitor the resources, especially the water resources, for present and future needs.

Ka 'Ohana is a community-based, tax-exempt nonprofit whose mission is to, "...care for, restore, and protect the natural and cultural resources of the Honu'apo area" (www.honuapopark.org). Ka 'Ohana has been actively working with the county, state, and community partners since our founding in 2005 to help manage and improve the approximately 230 acres of Honu'apo Park. The park is owned by the state and managed by Hawai'i County. Our organization is a "Friends of the Park" group and an example of how a concerned group of committed community residents can work together with the county and state to help manage their properties in perpetuity.

Honu'apo Park, including Whittington Beach Park, is located makai of the highway four miles south of Punalu'u Beach Park. The Ka'u Forest Reserve includes lands mauka of the park in the ahupua'a of Honu'apo. These mauka watershed lands directly impact the wetlands functions of Honu'apo Estuary by allowing clean mauka water flows to feed the more than 20 springs surrounding the fishpond at Honu'apo. This forest reserve management plan is very important because it can ensure the protection of the reserve's watershed and continue the beneficial functions of Honu'apo's wetlands and estuary, which contain numerous endemic, threatened, and endangered marine and terrestrial species.

Mahalo a nui loa,



Lehua Lopez-Mau, Executive Director