DRAFT ENVIRONMENTAL ASSESSMENT

AHU LANI SANCTUARY REFORESTATION PROJECT

North Slope of Mauna Kea
Big Island, Hawaii
TMK 4-4-013:010

In accordance with:
Chapter 343, Hawaii Revised Statutes

Proposed by:
Department of Land and Natural Resources
Division of Forestry and Wildlife
Honolulu, HI

June 2008

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I. **SUMMARY**

Project Name:	Ahu Lani Sanctuary Reforestation Project
Proposing Agency:	State of Hawaii Department of Land and Natural Resources Division of Forestry and Wildlife
Applicant & Property Owners:	John Lindelow, Roz Rapozo, Sally Klemm
Approving Agency:	State of Hawaii Department of Land and Natural Resources
Anticipated Determination:	Finding of No Significant Impact
Agencies & Organizations Consulted:	U.S. Department of Agriculture Natural Resources Conservation Service, Waimea Branch U.S. Department of Interior Fish & Wildlife Service State of Hawaii Department of Land and Natural Resources Division of Forestry and Wildlife, Hilo and Honolulu Branches Mauna Kea Watershed Partnership Paauilo-Mauka Kalopa Community Association Umikoa Ranch
Project Location:	North Slope of Mauna Kea, Hamakua District, Big Island TMK 4-4-013:010
Land Use Classification:	State Agriculture, County Agriculture
Land Area:	21 Acres of the 24 Acre Property
EA Trigger:	Use of state funds (from the Forest Stewardship Program) for the planting and management of trees intended for selective harvesting in 30-60 years, or more, from time of planting.

II. PROJECT DESCRIPTION

The proposed action is a long-term reforestation project funded in part by the Forest Stewardship Program (FSP) of the Department of Forestry and Wildlife, State of Hawaii Department of Land and Natural Resources (DOFAW). The project will include the building of a new fence along the western boundary of the property to protect the current extent of forest resources as well as future outplanted species from managed and possible feral ungulates damage. The project will sustainably harvest select trees using best management practices planted or managed under the FSP grant. Harvesting is not expected for 30 to 60 years from project initiation. A Forest Stewardship management plan has been approved for this project by the State Forest Stewardship Advisory Committee.

EA Triggers

The trigger for this EA is the use of state funds from the FSP. In particular, state funds acquired via the FSP will be used to fund, in part, the building of a new fence along the western boundary of the land in order to protect the project area from feral ungulate (e.g. feral pigs) damage. This boundary is the only side of the property that is not already fenced.

In addition, the EA is triggered by the property owners' plans to selectively harvest some of the trees planted under the FSP. Because of the slow growth of koa trees, harvest is not expected for 30 to 60 years. Due to the several decades that will pass before harvesting can be initiated, the owners do not have detailed plans regarding the process to be utilized. However, they intend to follow the Best Management Practices (BMPs) and harvest sustainably as promulgated by DOFAW prior to any harvest in order to mitigate any potential negative impacts on local watersheds.

FSP Management Plan

The proposed action's technical, economic, social, and environmental characteristics, together with time frames and budgets, are described at length in the Management Plan that has been prepared for this project under the FSP. This Management Plan is included as Appendix A, and the reader is asked to consult Appendix A for a full description of the project.

Time Frame of Project

The project is expected to begin in 2008 and continue for at least 10 years of funding from the FSP under DOFAW supervision, with an additional 20 years of project maintenance thereafter as the koa trees mature.

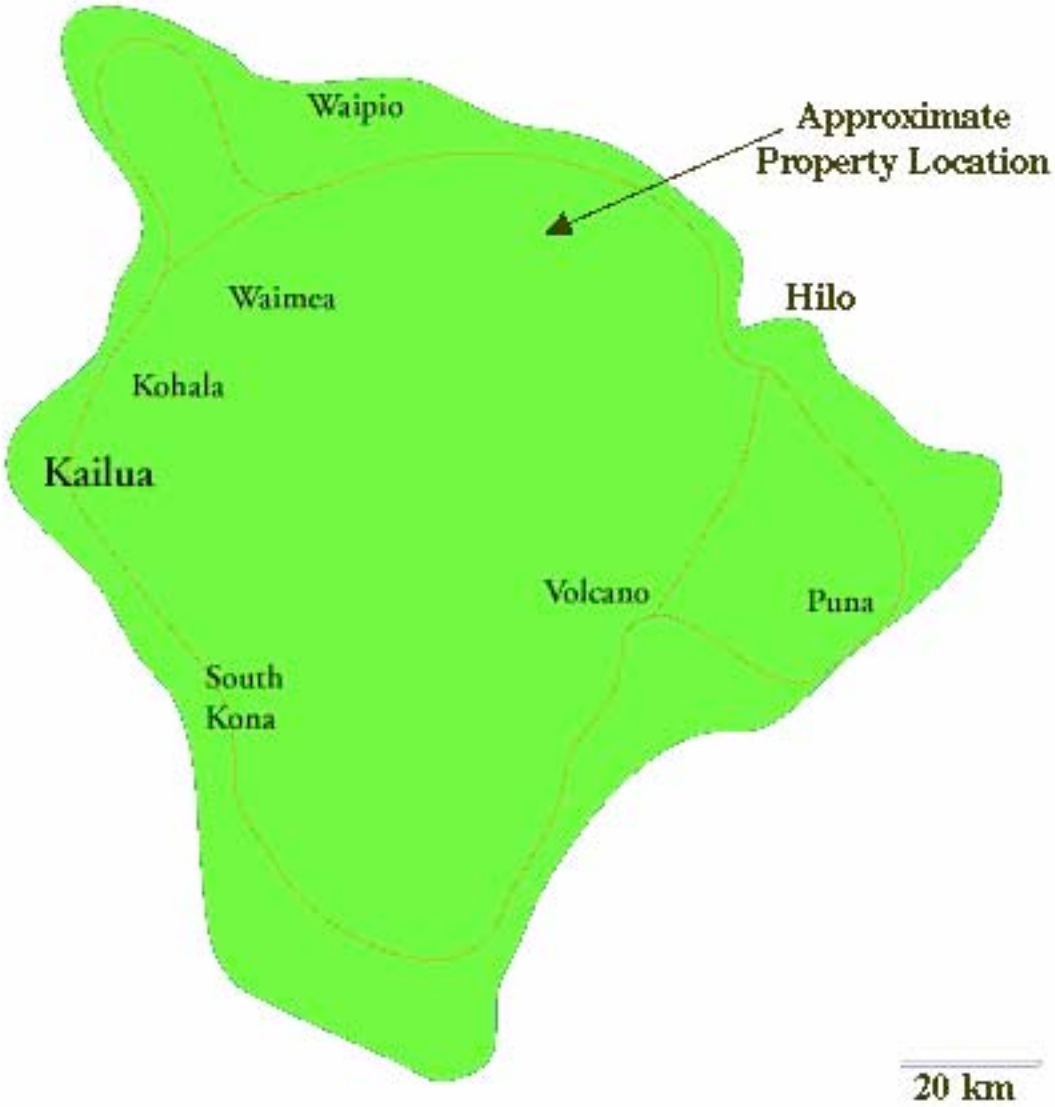
The times of most potential environmental disruption are during the first year of the project, when the new 750' fence is built and other boundary fences are upgraded. In 30 to 60 years when selective harvesting begins additional environmental disruption may occur. In the intervening decades, activities will be confined to germinating seeds, growing young trees under nursery conditions, out-planting trees, monitoring tree growth, and possibly thinning some trees out of the young forest.

Amount of State Funds
As outlined in the FSP Management Plan, the total of State funding currently projected, over the 10 year initial contract period is $86,200.

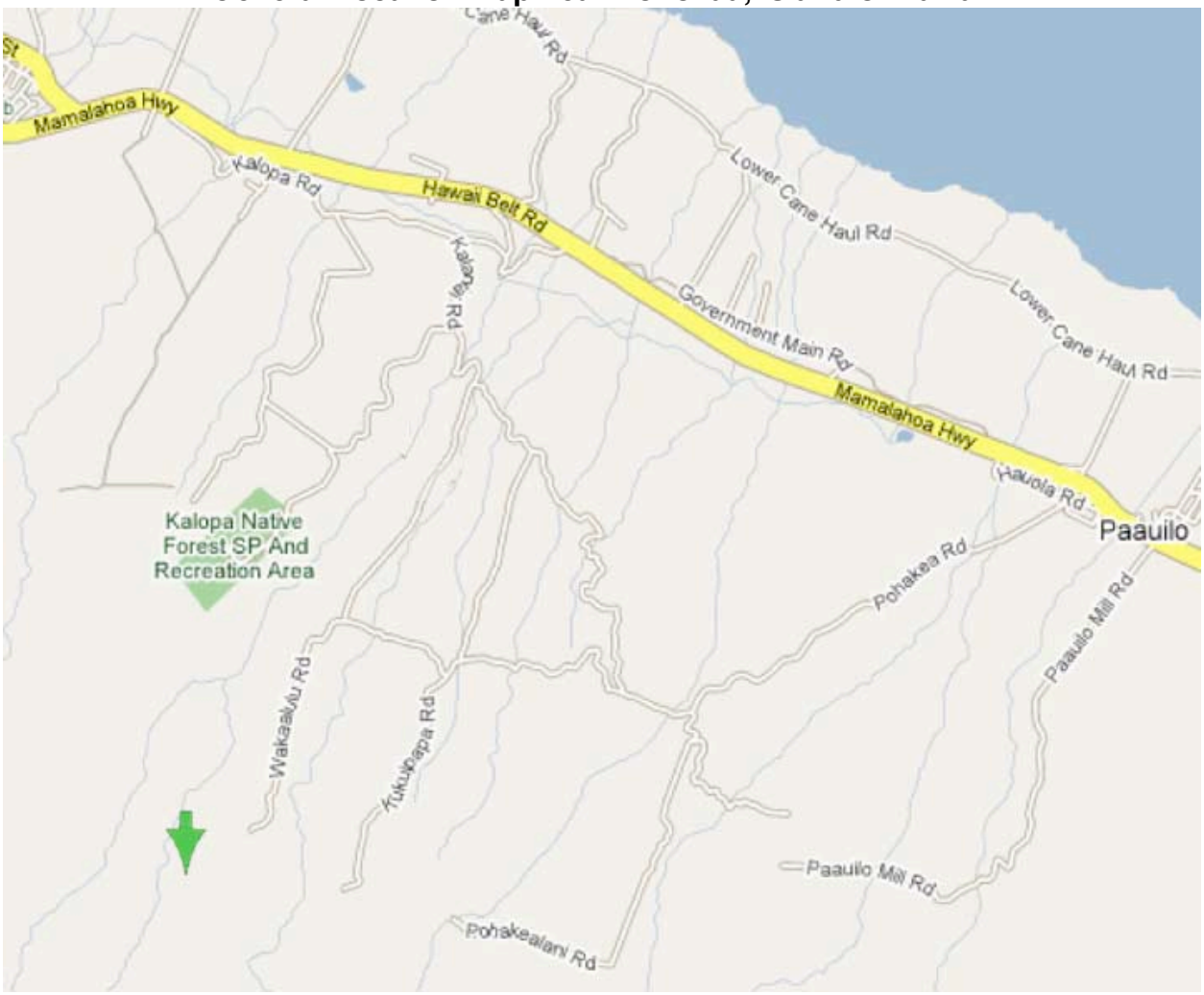
Best Management Practices
According to DOFAW, Best Management Practices (BMPs) are “effective, practical, structural or nonstructural methods which prevent or reduce the movement of sediment, nutrients, pesticides and other pollutants from the land to surface or ground water, or which otherwise protect water quality from potential adverse effects of silvicultural activities. These practices are developed to achieve a balance between water quality protection and the production of wood crops within natural and economic limitations.”

During the koa harvest period--30 to 60 years hence--current BMP's will be the guiding measurement for all harvest-related activities on the property.

III. MAPS OF PROJECT AREA

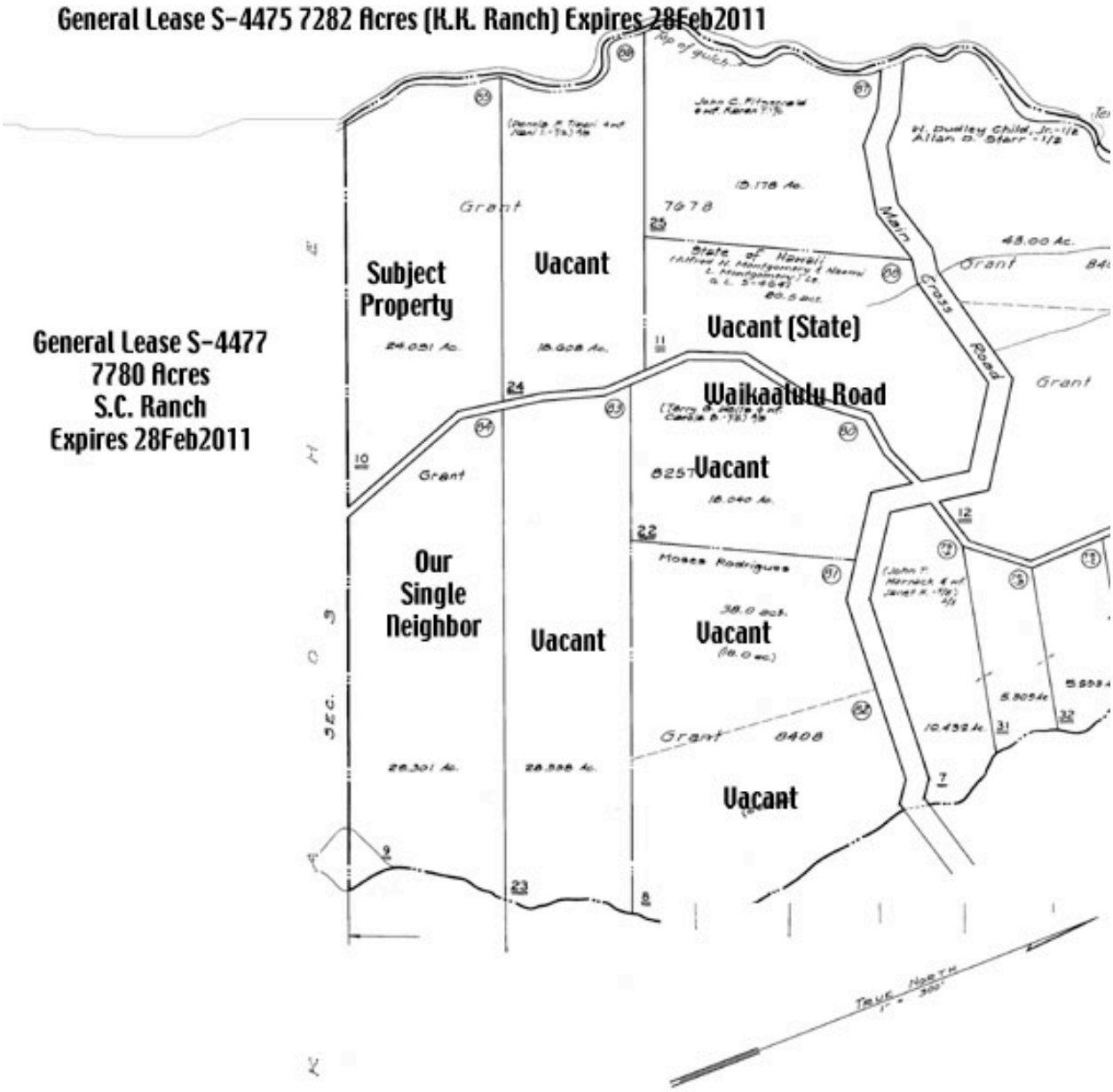


General Location Map near Honokaa, Island of Hawaii



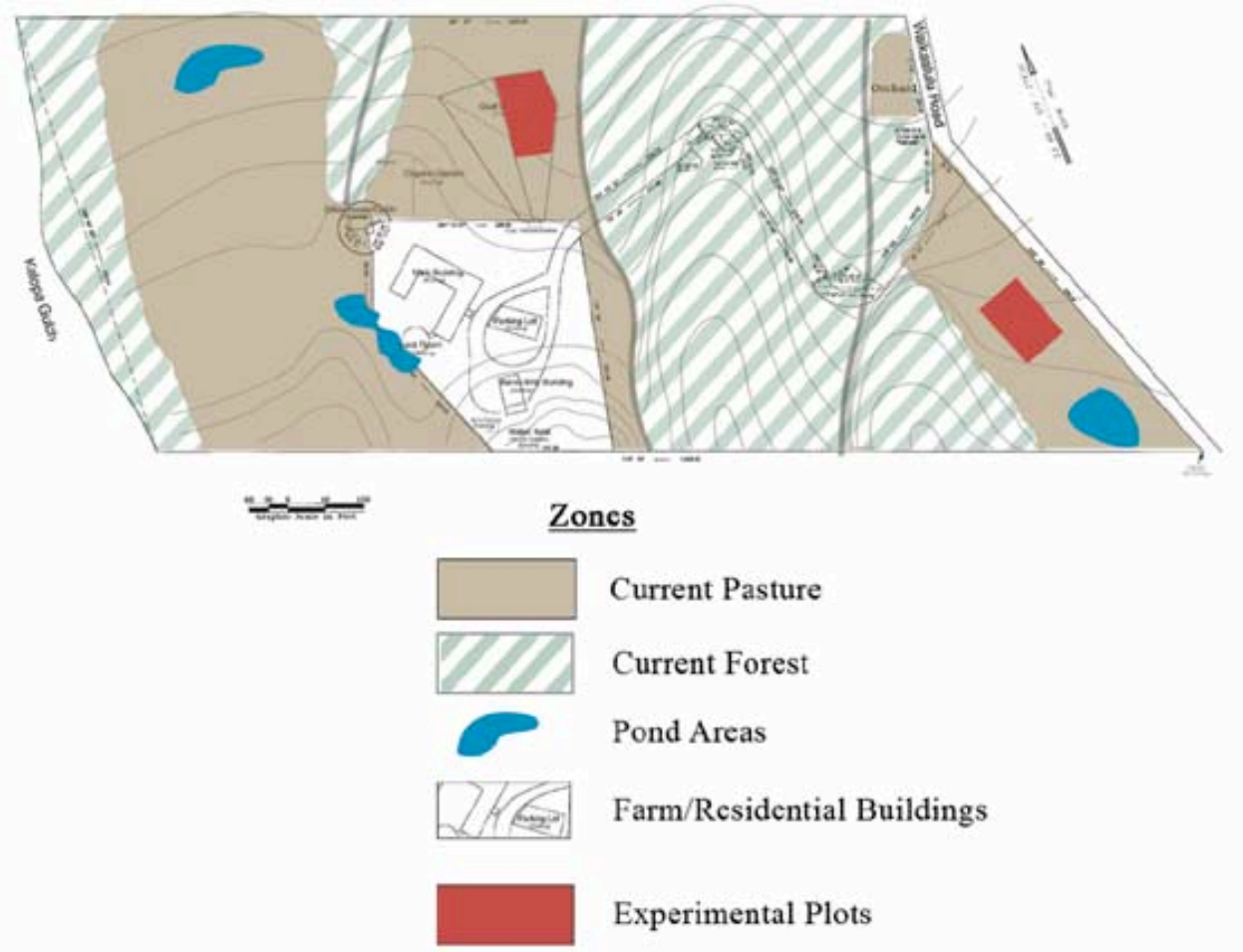
Green Pointer Indicates Subject Property

Portion of TMK Map Showing Neighboring Lands



Portion of 4-4-013 TMK Map.
State of Hawaii General Lease lands are to West and South. Upper portions of both of these General Lease parcels were recently restricted for palila (Loxoides bailleui) critical habitat mitigation purposes. Kalopa Gulch borders property on West (uppermost in this map) and continues up Mauna Kea to the South (left on map), and forms the boundary between the two blocks of State leased land.

Project/Site Map



* Colored and hatched areas (21 acres out of 24 total acres) are included in the Management Plan.

* Three gray lines represent gulches that are mostly dry except when significant rain falls.

* Three pond areas exist (in blue). Only the central pond has water year-round. The other two ponds fill only with rain and are soon dry again, so need liners.

* Elevations lines are approximate with interval of about 10'.

IV. **DESCRIPTION OF AFFECTED ENVIRONMENT**

The description of the affected environment will be discussed in two parts: 1) The construction of a fence along the Western boundary of the land; and 2) future harvest of timber.

Construction of a Ungulate Proof Fence Along Western Boundary
The project proposes to build a new fence along the Western boundary of the property. [See Project/Site Map above] The new fence will be approximately 750' long and will be 47 inch high "hogwire" fence with a single strand of 12-1/2-gauge barbwire on the top 8" above the hogwire, plus a hinged hogwire "apron" that will come halfway up the fence and then about two feet onto the ground on the outside of the fence. The apron will then be staked into the ground, forming a pig impermeable border. Posts will be approximately 10 feet apart. In addition, the fencing along the other boundaries of the property will be upgraded to above specifications, thus forming a complete pig-proof enclosure for the protection of newly planted trees, naturally recruited seedlings from existing native vegetation, and wildlife habitats.

The new fence along the Western boundary will be created in a mixed pasture/forest area. The only tree species in this area are the invasives *Psidium cattleianum* (Strawberry Guava) and *Eucalyptus Robusta*. Some of the smaller trees may need to be cut down to build the fence. These trees would be cut in any case as part of the restoration of native forests in this area.

Fence materials will be brought to areas where fence is to be built or improved by pickup truck on the subject property.

Standard fence building procedures will be followed, including digging of post holes, placement and packing of poles in the holes, stringing of hog wire along the poles, stringing of barbed wire along the top of the new fence, and staking of the apron. For the fence on the other three boundaries that is being improved, procedures will include all of the above, except that most of the existing posts are good and will be left as is.

The new fence will be near Kalopa Gulch but not placed within the Gulch area. It will be built at least 10 feet from the bank of the Gulch and thus will have no impact on the riparian waterway. The stream in Kalopa Gulch normally runs only after heavy rains.

Selective Harvest of Timber in 30 to 60 Years
The project proposes to harvest koa trees between 30 and 60 years after planting. Selective and gradual harvesting of the trees is anticipated, with the goal of maintaining a viable native forest for hundreds of years through sustainable harvest. The number of trees that can be harvested per year in this manner is currently unknown, but predictions range from 1 to 8 trees per acre per year (starting after the initial 30 to 60 year initial growth period).

Trees will be felled by standard BMP means (or any other appropriate standard at that future time), probably with the use of large chainsaws. The felling of the large Koa trees will

inevitably cause damage to other forest trees, particularly in the understory. This damage is actually beneficial to the forest as a whole, because it allows light into the understory, where smaller trees can then thrive and grow into future mature trees, thus continuing the sustainable harvest cycle. These temporal gaps between harvest supports a natural multi-story forest canopy.

Koa trees will be removed from the forest via tractor. This will cause local disruption of the soil, which will be mitigated through use of DOFAW's Best Management Practices.

Koa will be either milled on site using a portable mill, or transported to a operational mill on the Big Island. All County and State permits necessary at the time of harvest will be obtained prior to harvesting. Harvesting of trees near streams will follow the Stream Management BMP guidance

Flora, Fauna, Significant Habitats

The existing flora and fauna on the property are fully described in the FSP Management Plan (Appendix A). There are no know significant habitats for endangered species on the property or bordering the property.

A survey of existing plant species was conducted by Dr. David Clausnitzer, Pacific Islands Area Forest Ecologist, USDA-NRCS, in March 2008. Following are the results of this survey. Note that this survey does not indicate relative numbers of different species--only whether they are found on the property.

Origin: n=native, a=alien
Type: t=tree, tf=tree fern, s=shrub, h=herb, v=vine, f=fern

Scientific name	Local common name	NRCS common name	Origin	Type	NRCS Code
Metrosideros polymorpha	'ohi'a lehua	'ohi'a lehua	n	t	MEPO5
Acacia koa	koa	koa	n	t	ACKO
Charpentiera sp.	papala	papala	n	t	CHARP
Coprosma rhynchocarpa	pilo	woodland mirrorplant	n	t	CORH
Cheirodendron trigynum	olapa	olapalapa	n	t	CHTR2
Ilex anomala	kawa`u	Hawai`i holly	n	t	ILAN
Psychotria sp.	kopiko	wild coffee	n	t	PSYCH
Eucalyptus robusta	swamp mahogany	swampmahogany	a	t	EURO2
Olea europaea	olive	olive	a	t	OLEU
Psidium cattleianum	waiawi	strawberry guava	a	t	PSCA
Morella faya	faya tree	firetree	a	t	MOFA
Cibotium glaucum	hapu`u	hapu`u	n	tf	CIGL
Cibotium menziesii	hapu`u `i`i	hapu`u li	n	tf	CIME8
Cibotium chamissoi	hapu`u	Chamisso's manfern	n	tf	CICH
Pluchea carolinensis	sourbush	cure for all	a	s	PLCA10
Sida rhombifolia	cuban jute	cuban jute	a	s	SIRH
Cestrum nocturnum	night blooming jasmine	night jessamine	a	s	CENO
Peperomia sp.	`ala`ala wai nui	peperomia	n	h	PEPER
Commelina diffusa	honohono	climbing dayflower	a	h	CODI5
Ageratina riparia	Hamakua pamakani	spreading snakeroot	a	h	AGRI2

Arundina graminifolia	bamboo orchid	bamboo orchid	a	h	ARGR6
Stachytarpheta sp.		porterweed	a	h	STACH2
Hedychium gardnerianum	kahili ginger	Kahila garland-lily	a	h	HEGA
Desmodium sp.	desmodium	ticktrefoil	a	h,v	DESMO
Spathoglottis plicata	Philippine ground orchid	Philippine ground orch	a	h	SPPL
Plantago lanceolata	narrowleaf plantain	narrowleaf plantain	a	h	PLLA
Delairea odorata	German ivy	capeivy	a	v	DEOD
Rubus rosifolius	thimbleberry	West Indian raspberry	a	v	RURO
Christella parasitica			a	f	
Deparia sp.		false spleenwort	a/n	f	DEPAR
Blechnum appendiculatum	blechnum fern	hammock fern	a	f	BLOC
Adiantum hispidulum	rough maidenhair fern	rough maidenhair	a	f	ADHI
Microlepia strigosa	palapalai	palapalai	n	f	MIST4
Asplenium sp.		spleenwort	n	f	ASPLE
Dryopteris wallichiana	Wallich's woodfern	alpine woodfern	n	f	DRWA
Psilotum complanatum	moa nahele	flatfork fern	n	f	PSCO3
Dryopteris sp.	woodfern	woodfern	n	f	DRYOP
Sphenomeris chinensis	pala`a	Chinese creepingfern	n	f	ODCH
Dicranopteris linearis	uluhe	Old World forkedfern	n	f	DILI
Nephrolepis multiflora	scaly swordfern	scaly swordfern	a	f	NEHI
Nephrolepis cordifolia	narrow swordfern	narrow swordfern	a	f	NECO3
Anthoxanthum odoratum	sweet vernalgrass	sweet vernalgrass	a	g	ANOD
Holcus lanatus	velvetgrass	common velvetgrass	a	g	HOLA
Microlaena stipoides	meadow ricegrass	weeping grass	a	g	MIST
Paspalum conjugatum	hilograss	hilograss	a	g	PACO14
Pennisetum clandestinum	kikuyugrass	kikuyugrass	a	g	PECL2
Schizachyrium condensatu	beardgrass	Colombian bluestem	a	g	SCCO10
Andropogon virginicus	broomsedge	broomsedge bluestem	a	g	ANVI2
Sporobolus indicus	smut grass	smut grass	a	g	SPIN4

Archeological and Cultural Sites

The property contains no known archeological or cultural sites. In addition, no cultural practices have been observed on or near the property. No cultural practices or sites were identified by consulted parties during pre-consultation (see section titled Agencies and Community Groups Consulted below) that might be impacted by the building of the fence, nor the planting and eventual harvesting of koa.

V. IMPACTS AND MITIGATION MEASURES

Soil

The proposed project is expected to have positive benefits for soil quality. Koa trees are nitrogen fixers and provide a rich source of nitrogen for most forest plants. The establishment of a mature koa forest will also reduce soil erosion.

Soil will be disrupted during harvest operations in 30 to 60 years, and these will be mitigated through adherence to DOFAW's Best Management Practices. It will also be disturbed during creation of the fenceline, however it will be a slight disturbance.

Water

The proposed project is expected to have positive benefits for water quality. Vibrant forests retain rain water, thus reducing runoff and recharging aquifers.

Water quality is the main concern of BMPs, and these practices will be followed closely upon tree harvesting and fence building to mitigate any negative impact on water quality caused by felling, use of large equipment (e.g. bulldozers), and bucking trees.

Flora & Fauna

The proposed project will greatly benefit the flora & fauna by restoring native forest and associated habitat, including koa and understory plants, as outlined in the FSP Management Plan (Appendix A).

Historical and Archeological Resources

The proposed project is not expected to have any negative impacts on historical or archeological resources, as no such resources are known to exist on the property.

Cultural Resources

The proposed project is expected to have positive impacts on cultural resources. Koa forests are, in themselves, a cultural resource as well as the native birds they support, and these resources will be shared with the Hawaiian community.

Economic Impacts

The proposed project is expected to have positive impacts on economic resources. The project will contribute to the agricultural community and will provide a sustainable timber source, which aligns it fully with State and County zonings and designations.

The proposed project will employ the following types of workers: tree planters, foresters, lumberjacks, mill workers, fence contractors, and consultants.

VI. ALTERNATIVES CONSIDERED

No Action Alternative

The no action alternative would mean leaving the land as is. This would allow alien species to continue their invasion of the existing native forest on the property, thus degrading that habitat, and would not allow the native koa forest to be re-established except through natural regeneration of the trees. In addition, the no action alternative would negate all of the benefits outlined in the section above, including improved soil quality, improved water quality, improved habitat for native species, and the economic benefits. Therefore, the no action alternative is less beneficial than the proposed project.

Don't Build New Fence or Improve Existing Fences

In this alternative, the forestry component is carried out (planting and eventual harvesting) without building the new fence or improving the existing fence. The primary purpose of the fence is to keep feral ungulates and animals out of the 24 acre parcel. Pigs are very fond of any newly dug-out dirt, and thus are a danger to newly planted trees. Their presence makes planting new trees problematic. Dogs are dangerous to both native and non-native birds. Since one of the goals of the proposed project is to improve habitat for native species (including birds), the presence of dogs on the property is problematic. Since the actual building of the new fence and the improvement of the existing fence have no negative impact, the "don't build new fence or improve existing fences" is less beneficial than the proposed project.

Proposed Action

Under the Proposed Action alternative, both the forestry component and the building of the new fence and improvement of existing fence are carried out. Under this alternative, alien species are removed from the project area, native forest is re-established, soil and water quality are improved, habitat for native species is created and/or improved, and the economic benefits of future timber harvest are accrued. As such, this alternative is the most beneficial of the alternatives considered.

VII: ANTICIPATED DETERMINATION, WITH FINDINGS AND REASONS SUPPORTING

A finding of No Significant Impact (FONSI) is anticipated, based on the project meeting the following criteria:

1) The proposed project does not involve an irrevocable commitment to loss or destruction of any natural or cultural resource. Instead, the proposed project will both reverse the loss of native koa forests through extensive planting of koa and other native species, and it will get rid of many invasive species that threaten the health of native forests. In addition, cultural plant resources will be enhanced by the proposed project.

2) The proposed project does not curtail the range of beneficial uses of the environment. Instead, the proposed project will increase beneficial uses by restoring native koa forest, creating new habitat for native flora and fauna, and enhancing the quality of the Mauna Kea watershed which will have a positive impact far downstream.

3) The proposed project does not conflict 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 project is consistent with and furthers the environmental policies established in Chapter 344 and contributes to the conservation of threatened and endangered species by increasing the acreage of native forest available as habitat for these species.

4) The proposed project does not substantially negatively affect the economic or social welfare of the community and state. Indeed, the proposed project is expected to positively affect the economic and social welfare of the community and state by providing jobs (for the planting and growing of trees and the eventual harvest of the timber), educational opportunities (through community outreach), and direct economic benefit through the eventual sale of the native timber.

5) The proposed project does not substantially affect public health. Indeed, the proposed project may have a positive affect by increasing the quality of the Mauna Kea watershed and by removing carbon dioxide (a greenhouse gas) from the atmosphere. All activities pertaining to this project will be performed in accordance with the State's Best Management Practices (BMP).

6) The proposed project does not involve substantial secondary impacts such as population changes or effects on public facilities. Conditions in the area will essentially remain the same for decades. After 30 to 60 years, selective harvest of timber is anticipated (perhaps 2 to 8 trees per acre per year). When harvesting is done, it will be conducted in accordance with the State's Best Management Practices in effect at that time.

7) The proposed project does not involve a substantial degradation of environmental quality. Indeed, environmental quality is expected to improve due to the creation of new native forest areas, the provision of habitat for native flora and fauna, the improvement in water capacity and qualit, and the sequestering of carbon dioxide (a greenhouse gas) that the new trees will provide. In addition, all project actions will be conducted in accordance with the State's Best Management Practices.

8) The proposed project does not have considerable cumulative adverse effects. Indeed, the proposed project is expected to have considerable cumulative positive effects, including the development of a seed bank for koa, and the provision of new wildlife habitat for endangered species which can act as a sanctuary and springboard for further species recovery.

9) The proposed project does not substantially affect a rare, threatened, or endangered species, or its habitat. Indeed, the goals of the proposed project are to create an environment that can act as a sanctuary for rare, threatened, or endangered species. The proposed project is expected to enhance the quality and quantity of native forest habitat, and possibly benefit native species in this way.

10) The proposed project does not detrimentally affect air or water quality or ambient noise levels. Indeed, the proposed project is expected to enhance the quality of both air and water in the long-term, through the planting and maintenance of native forests, which have positive impacts on both air and water quality. Some ambient noise is expected in 30 to 60 years when timber harvest is expected, but this will be transient and short-term.

11) The proposed project does not affect nor is likely to suffer damage by being 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 project is not located in or near environmentally sensitive areas as indicated here.

12) The proposed project does not substantially affect scenic vistas and view planes identified in county or state plans or studies. The proposed project is on isolated private land and no such scenic vistas or view planes, as identified by county or state plans or studies, are known or are likely to exist in this area.

13) The proposed project does not require substantial energy consumption. The proposed project will consume small amounts of fuel for tractors and farm vehicles used for fence building and, in 30 to 60 years, timber harvest.

VIII. LIST OF PERMITS, VARIANCES AND APPROVALS REQUIRED FOR PROJECT

No permits are known to be required for the building of the fence or the future harvesting of timber.

IX: AGENCIES AND COMMUNITY GROUPS CONSULTED

Prior to the development of this Environmental Assessment, the following consultations took place with federal and state agencies, with the local community association, and with others. These are divided into two sections. The first documents Site Visits by various Resource Consultants, most from federal and state agencies. The second documents other consultations via email, phone, or other personal communications.

Site Visits by Agencies and Others

Date of Visit	Resource Consultants
Mar 1, 2007	• Ryan Peralta, Service Forester, DOFAW (Hilo Branch), DLNR, State of Hawaii
Jun 28, 2007	• Sheri S. Mann, Cooperative Resource Management Forester, DOFAW, DLNR, State of Hawaii • M. Irene Sprecher, Forester, DOFAW, DLNR, State of Hawaii
Jan 10, 2008	• Donna Ball, Fish & Wildlife Biologist USFWS (Hakalau) • Kimberyly Uyehara, Consultant, Natural Resources Conservation Service
Jan 30, 2008	Matt Wung, District Conservationist, Natural Resources Conservation Service
Feb 12, 2008	• Donna Ball, Fish & Wildlife Biologist USFWS (Hakalau) • Jennifer Higashino, Coordinator, Mauna Kea Watershed Partnership
Mar 11, 2008	• Dr. David Clausnitzer, Pacific Islands Area Forest Ecologist, USDA-NRCS • Matt Wung, District Conservationist, Natural Resources Conservation Service • David Matsuura, Umikoa Ranch
Mar 21, 2008	• Dr. David Clausnitzer, Pacific Islands Area Forest Ecologist, USDA-NRCS
Apr 24, 2008	• Dr. David Clausnitzer, Pacific Islands Area Forest Ecologist, USDA-NRCS • Steve Coffee, Educational Director, Tropical Reforestation and Ecosystems Education (TREE), Kona • Students from Cornell University, accompanying Dr. Clausnitzer

Other Consultations

* Landowner Assistance Workshop, Hilo, December 2007 (four people associated with Subject Property attended): Discussions with Laura Brezinsky, J.B. Friday, Donna Ball, Sheri Mann, Jennifer Higashino, NRCS personnel
* J.B. Friday, CATHR - various email communications
* Laura Brezinsky, UH Hilo - email communications
* Donna Ball, USFWS - various email & phone communications
* Mike Robinson, Forester, Hawaiian Home Lands - phone communications
* Tai Lake, President, Big Island Woodworkers Guild - phone communications
* State Historic Preservation Division - phone communication & attached letter

Ahu Lani Sanctuary

State of Hawaii
Forest Stewardship
Program

Management Plan

Applicant and Property Information

Applicant Names:	John Lindelow, Roz Rapozo, Sally Klemm
Mailing Address:	PO Box 61449, Honolulu, HI 96839
Property Address:	44-5350 Waikaalulu Road, Honokaa, HI 96727
Email:	cybernet@lava.net
Phone:	808-554-0448
FAX:	808-356-0416
Tax Map Key Number:	4-4-013-010
State and County Zone designation:	Ag 5
Elevation:	2900-3000'
Rainfall:	100"/year
Slope:	gently sloping with ~10% average grade
Total Property Acreage:	24 Acres
Acres of Proposed Stewardship Management Area:	21 acres
Consultants	The owners consulted with a variety of state and federal biologists and consultants in the preparation of this Management Plan. A list of these biologists and consultants can be found on the Signature Page section of this Plan.
Date Management Plan Completed	June 2008

Forest Stewardship Plan Signature Page

Applicant Certification: I have prepared this Forest Stewardship Plan in accordance with the advice of the Resource Professionals noted below, and hereby certify that I concur with the recommendations contained within. I agree that resource management activities implemented on the lands described shall be done so in a manner consistent with the practices recommended herein.

Applicant's Signature/Date:

Applicant's Name: John Lindelow

Site Visits by Resource Consultants:

Date of Visit	Resource Consultants
3/1/2007	• Ryan Peralta, Service Forester, DOFAW (Hilo Branch), DLNR, State of Hawaii
6/28/2007	• Sheri S. Mann, Cooperative Resource Management Forester, DOFAW, DLNR, State of Hawaii • Melissa Sprecher, Forester, DOFAW, DLNR, State of Hawaii
1/10/2008	• Donna Ball, Fish & Wildlife Biologist USFWS (Hakalau) • Kimberyly Uyehara, Consultant, Natural Resources Conservation Service
1/30/2008	• Matt Wung, District Conservationist, Natural Resources Conservation Service
2/12/2008	• Donna Ball, Fish & Wildlife Biologist USFWS (Hakalau) • Jennifer Higashino, Coordinator, Mauna Kea Watershed Partnership

3/11/2008	• Dr. David Clausnitzer, Pacific Islands Area Forest Ecologist, USDA-NRCS • Matt Wung, District Conservationist, Natural Resources Conservation Service • David Matsuura, Umikoa Ranch
3/21/2008	• Dr. David Clausnitzer, Pacific Islands Area Forest Ecologist, USDA-NRCS
4/24/2008	• Dr. David Clausnitzer, Pacific Islands Area Forest Ecologist, USDA-NRCS • Steve Coffee, Educational Director, Tropical Reforestation and Ecosystems Education (TREE), Kona • Students from Cornell University, accompany Dr. Clausnitzer

Other Consultations:

- Landowner Assistance Workshop, Hilo, December 2007 (four people associated with Subject Property attended): Discussions with Laura Brezinsky, J.B. Friday, Donna Ball, Sheri Mann, Jennifer Higashino, NRCS personnel
- J.B. Friday, CATHR - various email communications
- Laura Brezinsky, UH Hilo - email communications
- Donna Ball, USFWS - various email & phone communications
- Mike Robinson, Forester, Hawaiian Home Lands - phone communications
- Tai Lake, President, Big Island Woodworkers Guild - phone communications

State Forester's Approval: This plan meets the criteria established for Forest Stewardship Plans by Hawaii's Forest Stewardship Advisory Committee. The practices recommended in the plan are eligible for funding according to state of Hawaii Forest Stewardship Program guidelines and administrative rules.

Approved by:

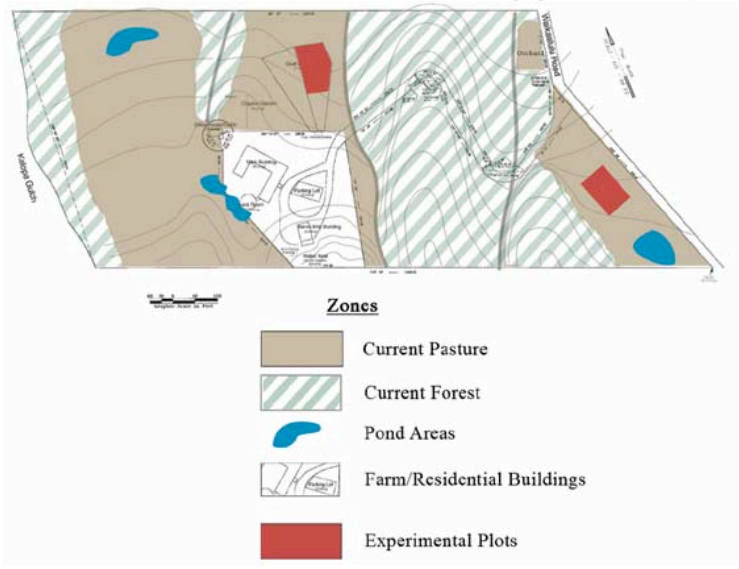
State Forester's Signature/ Date:

State Forester's Name:

Introduction

Property Map & Description

The property lies in the Kalopa watershed, Hamakua District, in the southwest corner of Kaapahu Homestead, adjacent to Kalopa Gulch at 2900-3000 ft elevation. The total land area is 24 acres, and is divided into five zones for the purposes of this Management Plan, as indicated in the map below.



- Current Pasture Land: Approximately 10 acres consists of former pasture land. Koa and associated native species will be planted on most of this land. This land is slowly being invaded by Euclyptus Robusta and Psidium cattleianum.
- Current Forest: Approximately 10 acres consists of old growth native ohi'a (`ohi`a/uluhe, *Metrosideros/Dicranopteris*) forest with a primarily non-native understory due to former grazing. The understory varies from solid native ferns to solid Kikuyu grass *(Pennisetum elandestinum)* and other invasives.
- Pond Areas: The pond nearest the central buildings is permanent. The other two pond areas hold water only after significant rain.
- Farm/Residential Buildings: In addition to native ohi'a and planted koa and other notive species, this 3 acre area contains a wide range of non-native plants that were planted by previous and current owners. This area also contains our tree nursery areas, where we germinate, plant, and grow seedlings of koa and other species.

- Experimental Plots: Two areas totally about 1 acre are being set aside for experimental forestry plots. We may grow other hardwoods in these areas, and/or experiment with "accelerating" the growth of quality koa timber.

The area encompassed by this Management Plan is the 21 acres consisting of Current Pasture, Current Forest, and Experimental Plots, plus the Pond Areas embedded in the Current Forest zone. Different strategies and goals apply to each zone, as explained further below.

Bordering the property on the west is Kalopa Gulch. This gulch has been fully invaded by Eucalyptus Robusta. Kalopa Stream runs after significant rain only.

The main access road winds through the ohi'a forest to the house area from Waikaalulu Road on the East edge of the map. The grey vertical lines represent usually dry stream beds through often steep gulches. A few koa managed to survive in those gulches, probably because they could not be reached by grazing cattle. These koa now form part of our native seed bank.

Forest Management Objectives

Our management objectives are as follows:

- **Growth and management of forests for timber and other forested products.** We intend to harvest koa in decades to come from the Current Pasture and Current Forest zones, and possibly from the Experimental Plots zone, depending on what we actually plant there.
  - Current Pasture: Koa will be planted throughout the former pasture lands at a high density from seedlings, together with a variety of native understory plants.
  - Current Forest: Koa will be planted within the existing ohi'a forest, together with a variety of native understory plants. The seedlings planted in this area will be "head started" in our nursery area (for example until 4 feet tall), because once under the ohi'a canopy they will grow much slower due to the lack of light.
  - Experimental plots: We may experiment, for example, with very dense seeding with koa and study the self-pruning and self-thinning of the koa trees as they grow.
- **Development of a database on koa growth and tree characteristics.** We intend to document and track throughout its life each individual koa tree we plant. Items tracked will include seed source, germination method, germination rate, innoculation technique, initial potting soil, time spent in pots or tubes, date of germination, dates of re-potting, date and method of planting in ground, location of planting, conditions of forest and soil at time of planting, rainfall thoughout life span, periodic measurements of growth (height and diameter), acquisition of diseases, special circumstances that might impact growth rate (e.g. damage from windstorms, fires, or floods), and other factors as they occur to us.
- **Native Species restoration and habitat improvement.** We have a very good starting point in that a healthy ohi'a forest already exists on approximately one third of the property. Our goal is to diversity this ohi'a forest by planting koa within it as well as a variety of native understory plants to include olapa, kawa'u, pilo, and kopiko;. In addition, we intend to plant koa in most of remaining areas (consisting of former pasture land) as a first step toward restoration of native forests in those areas. As the koa canopy grows in the former pasture areas, we will plant native understory plants such as olapa, kawa'u, pilo, and kopiko.
- **Aggressive elimination of invasive species accomplished by perimeter fence, ongoing alien weed control and planting of native species in remaining light gaps.** We intend to eliminate invasives from most areas of the land and grow only native plants within the ohi'a-koa forests. Methods of elimination will include perimeter fencing to keep out ungulates and manual cutting of invasive plants with selective application of herbicides to stumps. We also anticipate becoming an ideal site for the growth and propogation of endangered Hawaii forest plants.
- **Wildlife habitat enhancement**, especially for native bird species such as the Hawaiian Duck or koloa (Anas wyvilliana) and nene (Branta sandwicensis).
- **Watershed, Riparian, and/or Wetland Protection and Improvement**. (3 pond areas and Kalopa Gulch area). We believe that the protection and recovery of riparian areas is key to the recovery of the overall native Hawaiian forest.
- **Forestry Education.** We would like to provide a setting for experiential education for elementary and secondary schools in the areas of forestry, sustainable agriculture, and forestry. In addition, we would like to provide a setting for internships for foresters studying at the University of Hawaii at Hilo.
- **Community outreach and Education.** We are already working with neighbors and the local community association as a resource for information on landowner assistance programs, and gave a presentation to the Paauilo-Mauka Kalopa Community Assocation (http://pmkca.org) in early 2008.
- **Enhancing forest recreation opportunities** by maintaing existing hiking/walking trails on the property, and by providing opportunities for school groups and local community members to walk and experience the land, and plant a few trees.

Historical Use of Land

	Pasture	Crop Land	Sugar Cane	Range Land	Forest Grazed	Forest Non-Grazed	Residential
Historic	X			X	X	X	X
Current						X	X
Proposed						X	X

The current owners have owned the land for 5 years. The previous owner owned it for about 10 years. Both sets of owners did not allow cows or horses on the land for grazing, so it has been out of pasture for at least 15 years. The good condition of the ohi'a forest areas suggests that it may have been longer than that.

The land was never used for sugar production (too high) or other crop agriculture as far as we know. It was in all likelihood originally covered in native forest and suffered the same fate as most other forest land on the North slope of Mauna Kea: use as grazing land and subsequent deforestation.

Present Conditions

The current landowners have been implementing a variety of forest stewardship practices without external funding over the past five years including:

- Suppression of invasive species
- Planting of koa and other native plants
- No harvesting of ohi'a or other native trees
- Maintaining existing fences (although unsuccessful with pigproofing)
- Active trapping of mongoose
- Maintenance of mowed paths through property
- No pasture grazing
- Development of greenhouse and nursery areas for seed germination and seedling growth

These practices were also followed by the previous owner, so the property has had about 15 years of stewardship.

Land & Resource Description

Existing Vegetation

The area proposed for management is comprised of about 10 acres of native `Ohi`a/hapuu forest and 11 acres of open, former pasture land with alien grasses. The dominant tree fern is Cibotium glaucum.

- Two old growth koa (approx 30" diameter), one of which has dropped lots of seed pods over the years and whose seed we are now experimentally germinating.
- Two tall straight koa in gluches (approx 16-20" diameter) that have seed pods on upper branches.
- A dozen or so koa planted by the previous owner and probably 10-15 years old with maximum height of approx. 35 feet.
- About 50 koa trees planted by the current owners and 2-4 years old with maximum height of approx. 15 feet.

A healthy koa seed bank exists in various parts of the land, as evidenced by the emergence of a koa seedling in an area that was scraped by our tractor about a year ago (to remove other, undesirable vegetation), and by the growth of koa seedlings beneath some of the existing, established koa trees.

Other native species that have been identified include akala (Rubus hawaiensis, Hawaiian raspberry), maia (Musaceae, banana), kalo (Colocasia esculenta), palapalai (Microlepia strigosa, lace fern), hapuu (Cibotium splendens, tree fern), palaa (Sphenomeris chinensis, another lace fern), awa (Piper methysticum, kava), maile (Alyxia oliviformis), ilima (Sida fallax), and ama'u (Sadleria cyatheoides).

Plant Survey
In March of 2008, Dr. David Clausnitzer, Pacific Islands Area Forest Ecologist, USDA-NRCS, created the following cursory plant survey based on his walks on the property.

Keys: **Origin:** n=native, a=alien **Type:** t=tree, tf=tree fern, s=shrub, h=herb, v=vine, f=fern

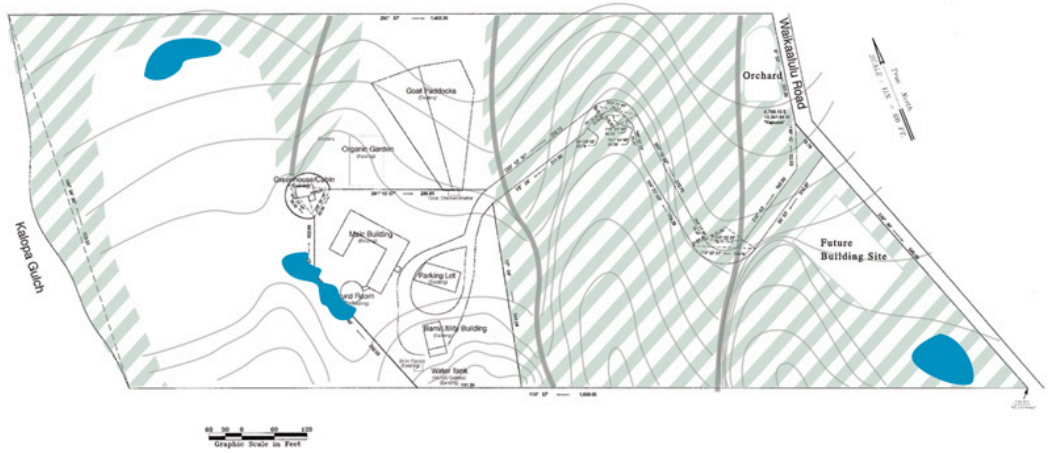
	Local	NRCS			NRCS
Scientific name	**common name**	**common name**	**Origin**	**Type**	**Code**
Metrosideros polymorpha	'ohi'a lehua	'ohi'a lehua	n	t	MEPO5
Acacia koa	koa	koa	n	t	ACKO
Charpentiera sp.	papala	papala	n	t	CHARP
Coprosma rhynchocarpa	pilo	woodland mirrorplant	n	t	CORH
Cheirodendron trigynum	olapa	olapalapa	n	t	CHTR2
Ilex anomala	kawa`u	Hawai`i holly	n	t	ILAN
Psychotria sp.	kopiko	wild coffee	n	t	PSYCH
Eucalyptus robusta	swamp mahogany	swampmahogany	a	t	EURO2
Olea europaea	olive	olive	a	t	OLEU
Psidium cattleianum	waiawi	strawberry guava	a	t	PSCA
Morella faya	faya tree	firetree	a	t	MOFA
Cibotium glaucum	hapu`u	hapu`u	n	tf	CIGL
Cibotium menziesii	hapu`u `i`i	hapu`u li	n	tf	CIME8
Cibotium chamissoi	hapu`u	Chamisso's manfern	n	tf	CICH
Pluchea carolinensis	sourbush	cure for all	a	s	PLCA10
Sida rhombifolia	cuban jute	cuban jute	a	s	SIRH
Cestrum nocturnum	night blooming jasmine	night jessamine	a	s	CENO
Peperomia sp.	`ala`ala wai nui	peperomia	n	h	PEPER
Commelina diffusa	honohono	climbing dayflower	a	h	CODI5
Ageratina riparia	Hamakua pamakani	spreading snakeroot	a	h	AGRI2
Arundina graminifolia	bamboo orchid	bamboo orchid	a	h	ARGR6
Stachytarpheta sp.		porterweed	a	h	STACH2
Hedychium gardnerianum	kahili ginger	Kahila garland-lily	a	h	HEGA
Desmodium sp.	desmodium	ticktrefoil	a	h,v	DESMO
Spathoglottis plicata	Philippine ground orchid	Philippine ground orchid	a	h	SPPL
Plantago lanceolata	narrowleaf plantain	narrowleaf plantain	a	h	PLLA

Delairea odorata	German ivy	capeivy	a	v	DEOD
Rubus rosifolius	thimbleberry	West Indian raspberry	a	v	RURO
Christella parasitica			a	f	
Deparia sp.		false spleenwort	a/n	f	DEPAR
Blechnum appendiculatum	blechnum fern	hammock fern	a	f	BLOC
Adiantum hispidulum	rough maidenhair fern	rough maidenhair	a	f	ADHI
Microlepia strigosa	palapalai	palapalai	n	f	MIST4
Asplenium sp.		spleenwort	n	f	ASPLE
Dryopteris wallichiana	Wallich's woodfern	alpine woodfern	n	f	DRWA
Psilotum complanatum	moa nahele	flatfork fern	n	f	PSCO3
Dryopteris sp.	woodfern	woodfern	n	f	DRYOP
Sphenomeris chinensis	pala`a	Chinese creepingfern	n	f	ODCH
Dicranopteris linearis	uluhe	Old World forkedfern	n	f	DILI
Nephrolepis multiflora	scaly swordfern	scaly swordfern	a	f	NEHI
Nephrolepis cordifolia	narrow swordfern	narrow swordfern	a	f	NECO3
Anthoxanthum odoratum	sweet vernalgrass	sweet vernalgrass	a	g	ANOD
Holcus lanatus	velvetgrass	common velvetgrass	a	g	HOLA
Microlaena stipoides	meadow ricegrass	weeping grass	a	g	MIST
Paspalum conjugatum	hilograss	hilograss	a	g	PACO14
Pennisetum clandestinum	kikuyugrass	kikuyugrass	a	g	PECL2
Schizachyrium condensatum	beardgrass	Colombian bluestem	a	g	SCCO10
Andropogon virginicus	broomsedge	broomsedge bluestem	a	g	ANVI2
Sporobolus indicus	smut grass	smut grass	a	g	SPIN4

The existing forested land corresponds fairly closely with the shaded area on the sketch of the property, below. The dominant tree is ohi'a, with an understory of hapuu, akala, and various lace ferns, plus various invasives in some areas (see below). Existing koa (both old growth and most newly planted) grows within the ohi'a forest and in open pasture areas.

Existing Forest Health & Function

In general, the ohi'a forested areas are quite healthy and robust. Additional photos of the land can be found at this link: http://ahulani.com/photos1/photos1.html.



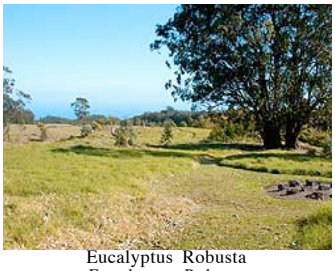
Invasive species include Eucalyptus robusta and strawberry guava (Psidium cattleianum) which primarily inhabit the west end of the property along and within Kalopa Gulch. There is also some strawberry guava that has invaded the main parts of the ohi`a forest (primarily the ridges). The eucalyptus growth that comes up Kalopa Gulch ends at the mauka end of our property. Other non-native species have been planted in controlled garden and orchard areas, including a variety of fruit trees, flowers, and garden vegetables.

Strawberry Guava
Psidium cattleianum

German Ivy
*Senecio mikanioides*or
Delairea odorata

Monstera
Monstera deliciosa

Kahili Ginger
Hedychium gardnerianum



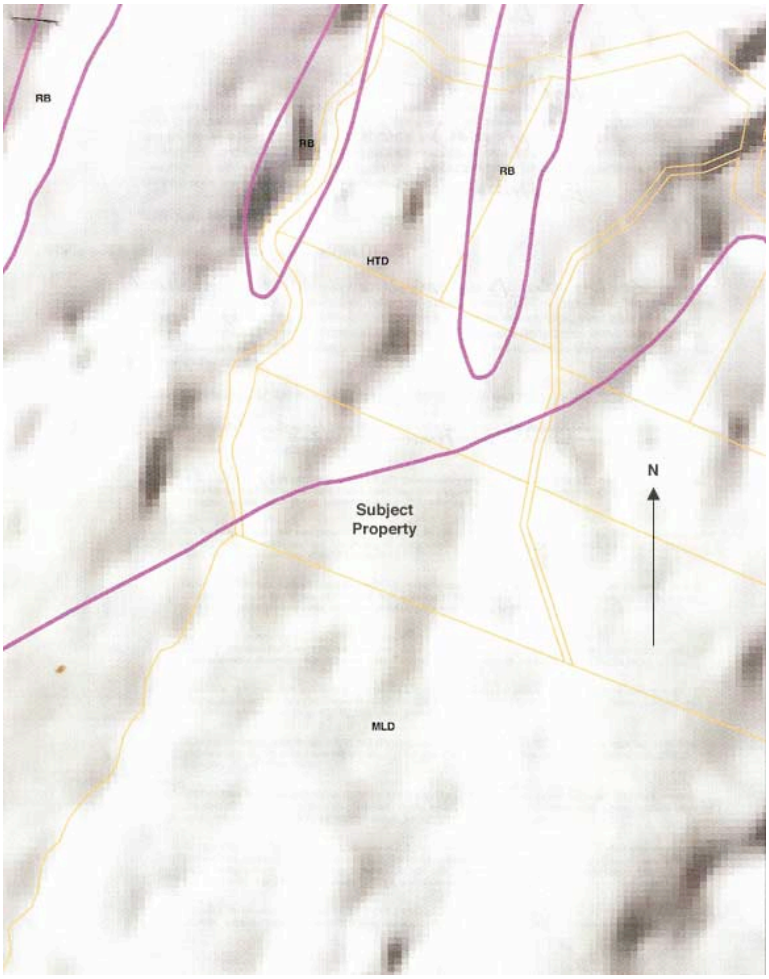
Eucalyptus Robusta
Eucalyptus Robusta

Fire Tree
Myrica faya

Soils, Slope, Aspect

The property is gently sloping with a 10-15% average grade, on the North slope of Mauna Kea at approximately 3000' elevation.

Soil types on the property include Maile silt loam (MLD) and Honokaa silty clay loam (HTD) [see map below].



HTD soils are found in the Northwest portion of the subject property, while MLD soils are found in the remainder.
(Map courtesy of David Clausnitzer of the Natural Resources Conservation Service, Waimea Branch)

- The Maile series consists of well-drained silt loams that formed in volcanic ash. These are nearly level to moderately steep soils on uplands. They are at an elevation ranging from 2500 to 4000 feet and receive from 60 to 90 inches of rainfall annually. Their mean annual soil temperature is between 57 and 60 degrees Fahrenheit. The natural vegetation consists of ohi'a, tree fern, alapaio fern, kikuyugrass, and white clover. These soils and Honokaa, Kahua, Kikoni, Palapalai, Pun Oo, and Umikoa soils are in the same general area. Maile soils are used for pasture and woodland.
- Maile silt loam (MLD) is found at intermediate elevations on the windward side of Mauna Kea. It has a dominant slope of about 15 percent. A representative profile has a surface layer of dark reddish-brown to very dark brown silt loam aabout 14 inches thick. The susboil is about 46 inches thick. It consists of dark yellowish-brown and very dark brown silty clay loam. The subsoil dehydrates irreversibly into fine sand-size aggregates. The prfile grades from medium acid in the surface layer to slightly acid and neutral in the subsoil.
- The Honokaa series consists of well-drained silty clay loams that formed in volcanic ash. These are gently sloping to steep soils on uplands at an elevation ranging from 1000 to 3000 feet. They receive from 100 to 150 inches of rainfall annually, and their mean annual soil temperature is between 66 and 69 degrees Fahrenheit. The natural vegetation consists of guava, ohi'a, kikuyu grass, hilo grass, and broomsedge. These soils are in the same general area as Akaka, Kaiwiki, Kukaiau, Maile, and Ookala soils. Honokaa soils are used mostly for sugarcane, pasture, and woodland. Small areas are used for truck crops and orchards.
- Honokaa silty clay loam (HTD) is found low in the windward side of Mauna Kea. In a representative profile the surface layer is dark-brown silty clay loam about 6 inches thick. The subsoil also is silty clay loam. It is dark brown, very dark brown, and very dark grayish-brown and is about 59 inches thick. This soil is medium acid to slightly acid throughout the profile. It dehydrates irreversibly into fine gravel-size aggregates.

(From http://www.ctahr.hawaii.edu/soilsurvey/Hawaii/hawaii.htm)

Soil Testing
Soil testing was conducted in March & April of 2008. Six soil samples were collected utilizing methods outlined in the CTAHR publication titled "Testing Your Soil: Why and How to Take a Soil-Test Sample". The samples were taken to the CTAHR Agricultural Diagnostic Service Center at the Univsersity of Hawaii at Manoa for analysis. For each of the six samples, a basic soil nutrient test was done, and a test for nematodes was done. Following are the results of the tests:

Sample:	**1**	**2**	**3**	**4**	**5**	**6**	**"Normal"**
Collection Area:	Upper Meadow	Middle Meadow	Orchard	Mauka of Orchard	Ohi'a Forest	Former Goat Paddock	
pH:	5.0	5.1	4.9	5.4	5.1	5.1	6.15
Phosphorus (ppm):	9.8	7.4	14	45	17	22	67.5
Potassium (ppm):	14	58	79	61	3.6	25	300
Calcium (ppm):	15	152	323	303	55	132	3500

Magnesium (ppm):	21	69	79	149	36	89	700
Nematodes	Spiral Nemadodes	Spiral Nematodes	None	None	None	None	None

The following soil experts were consulted in regards to the results of these tests: 1) Raymond Uchida of CTAHR, UH at Manoa; 2) Desmond of CTAHR, UH at Manoa; and 3) Davis Clausnitzer of NRCS, Waimea branch.

According to Uchida and Clausnitzer, the pH and nutrient levels found in these samples are normal for Hawaii rain forest areas. The rain, over long periods of time, tends to leach out the alkalinizing K, Ca, and Mg, thus producing moderately acidic soil. The soils remain fertile for native forest plants, which are adapted to these conditions.

According to Desmond of CTAHR, the Spiral Nematodes (Probably *Helicotylenchus spp.)*, as found in 2 of the samples, are not a dangerous nematode for Hawaii native forest plants. Of particular note is that none of the samples had evidence of root-knot nematodes *(Meloidogyne incognita) and M. javanica)*, which can be harmful to Acacia koa.

Water Resources and Condition

The property is in an area that receives approximately 100" of rain per year. There are three ponds, but only one that is permanent--the other two drain out rapidly after rains. Living structures are on catchment. Kalopa Gulch makes up the western boundary of the land, and has flowing water only when heavier rains occur up slope. The smaller streams through the property also flow nicely when heavier rains occur.

Timber Resources

The property currently has viable ohi'a timber resources and some koa resources, as described above.

Wetland Resources

The property contains three pond areas (see map above), which we are interested in developing as viable habitat for the Hawaiian duck (Anas wyvilliana). The central pond is a permanent pond that exists year-round. Blue herons are occasionally seen at this pond. The ponds in the southeast and northwest corners of the property currently have water only after rains. They need to be lined to hold water and become permanent or semi-permanent ponds.

In addition, Kalopa Gulch runs on the western boundary of the property, which has stands of water most of the time, and is a running stream or even torrent during periods of heavier rain.

Historical/Cultural Resources

No known historical or cultural resources exist on the property.

Existing Wildlife

Native birds observed on the property include`Io (Buteo solitarius), pueo (Asio flammeus sandwichensis), and possibly koloa. The Hawaiian hoary bat (Lasiurus cinereus semotus) has also been observed, primarily in the Kalopa Gulch area. Non-native birds observed include barn owl (Tyto alba), kalij pheasant (Lophura leucomelanos), ring-necked pheasant (Phasianus colchicus), blue heron, wild turkey (Meleagris gallopavo). Non-native mammals observed include mongoose (Herpestes auropunctatus), feral pig (Sus scrofa). Mongooses and cats have been actively trapped for 5 years. Feral pigs continue to be a major problem.

Threatened/Endangered Species

Threatened or Endangered species that have been observed include hoary bat, pueo, io, and possibly koloa duck.

Existing Recreational & Aesthetic Values

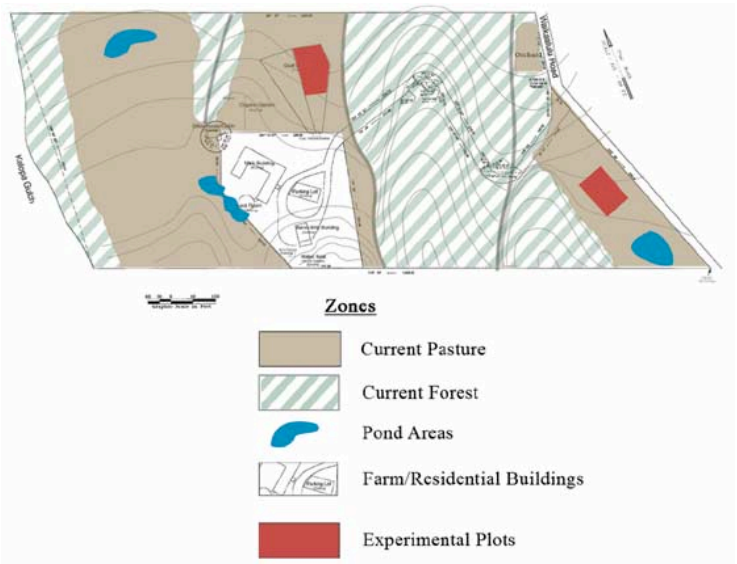
The land includes views of the ocean and the summit of Mauna Kea. We maintain mowed walking paths on much of the property which allow easy access.

Management Objectives and Practices

Our Management Objectives are laid out in the Introduction (please see), and encompass the restoration of native forests, the elimination or suppression of invasives, future harvesting of koa, the databasing and study of koa development, wildlife protection, community outreach, and forestry education.

MOVE: An open understory of smaller tree species, young trees (very few `ohi`a or koa saplings), and shrubs; Ground cover of assorted smaller ferns and young tree ferns (totalling 20-30% cover), some small native herbs, and leaf litter.

Management of Different Zones



The five property zones will be managed in the following manner:

- Current Pasture: Existing pasture land will be transformed to predominantly koa forest with the potential for significant future harvesting of koa. In addition, ative species will be planted in the understory. This forest will consist of:
  - An overstory of koa up to 80' tall and 36-48" diameter, spaced about 50' apart; and some ohi'a.
  - A secondary overstory of mostly olapa (), with some kawa`u (), pilo (), and Kopiko (), 15-40' tall;
  - A tertiary overstory of the three native tree fern species with canopy cover totaling 80-90%, 13-25' tall; Additional native species suitable for this layer include `ie`ie (Freycenetium arborea) and huehue (Cocculus orbiculatus).

  In 40 years or so, several koa per acre could be harvested per year, while new koa would be throughout the forty years to provide a basis for sustainable harvest forever. Some areas will not be planted and will remain in grassland or fern, in order to provide ocean and mountain viewplanes.
- Current Forest: The native forest envisioned for this zone is similar to that of the Current Pasture areas, except that this area is already heavily populated with ohi'a, and the ohi'a will likely remain much more dominant.
  - An overstory of ohi'a, with koa up to 80' tall and 36-48" diameter, spaced about 50' apart; and some ohi'a.
  - A secondary overstory of mostly olapa (), with some kawa`u (), pilo (), and Kopiko (), 15-40' tall;
  - A tertiary overstory of the three native tree fern species with canopy cover totaling 80-90%, 13-25' tall;
- Pond Areas: The management of the pond and riparian areas is complementary to the management of the forests, and will be undertaken with continuing guidance from the USFWS, NRCS, and others. All three pond areas will be lined so that they hold water better, and so that they become better attractants for koloa duck.
- Farm/Residential Buildings: This zone is the the main support area for forestry activities on the propert. Functions of this area include but are not limited to:
  - Seed germination and planting (in existing greenhouse and other under-cover areas)
  - Raising seedlings of koa and other native species until planting can be done
  - Maintenance and storage of farm equipment
  - Residential buildings for forestry workers, forestry interns, etc.
  - Meeting rooms for foresters, forestry workers, interns, students, etc.
  - Management and organization of complementary activities, such as bee keeping
- Experimental Plots: These areas are being reserved for small-scale forestry experiments. Possible experiments include:
  - The intensive growth of non-native hardwoods
  - Close-planting of thousands of koa seed to observe the self-pruning and self-thinning of koa in crowded conditions.

Site Preparation

Site preparation will consist of the following activites:

- Study of Best Management Practices for resotration of native Hawaiiian forest (ongoing)
- Meetings with a variety of experts in forestry and wildlife habitat (ongoing)
- Clearing land for the new fence (on Kalopa Gulch) and clearing land around existing fencing so that fencing improvements can be made.
- Control of invasives through manual means and selective and limited use of herbicides.
- Acquisition and/or repair of necessary equipment and facilities (tractor, greenhouse areas)
- Soil testing. Initial testing has been completed (see Soils, Slopes, and Aspect section under Land & Resource Description). Additional testing will be conducted based on the recommendations of consulting foresters and biologists.
- Koa seed acquisition from local sources and test germinations. We have acquired several hundred seeds from trees on the land and are actively germinating and planting at a low-level, as a means of garnering experience and expertise.
- Training in koa seed germination through spending time as volunteers at Hakalau Forest National Wildlife Refuge (a date for training has not yet been set).

Weed Control & Mulching

Existing invasives will be eliminated or controlled via manual cutting and selective application of herbicides. We will utilize the accumulated experience of Big Island foresters to identify and control invasives. Resources provided by the University of Hawaii's College of Tropical Agriculture and Human Resources (CTAHR) will be utilized heavily, such as *Weeds of Hawai'i's pastures and natural areas -- An identification and management guide.*

Newly planted trees will be mulched and kept weeded during the first few years via manual weeding and re-mulching. [At present, the pigs on the land have an appetite for mulch, so we are not using it much.]

Seedling Acquisition

The sources and acquisition of koa seedlings is being actively researched at present. The focus is on obtaining koa seeds from trees in the vicinity of the property. At least three koa on the property are providing seed, which we are collecting, germinating, and planting. Other koa trees in the vicinity (on neighbors' lands & at Kalopa State Park) are being sought as seed sources, with the goal of obtaining seed from at least 30 local trees (within 1-2 miles of the property). In addition, we will obtain seeds and seedlings from other known good seed sources, perhaps including Hakalau Forest National Wildlife Refuge.

We are currently germinating seeds from the three old growth koas on the property. We plan to germinate and propogate most seeds on-property.

Planting

Our plan for planting koa is as follows:

- Germinate most seeds on-property and grow into seedlings utilizing existing or new greenhouse facilities;
- Carefully mark and document each seedling and where it is planted;
- Plant koa from a large variety of sources on the property so that the genetic diversity is large;
- Maintenance of a database of plantings including the source of the seed, germination method, dates of germination and planting, plant marker tag, location and characteristics of planting area, maintenance operations, and growth records. This could provide a valuable information source for future re-forestation projects.
- Planting will be done in the two main eco-system areas:
  - Underplanting within the existing ohi'a forests to an initial density of 200 trees per acre, with a desired endpoint (after natural and active thinning) to a density of about 40 trees per acre;
  - Former pasture areas, planting to an initial density of 400 trees/acre, with a desired endpoint (after natural and active thinning) to a desnity of about 40 trees per acre.
- For the ohi'a forests, 12 acres X 200 seedlings/acre = 2400 seedlings will be planted.
- For the pasture areas, 7 acres X 400 seedlings/acre = 2800 seedlings will be planted.
- Thus a total of 5200 koa seedlings will be required.
- In addition, in the two Special Areas (2 acres total), 400 seedlings/acre = 800 seedings will be planted (of Toon or similar hardwood).

Fencing

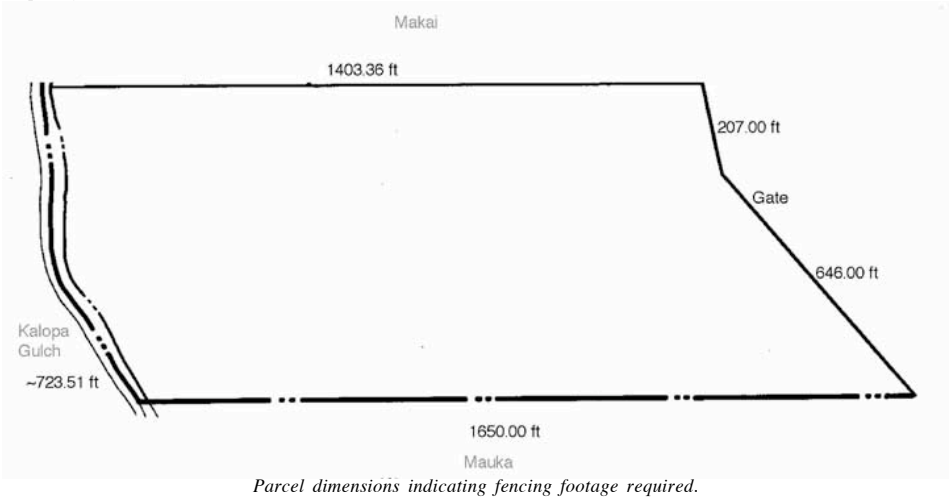
Appropriate fencing is a vital and primary concern of our Forest Stewardship practices, and thus will be the first focus of our efforts. Although the property is currently fenced on three sides (the Kalopa Gulch side is not currently fenced), pigs have daily access because the quality of the existing fence is suitable for cows and horses but not pigs. And pigs have shown a fondness for mulch and fertilizer, so are a clear danger to newly planted trees. In addition, dogs have invaded the property on several occasions and killed our chickens.

Because our overall Management Plan includes providing a safe haven for endangered wildlife such as Koloa Duck and possibly nene, a pig-proof and dog-proof fence is vital. Thus, our Management Plan calls for the construction of a new fence on the Kalopa Gulch (Western) border of the property, and the reinforcement and partial rebuilding of the fence on the other three sides. In addition, the construction of our front gate is rather open in design providing easy access for pigs and dogs. Thus, the gate will be covered in hog wire and a cement pad poured to prevent animals from digging under it.

For all sides of the fence, we anticipate building or upgrading to a 47 inch high "hogwire" fence plus a single strand of 12-1/2-gauge barbwire on the top 8" above the hogwire, plus a hinged hogwire "apron" that will come halfway up the fence and then about two feet onto the ground on the outside of the fence. The apron will then be staked into the ground, forming a pig and dog impermeable border. This type of fence is particularly important where the terrain is rough in and around the stream beds that cut through the land.

The fence will be supported by T-type fence posts at intervals of 10 feet or less. End braces will be installed or upgraded on both sides of stream beds and gulches and where the new fence starts and ends. Self-closing swinging gates will be installed at 2 locations along Kalopa Gulch for access to areas nearer the Gulch.

Hogwire and barbed wire will be Bezinal and plastic-coated for longevity, particularly since the hogwire aprons will be in close contact with the earth. An investment in a quality fence at the outset will prevent pig and dog breaches in the future offering peace of mind and insurance against losses. In addition, the initial greater investment in fence material coated with corrosion-inhibitors will pay off in the future because re-building the fence will not have to be done as frequently.



Parcel dimensions indicating fencing footage required.

Other Tree Protection

As long as fences are kept in adequate repair to keep out pigs, no additional tree protection is anticipated.

Irrigation

No existing piped-in water is currently available at the property. Water for building areas is via catchment with a

40,000 gallon tank.

Rainfall is approximately 100" per year. In addition, the humidity is generally high at 3000 feet, with the land frequently in a cloud bank, especially in afternoon. Existing plantings of koa and other plants have done well without additional irrigation.

Nevertheless, newly planted trees may be susceptible to dry conditions, so we will closely monitor new plantings and irrigate as needed from existing catchment sources. A mobile water storage tank may be necessary for this purpose.

After establishment of planted trees, no additional irrigation is anticipated as the trees adapt to existing water conditions.

Fertilization

New seedlings will be closely monitored and given fertilization in their young stages. Newly planted trees will be mulched and fertilized with organic compost to improve local soil condition. No ongoing fertilization is anticipated, except in special areas (see below).

Intensive Revegetation

The entire property has full vegetation with a mix of native and non-native species. No intesive revegetation is anticipated. Rather, we will focus on the slow transformation of the forests back to their native state.

Special Areas

Two areas of about one acre in size are being reserved as experimental areas. No decisions have been made in regards to what, exactly, we'll do, but possibilities include:

- The intensive growth of non-native hardwoods. Candidates include:
  - Australian Toon *(Toona ciliata)*
  - African mahogany *(Rhaya nyasica)*
  - Teak *(Tectona grandis)*
  - pheasant wood *(Cassia siamea)*
  - *Flindersia brayleyana*
  - Narra *(Pterocarpus indicus)*
- Close-planting of thousands of koa seed to observe the self-pruning and self-thinning of koa in crowded conditions.

These areas will each be in existing pasture land so will not displace any native forest.

Trail Construction

A large network of mowed paths already exists on the property, primarily in the former pature land. These continue to be maintained, both for easy access and for recreational walking.

This network will be supplemented by a few narrow trails for access to select areas in the native forest areas, so that planting and maintenance activities can be carried out.

Non-Commercial Thinning

Ohi'a trees in the existing native forest areas will not be thinned unless deemed necessary by a consensus of experienced foresters. Koa trees planted within the ohi'a forest may be thinned after approximately 10 years if their spacing is deemed too close for optimal growth. Koa trees in the current pasture areas will be thinned after approximately 10 years to a density of approximately 40 trees per acre.

Practice Component	Units	Cost/Unit	Frequency	Total Cost	Applicant Share	FSP Share
Management Plan	1 Plan	$4,000	Once only	$4,000	$1,000	$3,000
Site Preparation	21 Acres	$400	First year	$8,400	$4,200	$4,200
Weed Control & Mulching	21 Acres	$400	Each year (10)	$48,000	$24,000	$24,000
Seedling Acquisition	6000	4.00	N/A	$24,000	$12,000	$12,000
Planting	21 Acres	$300	Within first two years	$6,300	$3,150	$3,150
Fencing-New Pig Proof	725 ft	$10.00	Within first year	$7,250	$2,250	$5,000
Fencing-Upgrade Existing to Pig Proof	3906 ft	$5.00	Within first year	$19,530	$6,030	$13,500
Trapping of Mongoose & Wild Cats	21 Acres	$30	Each year (10 years)	$6,300	$6,300	$0
Non-commercial thinning	9 Acres	$300	Once in 10th year	$2,700	$1,350	$1,350
Trail Maintenance (Mowing & Weedwhacking)	3000 ft	$2/ft/year	Each year (10 years)	$60,000	$40,000	$20,000
Outreach & Education	10 Years	$5000	Each year (10 years)	$50,000	$50,000	$0
Infrastructure Maintenance	10 Years	$5000	Each year (10 years)	$50,000	$50,000	$0
TOTALS				$286,480	$200,280	$86,200

2008

Practice Component	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share
Management Plan	1 Plan	$4,000	$4,000	$1,000	$3,000
Site Preparation	21 Acres	$400	$8,400	$4,200	$4,200
Weed Control & Mulching	21 Acres	$400	$4,800	$2,400	$2,400
Seedling Acquisition	3000	4.00	$12,000	$6,000	$6,000
Planting	10.5 Acres	$300	$3,150	$1,575	$1,575
Fencing-New Pig Proof	725 ft	$10.00	$7,250	$2,250	$5,000
Fencing-Upgrade Existing to Pig Proof	3906 ft	$5.00	$19,530	$6,030	$13,500
Trapping of Mongoose & Wild Cats	21 Acres	$30	$630	$630	$0

Trail Maintenance (Mowing & Weedwhacking)	3000 ft	$2/ft/year	$6,000	$4,000	$2,000
Outreach & Education	10 Years	$5000	$5,000	$5,000	$0
Infrastructure Maintenance	10 Years	$5000	$5,000	$5,000	$0
TOTALS			$73,760	$38,085	$37,675

2009

Practice Component	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share
Weed Control & Mulching	21 Acres	$400	$4,800	$2,400	$2,400
Seedling Acquisition	3000	4.00	$12,000	$6,000	$6,000
Planting	10.5 Acres	$300	$3,150	$1,575	$1,575
Trapping of Mongoose & Wild Cats	21 Acres	$30	$630	$630	$0
Trail Maintenance (Mowing & Weedwhacking)	3000 ft	$2/ft/year	$6,000	$4,000	$2,000
Outreach & Education	10 Years	$5000	$5,000	$5,000	$0
Infrastructure Maintenance	10 Years	$5000	$5,000	$5,000	$0
TOTALS			$34,580	$24,605	$11,975

Years 2010, 2011, 2012, 2013, 2014, 2015, 2016

Practice Component	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share
Weed Control & Mulching	21 Acres	$400	$4,800	$2,400	$2,400
Trapping of Mongoose & Wild Cats	21 Acres	$30	$630	$630	$0
Trail Maintenance (Mowing & Weedwhacking)	3000 ft	$2/ft/year	$6,000	$4,000	$2,000
Outreach & Education	10 Years	$5000	$5,000	$5,000	$0
Infrastructure Maintenance	10 Years	$5000	$5,000	$5,000	$0
TOTALS			$19,430	$17,030	$4,400

2017

Practice Component	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share
Weed Control & Mulching	21 Acres	$400	$4,800	$2,400	$2,400
Trapping of Mongoose & Wild Cats	21 Acres	$30	$630	$630	$0
Trail Maintenance (Mowing & Weedwhacking)	3000 ft	$2/ft/year	$6,000	$4,000	$2,000
Non-commercial thinning	9 Acres	$300	$2,700	$1,350	$1,350
Outreach & Education	10 Years	$5000	$5,000	$5,000	$0
Infrastructure Maintenance	10 Years	$5000	$5,000	$5,000	$0
TOTALS			$22,130	$18,380	$5,750

Budget Summary

Year	Total Budget	Landowner Share	State Share	Other Funding Share
2008	$75,760	$38,085	$37,675	
2009	$36,580	$24,605	$11,975	
2010	$21,430	$17,030	$4,400	
2011	$21,430	$17,030	$4,400	
2012	$21,430	$17,030	$4,400	
2013	$21,430	$17,030	$4,400	
2014	$21,430	$17,030	$4,400	
2015	$21,430	$17,030	$4,400	
2016	$21,430	$17,030	$4,400	
2017	$24,130	$18,380	$5,750	
TOTALS	$286,480	$200,280	$86,200	

Year one (1) begins upon contract execution, therefore the years listed in this table need to reflect delays in contract development and may eventually be changed.

Koa timber production from "scratch", as is being done on the subject property, is characterized by an initial, significant investment (sourcing seeds, germinating, planting, fencing), followed by a 30 to 50 year period of growth and maintenance (weeding, thinning) while the koa reaches maturity, followed by a sustainable harvest lasting into the indefinite future.

As discussed in Goldstein et al. (2006), "from a business perspective, three financial barriers of converting pasture to koa forest must be addressed: high upfront costs of restoring forest cover; a 35 to 45 year wait before timber revenue would be available; and

uncertainties about the future that could change the value of koa." *[Goldstein, J.H., G.C. Daily, J.B. Friday, P.A Matson, R.L. Naylor, and P. Vitousek. 20006. Business strategies for conservation on private lands: Koa forestry as a case study. Proceedings of the National Academy of Sciences 103(26): 10140-10145.]*

Due to these factors--especially the decades-long initial growth period before getting any return on investment--normal investment analyses become of questionnable value. The owners of the land must either have very deep pockets (not true here), be planting the koa forests for altruistic reasons (true here), or be getting some financial assistance for the initial establishment of the koa forest (also true here and the subject of this proposal).

As such, the economic analysis here will look at two factors: 1) The amount of investment up until the time of first harvest, which will be assumed for this analysis to be 40 years from planting; and 2) The amount of annual sustainable income that might be expected after the 40 year initial growth period.

Investment Until Time of First Harvest
According to the Practice Implementation Schedule section of this Management Plan, the first 10 years of the program would cost about $186,000, not including Outreach & Education and Infrastructure Maintenance, costs that are not central to this analysis. For the next 30 years, assume a cost of $15,000/year for weed control, fence maintenance, non-commercial thinning, trail maintenance, and planting of new koa trees within the existing forest (in order to create several generations of koa within the forest so that it becomes truly sustainable). Thus, total investment after 40 years would be $186,000 plus $450,000 = $636,000.

Future Sustainable Income from Continual Koa Harvest
Stumpage price is the value of timber as it stands uncut, i.e., the amount paid by the logger to a landowner for the right to harvest trees. The 2005 stumpage price for Koa of about $4000 per thousand board feet ($4000/mbf) will be used in this analysis.

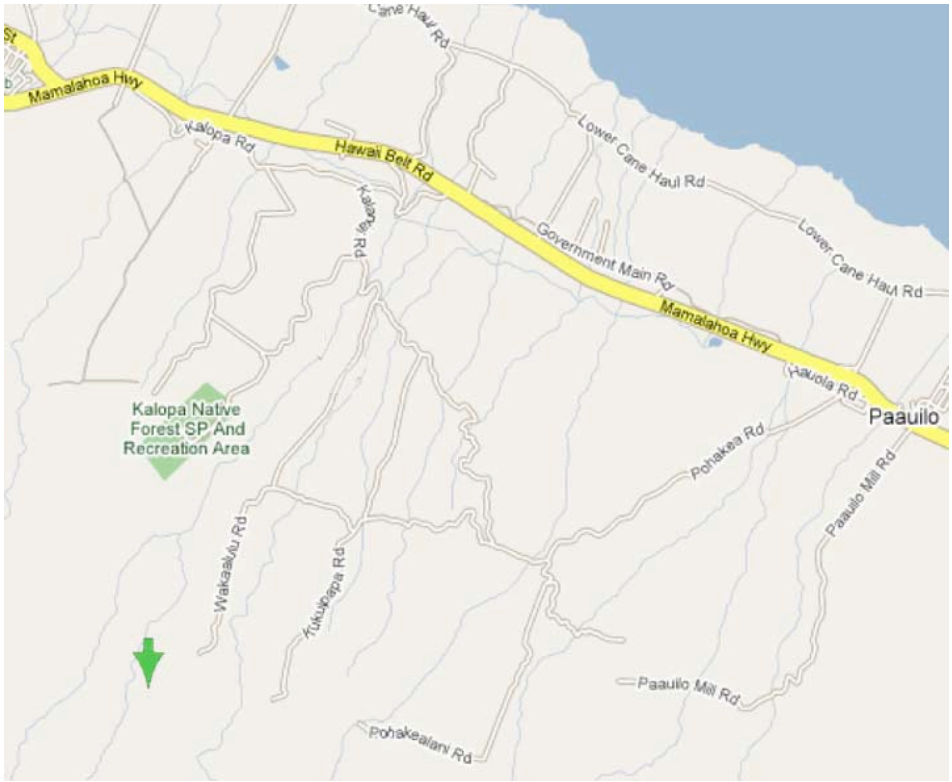
The yield of koa per acre is the number of board feet that can be expected if koa is clear cut. We'll utilize an average value of 10,000 board feet/acre (10 mbf/acre) after 40 years of growth.

Thus, the value of 20 acres of koa forest, if clearcut, after 40 years of growth, using present-day values, would be: 20 acres X 10 mbf/acre X $4000/mbf =$800,000. Since the intention is to sustainably harvest the koa over time by harvesting not more than 20% of the koa in each year, the annual sustainable income from the koa harvest would be 20 percent of $800,000, or $160,000/year.

Inherent Uncertainties
This analysis is based on the assumption that the koa trees being planted will in fact grow into straight, marketable trees suitable for timber. In practice, however, according to Paul Snowcroft of the US Forestry Service, most planted koa does NOT grow straight and tall and is not suitable for timber production. [Ref: *Plantation Koa: Another Inconvenient Truth?*, talk given at the 2007 Hawai`i Conservation Conference]. To mitigate this situation, the land owners plan to experiment with methods to improve the genetic characteristics of the trees they plant, e.g. through generating and planting air-layered root sprouts from existing straight and true koa trees.

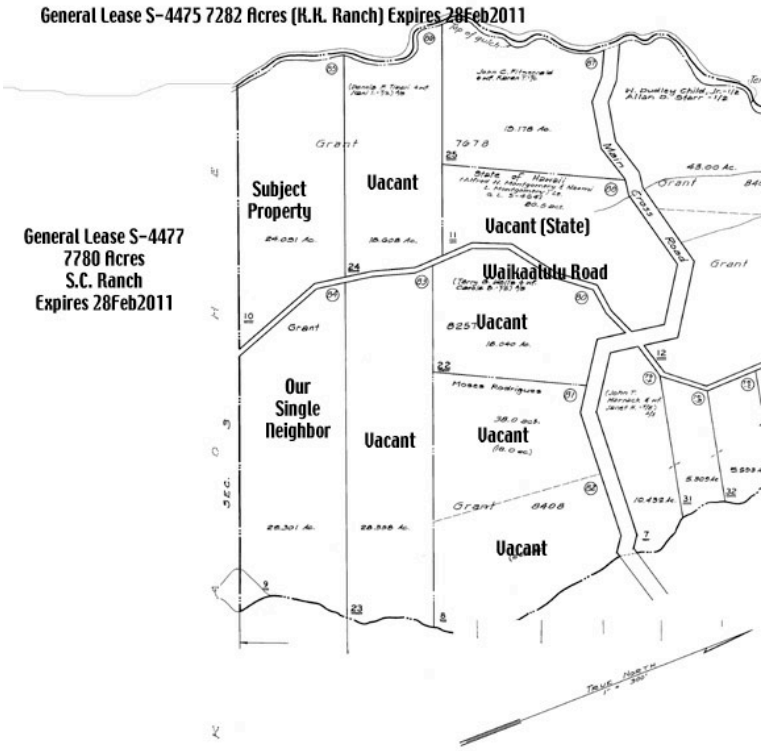
Maps & Photos

General Location Map near Honokaa, Island of Hawaii



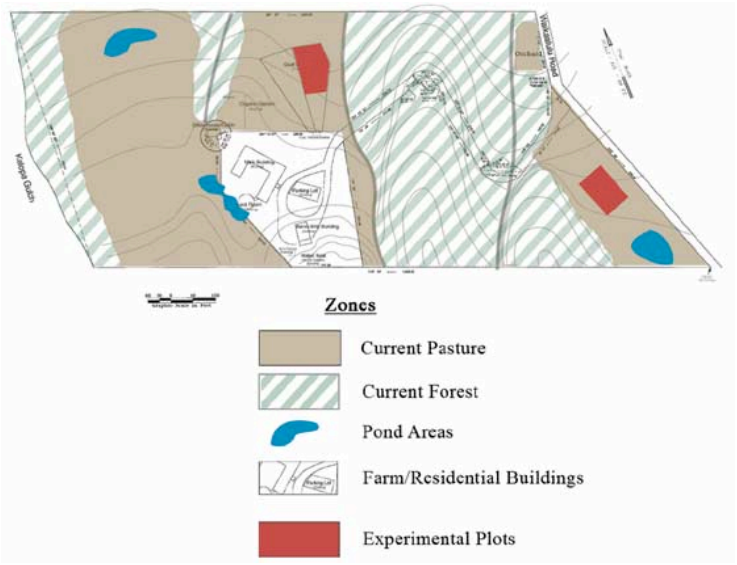
Green Pointer Indicates Subject Property

Portion of TMK Map Showing Neighboring Lands



Portion of 4-4-013 TMK Map.
State of Hawaii General Lease lands are to West and South. Upper portions of both of these General Lease parcels were recently restricted for palila (Loxoides bailleui) critical habitat mitigation purposes. Kalopa Gulch borders property on West (uppermost in this map) and continues up Mauna Kea to the South (left on map), and forms the boundary between the two blocks of State leased land.

Project/Site Map



- Colored and hatched areas (21 acres out of 24 total acres) are included in the Management Plan.
- Three gray lines represent gulches that are mostly dry except when significant rain falls.
- Three pond areas exist (in blue). Only the central pond has water year-round. The other two ponds fill only with rain and are soon dry again, so need liners.
- Elevations lines are approximate with interval of about 10'.

Additional Photos

Additional photos of the land can be found at this link: http://ahulani.com/photos1/photos1.html.

Monitoring Activities

The owners will either live on the land or have a full-time caretaker (as has been the case for the past five years) whose principle charge is to monitor and maintain forest resources and related projects.

Monitoring will be ongoing on nearly a daily basis by the caretaker. In addition, we plan on having a variety of volunteers and/or interns at the property to assist with planting, fertilizing, and weeding activities. During drought, new seedlings will be manually watered if necessary.

In addition to basic monitoring and maintenance activities, we will maintain a database of the planted koa trees (as described earlier), including their origins, growth rates, experience with disease, and so on, which we feel will provide an important set of data in the future.

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Melissa I Sprecher/DLNR/StateHiUS
06/10/2008 01:40 PM

To John Lindelow <cybernet@lava.net>
cc Sheri.S.Mann@hawaii.gov
bcc
Subject Re: Management Plan for Ahu Lani Sanctuary

Aloha John,
Thanks for getting me our pdf plan so quickly. I have just finished the initial review of our plan and it looks pretty complete. I have a few questions or comments listed below. The next Committee meetings is on June 20, 2008 at Kokua Kahili Valley here on Oahu. Would you be interested and coming to the meeting to represent our plan and meet the Committee members? Let me know if you would like to attend.

1) If you plan on doing an commercial harvesting, which I believe you do, there are a few requirements under the program:
- You will be required to enter into a 30 year management agreement (1st 10yrs with funding and an additional 20yrs of maintenance)
- There is an approximate 5% back payback fee to the State for any commercial sale of timber harvested that was supported by the FSP funding
- We will need a more detailed harvest plan on how you plan on harvesting and selecting tree to harvest.

2) I am glad that you are incorporating education into your plan. Have you already contacted those schools or programs that you would like to be involved in? If so, can you please submit a letter of support from those parties.

3) On page 5 of 15, I am not sure what the map is explaining or making reference to. Does this simple represent the FSP project area?

4) On page 9 of 15, I think that you were intending to include the scientific names of the species mentioned... there are empty (). As they are listed in the previous table on can excluded the empty ().

5) Are you working any NRCS or US F&WS programs for your property/project area? WHIP or EQIP might also be a good fit for some of your pond or wetland areas...

6) If you will not be seeking funds in relation to intensive revegetation, you can exclude that part from your plan... that is usually used as a special areas practice if needed.

7) For whatever you decide to plant in your 2 acre experimental section, we need to make sure that it is not an invasive species... you should probably include language to that effect in your management plan.

8)The budget looks good, I have only couple of questions on your match under Outreach & Education and Infrastructure Maintenance. What does this practice related? Under the units it is listed as 10years at $5000, what does this directly related too?

9) In the Budget Summary, you will need to change the Year column to read 'Year 1; Year 2; Year3; etc'. (Leaving the years '2008; 2009; 2010; etc' in that column can be confusing when implementing depending on when the contract is finalized).

If you can update anything in your plan to address these issues before Friday morning (6/13), I will include it with the FSP Committee packet for their review. Otherwise if we can address any of these items before the next meeting we can email the Committee members. Thanks for your continued interest.

Regards,

M. Irene Sprecher
Forester, Division of Forestry & Wildlife