Koloa Forest Stewardship Proj -

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT S. COLOMA-AGARAN

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

RECEIVED
'98 JAN 21 P2:25
OFC. OF ENVIRONMENTAL QUALITY CONTROL

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT
WATER RESOURCE MANAGEMENT

January 14, 1998

Mr. Gary Gill
Director
Office of Environmental Quality Control
235 South Beratania Street, Suite 702
Honolulu, Hawaii 96813

Subject: Negative Declaration Determination and Final Environmental Assessment for Hawaiian Mahogany Company, Inc. Forest Stewardship Project, Koloa, Kauai, tax map keys: 2-8-01-3; 2-8-01-4; 2-8-01-5; 2-7-01-1; 2-7-01-2; 2-7-01-4; 2-7-01-5; 2-9-02-1; 3-4-05-3; and 3-4-01-2.

Dear Mr. Gill,

The Department of Land and Natural Resources, Division of Forestry and Wildlife has reviewed the comments received during the 30-day public comment period that began on December 8, 1997 for the subject project. We have determined that this project is not likely to have a significant impact on the environment. Please publish a notice of determination for this negative declaration in the OEQC Bulletin as soon as possible.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the Final EA for the project. Please contact Nelson Ayers of the Division of Forestry and Wildlife at 587-4175 if you have any questions.

Sincerely,

Michael Buck
Administrator

Enclosures

cc: Nelson Ayers
Bill Cowern

5

1998-02-08-KA-FEA-Koloa Forest Stewardship Project

Final Environmental Assessment

For

The Hawaiian Mahogany Company, Inc.
Forest Stewardship Project

Submitted by
Bill Cowern
Hawaiian Mahogany Company, Inc.
PO Box 649
Lawai, Hawaii 96765
(808)332-8570

1. Applicant:
Hawaiian Mahogany Co., Inc.
4896-E Kua Road - P.O. Box 649
Lawai, Hi. 96765
Tel: 808- 332-8570

2. Approving Agency:
Department of Land and Natural Resources
Division of Forestry and Wildlife
P.O. Box 621
Honolulu, Hi. 96809

3. Agencies Consulted:
The DLNR Forest Stewardship committee approved the management plan for this project. (Attachment A) The Natural Resources Conservation Service reviewed the plans and supplied soils analysis data. The DLNR Division of Forestry and Wildlife Kauai office was consulted numerous times during the development of the management plan as was the Garden island R.C.&D. Forestry committee. Individuals of the U.S. Forest Service were also consulted as were numerous members of the Hawaii Forest Industry Association Board, staff members of the Hawaiian Agricultural Research Corporation (HARC) , staff members of the College of Tropical Agriculture (Manoa) , the Kauai County Farm Bureau Board, and numerous other organizations and individuals.

4. Description of the action's technical, economic, social and environmental characteristics.

The owner proposes to afforest approximately 800 acres of lands previously in sugar cane with short and medium rotation timbers of promising commercial value. The change in land use would be from sugar cane monoculture to biodiverse forest.

To briefly describe the planting process, the land is first mowed to take down the remaining cane and weed grasses. The area is then raked to windrow the cut material and to create rows 13 feet wide. It is during this step that the contours are identified and the rows laid

out to take advantage of these contours. The rows themselves are then disc harrowed to remove the root systems of the remaining weed species and tilled to smooth the surface. The area between the rows remains intact and is routinely mowed. 4 foot wide plastic mulch is then laid down to prevent weed re growth in the rows, and the trees are planted through the plastic. These steps and the extensive use of nitrogen fixing trees, allow the entire planting and growing process to proceed free of any chemical input. Even the initial fertilization is organic. The first thinning , at about 8 years will allow us to also eliminate the use of the plastic mulch and replace it with chipped mulch in our subsequent plantings.

The methods to be used at the time of harvest are not yet established as rapidly changing harvesting techniques preclude making a decision 15 years in advance. We expect that the methods and machinery will continue to evolve into lower impact harvesting and we will use the best methods and equipment available at the time, just as we have done in the planting.

The project will only have a modest impact on community economics in the short term, with the potential for more significant positive impacts in the long term.

It is believed that the afforestation will benefit the region aesthetically, environmentally, and will significantly reduce erosion.

5. Summary description of the affected environment, including suitable and adequate location and site maps.

Please see the Forest Stewardship Plan (p. 4) for a detailed site map. All of the included parcels have been in active and continuous sugar cane production for at least the last 70 years. Some have been in sugar cane production for over 150 years. This continuous cultivation means there are no native or endangered species of plants or animals on these parcels. There are also no significant historical sites on the parcels.

All parcels are within the lands owned by Grove Farm Land Co. and as such they are not only the landlord, but the only adjacent land owner as well.

6. Identification and summary of major impacts and alternatives considered, if any:

Potential considerations about this development concern the possibility of erosion during tree establishment and are addressed in the management plan (p. 20). The extensive use of nitrogen fixing

trees, as companions to other commercial species, have been shown to dramatically improve the soil conditions and mitigate erosion in numerous studies, both here in Hawaii and throughout the world. This is clearly a better use of the land, from an environmental standpoint, than most other agricultural uses or abandonment would be. Best management practices are to be used on this project.

7. Proposed mitigation measures, if any:

The practices identified in the management plan are designed to reduce the surface runoff of topsoil from the start of afforestation and should become more and more effective as the trees grow. The use of contour planting, and the retention of the existing weed species between the rows, has proven to be effective in controlling runoff in previous plantings. Those areas next to waterways will have a vegetation buffer maintained.

8. Determination:

This action will not have a significant impact on the environment and in the long term is expected to improve the ecological and aesthetics values of the area.

9. Findings and reasons supporting the determination:

The proposed project will not involve an irrevocable commitment to loss or destruction to any natural or cultural resources. If there ever were natural or cultural resources on the sites, decades of sugar cultivation have removed them. There are no resources to destroy.

The proposed project will not curtail the range of beneficial uses of the environment. This project replaces numerous weed species and sugar cane with a biodiverse forest and will therefore not curtail the range of beneficial uses of the area.

The proposed project will not conflict with the State's long term environmental policies. This project will not harm or degrade environmental resources.

The proposed project will not substantially adversely affect the the economic welfare, social welfare, or public

health of the community. By adding to the base of long term forestry products, potential industries can develop which would greatly enhance the public welfare, in a county with significantly high unemployment.

The proposed project will not involve a substantial degradation of environmental quality. From the outset the environmental quality of the sites should improve and continue to as growth of the forest continues.

The proposed project will not have cumulative impacts or involve a commitment for larger actions. The EA and the Forest Stewardship Plan describe the entire implementation and maintenance of the project; no further or larger actions are anticipated or intended.

The proposed project will not substantially affect any rare, threatened, or endangered species of flora and fauna or habitat. The sites are not currently habitat for any known rare, threatened, or endangered species of flora and fauna. In the long run this project is intended to enhance the creation of this type of habitat.

The proposed project will not detrimentally affect air or water quality or ambient noise levels. The proposed project has been designed to minimize impact to water resources. The long term effect on water quality will continue to improve. Air quality and ambient noise levels will not be influenced.

The proposed project will not affect or is likely to suffer damage by being located in an environmentally sensitive area such as flood plain, tsunami zone, beach, erosion prone area, geologically hazardous land, estuary, fresh water or coastal waters. The practices embodied in this proposal are meant to substantially improve the only present potential problem, which is erosion runoff from freshly plowed sugar cane fields. The sites are not in an environmentally sensitive area, they are not in flood plains, tsunami zones, or near the beach. They are not erosion prone areas, near coastal waters, in hazardous geological areas or estuaries. They are near a small stream which accepts the runoff from these sites and eventually empties into the sea. These riparian areas will remain buffered.

The proposed project will not substantially affect scenic vistas and view planes identified in county or state plans or studies. There are no view planes so identified to be affected and with the exception of one, the sites are located in remote areas. In the one case the site is directly next to the road, but there is a significant rise from the road to the site making a view plane impossible.

The proposed project will not require substantial energy consumption. As the plan allows for significant areas to remain undisturbed during planting, and as there is minimal maintenance required after planting, the project will not require substantial energy consumption.

Reforestation for Value-Added Wood Products— A Forest Stewardship Plan

Hawaiian Mahogany Company, Inc.
4896 E Kua Road
Lawai, HI 96765
808-332-8570

Prepared by:
Craig Elevitch
Source Ecosystems
P.O. Box 428, Holualoa, HI 96725
Tel: 808-324-4427, Fax: 808-324-4129
Internet: agroforester@igc.org
March 5, 1997
Revised August 12, 1997

II. Signature Page

Forest Stewardship Plan Signature Page

Professional Resource Consultant Certification; I have prepared (revised) this Forest Stewardship Plan. Resource Professionals have been consulted and/or provided input as appropriate during the preparation of this plan.

Prepared by: Craig Elevitch 8/20/97
Professional Resource Consultant's Signature Date

Craig Elevitch
Professional Resource Consultant's Name

Landowner Certification: I have reviewed this Forest Stewardship Plan and hereby certify that I concur with the recommendations contained within. I agree that resource management activities implemented on the tends described shall be done so in a manner consistent with the practices recommended herein.

Prepared for: William I Cowern 9-11-97
Landowner's Signature Date

William I Cowern
Landowner's Name

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 under the appropriate Stewardship Incentives or Forest Stewardship program.

Approved by: for Nelson J Ayers 9/15/97
State Forester's Signature Date

Michael G Buck
State Forester's Name

III. Stewardship Plan Preface

This stewardship plan describes the existing vegetation, soils, and wildlife/fish on the property and addresses the opportunities for the protection and enhancement of all natural resources while assisting the landowner meet his/her objectives for the management of the property. It provides guidelines for a sound strategy which reflects the landowner's commitment to a land stewardship ethic that focuses on integration of all resources to manage the property as a valuable legacy for future generations.

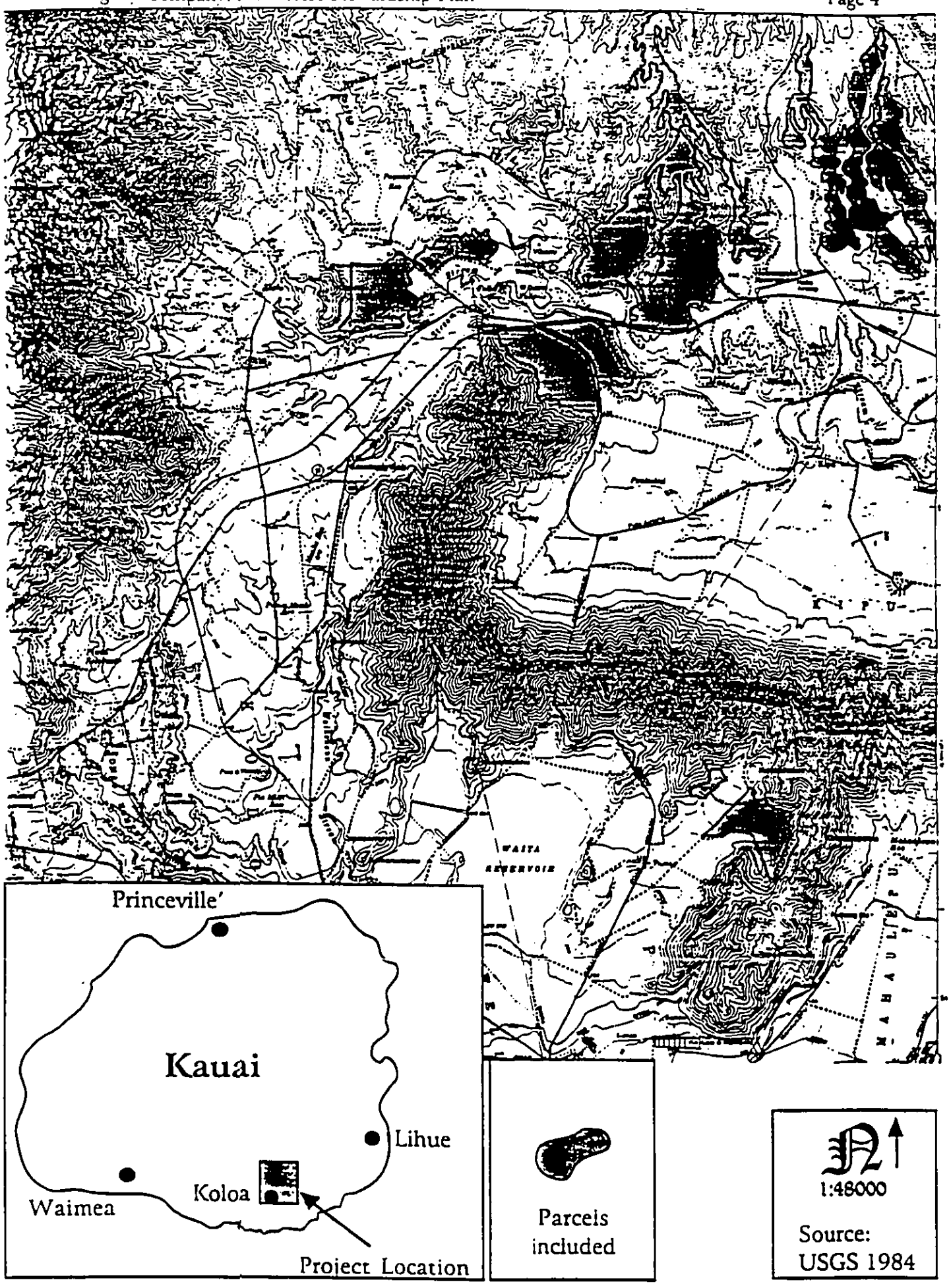
In addition to the vegetative, soil and wildlife/fish resources, this plan addresses the enhancement of additional resource topics checked below. The plan may need to be revisited as the landowner's objectives, conditions, and/or opportunities change.

Applicable Resource Areas Covered
Those checked are targeted by landowner management objectives and are considered in this stewardship plan.

[✓]	Water Quality	[ ]	Threatened/Endangered Species
[✓]	Agroforestry	[✓]	Forest Health
[ ]	Recreation	[ ]	Archaeological - Cultural Resources

[✓] **No threatened or endangered species, cultural or historic resource, floodplain or wetland has been identified or is known to exist on this property.**

This plan provides a strategy and action plan for sound integrated resource management of the property, and reflects the desires of the landowner to protect or enhance all resources in the management of the property for at least 10 years.



Project Summary/Abstract

This Forest Stewardship Project will afforest 800 acres of former sugarcane land on Kauai with short- and medium-rotation timbers of promising commercial value. This plan proposes many innovative practices leading to a diversified silvicultural system composed of short to long-term timber species. Innovations include:

- Diversification to a broad range of species for product variety and ecosystem stability
- An establishment system which almost entirely eliminates chemical herbicide use
- Integration of fast-growing nitrogen fixing tree species for nutrient contribution to other species and possible products such as timber or biomass.
- Integrated windbreak species
- Periodic growth measurements with reporting to the Forest Stewardship Program
- A value-added component which multiplies yield potential

In the short term of 7-20 years, the wood produced will be processed in a value-added industry being developed in Hawaii by the Project Coordinator. In the long term, it is the Project Coordinator's vision that management of this land will lead to a biodiverse, self-sustaining, selectively harvested forest comprised of both native and non-native hardwood species. To this end, a broad range of long-term timber species will be planted throughout the project area. It is hoped that this project will form a foundation of economics and knowledge for stable and sustainable management of forested lands.

Two primary commercial species are being planted on 85% of the project area, kamarere (*Eucalyptus deglupta)* and tallowwood (*Eucalyptus microcorys)*. Both species have quality wood suitable for a wide range of products; fast growth; resistance to disease, insect attack, and wind damage; a proven ability to thrive in plantation environments; and outstanding growth on Kauai. On the area planted to kamarere and tallowwood, fast growing nitrogen fixing companion trees (principally *Paraserianthes falcataria*) will also be planted following the promising work on fast-growing Eucalyptus plantations in Hawaii (Whitesell, et al, 1992; Crabb, 1997). A fourth species, *Eucalyptus dunnii*, will be planted strategically throughout the Kamarere/Tallowwood plantings to contribute wind protection.

On the remaining 15% of the area, a diverse range of medium- and long-term rotation high-value timbers will be planted, adding to the diversity of the plantings and potential wood product line. These will also be mixed with nitrogen fixing companion trees to provide nutrients.

To summarize, this plan covers:

- Establishment of 85% of the area (680 of 800 acres) in integrated stands of

kamarere and tallowwood together with nitrogen fixing companion trees.
- Establishment of 15% of the area (120 of 800 acres) in diverse stands of hardwood timber species with nitrogen fixing companion trees.
- Cost-effective techniques and machinery for establishing and maintaining forestry trees on this land developed through extensive planting trials during 1996 by the Project Coordinator. Planting techniques include the use of a weed barrier and the elimination of the use of herbicides.
- An analysis of projected costs and returns.

Twenty-year leases for the project area consisting of over 800 acres of former sugarcane land have been secured. The project area will be planted in 200 acre increments over four years. Subject to the approval of this plan by the Forest Stewardship Committee, matching funds have been secured from private investors. Specific product lines have been determined, with a value-added processing strategy which increases project viability and economic returns to Hawaii's economy.

Economic projections in this proposal are based on stumpage value. The economic return is expected to give the investors an adequate return. The total cost of this project will be in excess of $2,470,571, of which $708,238 cost-sharing is sought from the Hawaii State and Federal Stewardship Forestry Incentive Programs.

IV. Introduction

General Property Description

This project will take place on former sugarcane land in the Koloa and Haiku areas on Kauai. The total area to be leased is in excess of 800 acres. The properties are accessed by an extensive network of existing sugarcane haul roads.

Property Tax Map Keys

Much of the land covered by these TMKs is rough land lying on the periphery of cultivated areas. Therefore, these TMKs cover more land than will actually be reforested. This plan deals only with areas within these TMKs that were under previous cultivation. Lands included are portions of the following TMKs: 2-8-01-3; 2-8-01-4; 2-8-01-5; 2-7-01-1; 2-7-01-2; 2-7-01-4; 2-7-01-5; 2-9-02-1; 3-4-05-3; 3-4-01-2.

Topography, Elevation and Climate

Aspect

The land parcels are gently rolling, with slope gradients ranging from zero to approximately 15 percent.

Gulches/Draws & Ridges

There are no gulches or draws on the subject parcels. All rough, steep land is on the periphery of the parcels.

Elevation

The parcels lie between 450 feet and 1200 feet elevation. (See topographic lines on Project Location Map.)

Climate

Rainfall maps indicate an annual average of 70-80 inches. Existing vegetation surrounding these fields supports that estimate. McBride records indicate 80+ inches average and up to 120 inches near the mountains.

Prevailing trade winds come predominantly from the east.

Brief History of Uses and Present Condition

These fields have been in industrial sugarcane production for the past several decades. Some of the area is still in production and will be taken out of sugarcane in the next one to four years.

Description of Landowner Management Objectives

This Forest Stewardship Project will afforest former sugarcane land with short- and medium-rotation timber trees of promising commercial value. The tree species have been selected for their disease and insect resistance, fast growth, and quality timber. Other design goals are mitigation and protection from wind, stabilization and improvement of soils, and improved watershed. This project will serve as an example for tree-based economic development, including value-added processing, for former sugarcane lands on Kauai. The total project area is 800 acres, which is to be planted in two hundred acre increments during 1997-2000.

The following practices are included, corresponding to stewardship management practices as outlined by the Hawaii Division of Forestry and Wildlife:

- SIP 1: Management Plan Development
- SIP 2: Reforestation and Afforestation
- SIP 4: Windbreak and Hedgerow Establishment

V. Land and Resource Description

Existing Vegetation

Weeds consisting predominantly of Guinea grass (*Paspalum dilatatum*), sugarcane (*Saccharum officinarum)* regrowth, and other grasses, are beginning to become established in the fields recently taken out of sugarcane production. A weed species list is given below to help indicate site and soil conditions, and for use in determining strategies for weed control. This is by no means a complete species inventory of the sites—it represents the wide spectrum of weeds found on the parcels.

Representative Species Inventory:

On cultivated lands:		Adjacent vegetation:	
Abutilon sp.	abutilon	*Hibiscus tiliaceus*	hau
Amaranthus spinosus	amaranth	*Leucaena leucocephala*	haole koa
Anethum sp.	fennel	*Mangifera indica*	mango
Commelina diffusa	honohono	*Pandanus odoratissimus*	hala
Cordyline terminalis	ti	*Paraserianthes falcataria*	albizia
Crotalaria sp.	crotalaria	*Psidium sp.*	guava
Cyperus spp.	nut grass		
Ipomoea obscura	morning glory		
Lactuca serriola	wild lettuce		
Mimosa pudica	sensitive plant		
Paraserianthes falcataria	albizia		
Paspalum dilatatum	Guinea grass		
Pennisetum purpureum	Napier grass		
Saccharum officinarum	sugarcane		

Native Forest Areas

There are no native forest areas on the parcels. The Lawai/Koloa Forest Reserve lies mauka of the parcels, but is severely degraded by the presence of numerous exotic species such as guava and albizia. The nearest intact native forest is two to three miles from the project area.

Soils and Their Condition

The soils on these lands have been heavily cultivated for the past several decades. In general, they are friable and well-drained. On similar soils in Kokea, Wailua and Lawai, both state and private plantings of kamarere and tallowwood have performed exceptionally well.

Soil Type	Woodland Group	Brief description
Kapaa silty clay	9 (400-800 bd. ft./acre)	well-drained
Lawai silty clay	7 (500-1500 bd. ft./acre)	moderately well-drained
Halii gravelly silty clay	9 (400-800 bd. ft./acre)	moderate to well drained
Lualualei clay	4 (300-800 bd. ft./acre)	well-drained
Puhi silty clay loam	7 (500-1500 bd. ft./acre)	well-drained

Water Resources and Their Condition

There are no known springs or other water resources on the parcels.

Historic and Cultural Resources

These parcels have been in mechanized sugarcane production for many decades. There are no known historic or cultural resources remaining on the subject parcels.

Existing Wildlife

Common birds of Kauai are the only known wildlife on the parcels.

Threatened and Endangered Species Existing on Property

There are no known threatened or endangered species existing on the property.

Existing Recreational and Aesthetic Values

The property does not currently have recreational use.

VI. Recommended Treatments and Practices

SIP 1—Management Plan Development

The Project Coordinator, who will supervise all facets of this project, has extensive experience in the silviculture of numerous timber species on his property in Lawai and in a 150 acre Forest Stewardship Project in Koloa commenced in 1996. A key element of the Project Coordinator's business plan is to harvest, process, and market wood products, creating a value-added industry directly linked to the forestry project. He has been extensively involved in the presentation of this Forest Stewardship Plan.

Plan revisions were made through a series of phone calls between the Resource Consultant, the Project Coordinator, and several other forestry practitioners and planners.

The recent literature in plantation forestry in Hawaii has been consulted extensively, forming the foundation for species selection, spacing, fertilization schedules, erosion control, and economic projections. Much research has been directed toward reforestation of former sugarcane land (Whitesell, et al, 1992; Groome, et al, 1994 a, b), and has been applied straightforwardly to this plan. The Project Coordinator's experience and projections derived therefrom are combined with recent (during 1996-early 1997) innovations in establishment techniques, short- and mid-term harvest and marketing strategies to bring about this pioneering project.

The Project Coordinator extends a special thanks to Ralph Daehler for his avid encouragement and exceptional foresight in species selection.

The Kauai Department of Land and Natural Resources Division of Forestry and Wildlife (DOFAW) has been invaluable in providing assistance and data resources to the Project Coordinator. All of the wood used for testing was supplied by this group. The Project Coordinator expects to work closely with the DOFAW through the life of the project.

Kim Wilkinson of Future Forests Nursery & Design contributed major technical and logistical support to this plan. Generous comments and review were received from many people including Roger Imoto, State Forester; Katie Friday, Associate Pacific Islands Forester; Nick Dudley, HARC Tree Crops Specialist; Galen Kawakami, DOFAW Kauai; Thomas Crabb, Consulting Forester; Steve Skipper, NRCS District Supervisor; Bob Joy, USDA Plant Materials Center; Karl Dalla Rosa, DLNR; and Jay Warner, Woodworker and HFIA Board Member.

SIP 2—Reforestation and Afforestation

2.1 Tree Groupings

Two tree groupings will be planted on this project, summarized in the table below:

Tree grouping	Number acres of 800	Acres planted annually, yrs 1-4
kamarere/tallowwood/NFTs	680	170
high-value hardwoods	120	30

2.1.1 Kamarere/Tallowwood/NFTs

Modeled on a project conducted by BioEnergy Development Corporation, the USDA Forest Service, and the U.S. Department of Energy on the Big Island during 1978-88 (Whitesell et al, 1992), stands of kamarere and tallowwood will be planted together with nitrogen fixing companion trees (680 of 800 acres).

The species selected, kamarere (*Eucalyptus deglupta*) and tallowwood (*E. microcorys*) have demonstrated great promise for their productivity when grown under conditions such as those of the project areas. In the Hawaii State DBEDT's *Forestry Investment Memorandum* prepared by the Groome Pöyry Ltd. forestry consulting firm, kamarere and tallowwood are two of the nine species on the list of "preferred species" for Hawaii forestry industry (Groome et al, 1994 a, b).

Five-year-old trials conducted on Kauai by the Project Coordinator under conditions similar to those of the project areas demonstrate outstanding growth, confirming productivity projections included in the *Forestry Investment Memorandum*. In a study conducted by HSPA, favorable growth results for both kamarere and tallowwood have been observed (Dudley, 1996).

Although the young tallowwood (to 5 years old) is not considered to be wind tolerant, it has good resistance to wind gusts as it grows larger. Kamarere has good wind resistance once it is established (Groome et al, 1993). Most kamarere sustained only modest damage in Hurricane Iniki, and have since recovered.

In addition to productivity, marketability of the selected species has been carefully considered by the Project Coordinator. Since it is part the coordinator's vision to support primary, secondary, and tertiary value-added processing on Kauai, the potential for a wide variety of wood products has been a major factor in species selection. Niche markets for these two species are presently being developed, as presented below under "Marketing."

The BioEnergy project had very promising results from the practice of mixing *Eucalyptus* species together with *Paraserianthes falcataria*, a fast growing nitrogen fixing tree (NFT) which is found naturalized throughout Hawaii. The two major benefits of adding the *Paraserianthes* to the *Eucalyptus* planting included:

- The elimination of the need for supplemental N fertilizers after the first year

- Increased height and diameter of *Eucalyptus* in interplanted plots as compared to pure stands as stated in their report, "Because the *Eucalyptus* trees were so large (which lowers harvesting costs), mixed treatments may be more economical than pure *Eucalyptus* stands, even if the *Albizia* [*Paraserianthes*] trees are not utilized."(Whitesell et al, 1992)

As herbicides will not be used and organic fertilizer is utilized for year one, it is possible that the kamarere/tallowwood/NFT group will yield timber which is organically certifiable, likely commanding a higher price on the market.

While the primary NFT for interplanting will be Paraserianthes, other NFTs considered for interplanting (fast-growing, tall at maturity) are:

NFT species	Common name	Presence in Hawaii
Acacia mangium	Mangium	limited
Albizia lebbeck	Tibet tree	naturalized
Enterolobium cyclocarpum	Earpod	naturalized
Paraserianthes falcataria	"Albizia"	naturalized
Samanea saman	Monkeypod	naturalized
Tipuana tipu	Tipu	limited

2.1.2 Hardwoods/NFTs

Diverse stands of several high-value timber species will be planted on 15% of the area (120 of 800 acres).

The Project Coordinator's vision is that this project will eventually lead to a biodiverse, self-sustaining, selectively harvested forest comprised of both native and non-native hardwood species. To this end, a broad range of high-value timber species will be planted in sections throughout the project area.

It should also be noted that many of the hardwood species being grown are nitrogen fixers themselves and should provide some of the basis for a sustainable biodiverse forest in the future.

Hardwood species include:

species	common name	species	common name
Acacia koa	Koa	*Intsia bijuga*	Borneo teak
Acacia mangium	Brown salwood	*Khaya nyasica*	African mahogany
Acrocarpus fraxinifolius	Pink cedar	*Khaya senegalensis*	African mahogany
Afzelia quanensis	Rhodesian mahogany	*Khaya ivorensis*	African mahogany
Albizia guachepele	Guavaquil	*Melia azadirachta*	Pride of India
Albizia lebbeck	Tibet tree	*Peltogyne purpurea*	Purpleheart
Astronium graveolens	Goncalo alves	*Pericopsis mooniana*	Indian walnut
Calophyllum inophyllum	Kamani	*Platymiscium pinnatum*	Roble
Cedrela odorata	Spanish cedar	*Pterocarpus angolensis*	Muninga
Cordia subcordata	Kou	*Pterocarpus dalbergioides*	Padauk
Dalbergia hainenensis	rosewood	*Pterocarpus indicus*	Narra
Dalbergia nigra	Brazilian rosewood	*Roseodendron donnell-smit*	Gold tree
Dalbergia retusa	Cocobolo	*Samanea saman*	Monkeypod
Dalbergia sissoo	Indian rosewood	*Santalum album*	Sandalwood
Dimnocarpus longan	longan/dragon eye	*Senna siamea*	Pheasantwood
Elaeocarpus grandis	Blue marble	*Swietenia macrophylla*	Mahogany
Enterolobium cyclocarpum	Ear pod tree	*Tectona grandis*	Teak
Eucalyptus citriodora	Lemon gum	*Thespesia populnea*	Milo
Eucalyptus cloeziana	Gympie's messmate	*Tipuana tipu*	Tipu
Flindersia brayleyana	Queensland maple	*Toona ciliata*	Toon
Grevillea robusta	Silk Oak		

NFT's in these plantings will include *Gliricidia sepium* and *Calliandra calothyrsus.*

2.1.3 Schematic of a 200 Acre Yearly Increment

Each year a two hundred acre area is scheduled for planting. Contiguous blocks of 30 acres each for the Hardwood groupings will be selected based on several criteria. Areas under high-voltage power lines and where view planes are to be preserved will be reserved for the hardwoods with a short, compact form and slow growth.

Planting Schematic for Representative 200 Acre Area

2.2 Cultural Practices

The Project Coordinator, Bill Cowern, has extensive experience in silvicultural techniques for kamarere, tallowwood, and a broad range of other species mentioned in this plan. During 1996 he tested various land preparation, planting, moisture retention and weed control techniques on a 50 acre site similar to those proposed for planting under this plan. During late 1996 and early 1997 he planted a significant portion of a 150+ acre Forest Stewardship Project approved in July 1996.

This plan describes techniques which have been found to be effective and efficient by the Project Coordinator through an extensive series of trial plantings. A significant development is the use of a plastic mulch which acts as a weed barrier to almost eliminate the need for herbicides. The mulch also helps to retain moisture and increase soil temperatures during the cool winter season.

2.2.1 Land Preparation

The areas to be reforested have been in industrial sugarcane cultivation and consist exclusively of lands accessible to and worked by heavy machinery. Marginal land which is too steep and rocky lies fallow wholly on the periphery of the parcels.

Land preparation will occur as follows: The site will be mowed with 85 hp tractor operating a 10 foot rotary mower. On a second pass a flail mower is used to chop the cut weeds into fine material. Next, strips will be cultivated with a spader close to contour, incorporating cut material. On a fourth pass a vertical tine tiller lely or a straight tine tiller smoothes clods and cut material. The contour strips will be on 13 foot centers and 5-7 feet wide.

After the ground has been prepared, a 4' wide plastic sheet is laid over the ground and buried 8" on each edge using a specially designed plastic laying machine. On 8'4" centers, a 4" hole is cut by a planting machine which also dispenses a water-absorbent polymer and fertilizer for each seedling. The plastic sheet suppresses weed growth around the seedling (except for those weeds that sprout through the hole in the plastic) and tends to keep the soil moist and friable. By using the plastic sheet as a weed barrier, the use of herbicide for weed control adjacent to the trees is almost entirely eliminated. It also heats the root zone and accelerates growth in cooler winter months.

2.2.2 Planting Pattern and Spacing

Spacing Kamarere/Tallowwood/NFTs

Initial tree spacing influences costs of establishment and maintenance as well as yields of marketable timber over time. The 10-year research and development program for short-rotation eucalyptus for biomass production in Hawaii indicates that while dense spacings of 600-1200 TPA may yield higher quantities of total biomass, less dense stands will produce larger stem diameter, and larger quantities of

usable timber (Whitesell et al, 1992). Studies on yield for several *Eucalyptus* species indicate that a final density of 80-100 TPA maximize merchantable volume of timber (Hillis, 1984).

In this project, where a thinning harvest is desired at 7-8 years, there is further justification for an initial spacing which gives maximum merchantable volume of timber at that time. Through consultation with foresters and the Project Coordinator's own experience with these species, it was determined that an initial density of 400 TPA (13' X 8'4" spacing) is ideal for this project. Due to rapid growth, the canopy will close at 2 years at 400 TPA, making maximum use of solar radiation and minimizing the presence of vigorous weeds in the understory. After 7 or 8 years, the stand will be thinned for a final density of 100 TPA. Any denser initial spacing would result in a bole too small for a potentially commercial thinning at 7-8 years. (See "Interim Harvest and Release" for details.)

Following the recommendations of the BioEnergy project, this project will interplant NFTs with *Eucalyptus* using the following strategy:

- The *Eucalyptus* and NFTs will be planted in alternating rows
- No N or other fertilizers will be applied beyond the first year, unless need becomes apparent.
- Spacing: 13' X 8'4" (same as for Kamarere/Tallowwood)
- Mixture: 50% *Eucalyptus*, 50% NFTs
- Total stem density: 400 TPA, *Eucalyptus spp.*: 200 TPA; NFTs: 200 TPA

Planting Pattern Kamarere/Tallowwood/NFTs

The same interplanting strategy is uses as for Kamarere/Tallowwood above.

Initial
(13' X 8'4" spacing, 400 TPA)

N	K	N	T	N	K
K	N	K	N	K	N
N	T	N	K	N	T
K	N	K	N	K	N
N	K	N	T	N	K

Final (kamarere released)
(26 X 16'8" foot spacing, 100 TPA)

K	K	K
K	K	K
K	K	K

K = Kamarere, *Eucalyptus deglupta*
K = Kamarere, *Eucalyptus deglupta*, harvested at 15-20 years
T = Tallowwood, *Eucalyptus microcorys*, all harvested at 7-8 years
N = Nitrogen Fixing Trees

Spacing Hardwoods

Due to the slower rate of growth for the hardwood species, denser spacing is desirable for quicker closure of the canopy. The distance between rows is 10' and spacing in-row is 8'. This gives a planting density of 540 TPA.

The strategy to create a diverse planting is to mix two to four species of projected similar growth rate and final height randomly throughout the planting block. This allows an even distribution of all species throughout the area. Representative mixes are:

	Hardwood mix 1	Hardwood mix 2	Hardwood mix 3
Wind hardy species	*Thespesia populnea*	*Calophyllum inophyllum*	*Grevillea robusta*
Species 2	*Astronium graveolens*	*Peltogyne purpurea*	*Elaeocarpus grandis*
Species 3	*Dalbergia nigra*	*Khaya senegalensis*	*Flindersia brayleyana*
Species 4	*Dalbergia retusa*	*Tectona grandis*	

Planting Pattern Hardwoods/NFTs

Schematic planting pattern for a three species hardwood mix, with NFTs:

Initial
(10' X 8' spacing, 540 TPA)

1 N 3 N 1 N 2 N 3 N 1
N 3 N 1 N 2 N 3 N 1 N
3 N 2 N 2 N 3 N 3 N 2
N 2 N 2 N 3 N3 N 2 N
1 N 3 N 1 N 2 N 2 N 1
N 2 N 2 N 3N 3 N 2 N

Final (Vigorous trees released)
(20' X 16' foot spacing, 135 TPA)

1 3 1 2 3 1
3 1 2 3 1
3 2 2 3 3 2
2 2 3 3 2
1 3 1 2 2 1
2 2 3 3 2

1 = Hardwood species 1
2 = Hardwood species 2
3 = Hardwood species 3
N= Nitrogen Fixing Tree

2.2.3 Planting

Planting steps are the same for both tree groupings. Planting will be accomplished as soon as possible after the mechanical land preparation and application of the plastic weed barrier has taken place. The annual planting will take place at the beginning of the rainy season, which usually commences in the month of October.

Although planting is scheduled for the rainy season, periods of dryness are possible. The addition of a water absorbent polymer directly to the planting hole will be done to reduce the risk of seedling mortality due to drought. The polymer holds up to 100 times its weight in water. During a dry period, the polymer releases water to the surrounding soil for 2-3 weeks, and has been shown by the Project Coordinator to bolster establishment rates during dry periods. Approximately one cup of hydrated polymer will be added to the planting hole at the time of planting. Two slow release fertilizer tablets will also be dropped into the prepared holes.

During the six months after the area has been planted, seedling survival will be monitored. If necessary, the area will be replanted until a minimum of 90% survival rate is obtained.

Summary of planting steps (same for all three tree groupings):

1. The land is mowed with rotary mower
2. Rows are cultivated along the contour for planting.
3. A band of fertilizer is laid along the center of the row.
4. A 4 foot wide plastic weed barrier will be laid along rows with edges buried 8".
5. Four inch long slits are cut in the plastic at the appropriate in-row spacing.
6. Into the hole are put approximately 1-2 cups hydrated water-absorbent polymer and two 21-gram sustained release fertilizer tablets @6-6-6.
7. Trees are planted by hand in the center of the cleared area.
8. Water may be provided by tractor-mounted distribution once after planting, if dry conditions are present.

2.2.4 Fertilization

Initial fertilization will take place in the planting hole using slow-release tablets which are standard for the forestry industry. Additionally, 200 lbs/acre of feather meal /bone meal will be distributed under the plastic. Subsequent rates of fertilization will follow recommended rates of four ounces of feather meal / bone meal mixed at three months, and broadcast applications of feather meal / bone meal each 2 months at 1.5 ounces per tree, minimum, the first year. It will require some testing to determine optimum levels of N as most research done in Hawaii has dealt with much closer spacing than in this project, and for shorter terms.

It is expected that fertilizer will not be needed after the first year (Whitesell et al, 1992). However, if after the first year observed growth rates are below those of the

fertilized Kamarere/Tallowwood plantings, fertilization will be done on a need-only basis.

2.2.5 Weed Control

It is the intent of the Project Coordinator to eliminate the use of herbicide The primary form of weed control close to the seedlings is performed by the plastic weed barrier. Between rows, mowing will be done before planting, and then at six weeks, three months, and every two months each year thereafter, as necessary for the duration of the project, to minimize competition and fire hazard.

The primary competitive weed species in the area are bunch grasses such as Guinea grass, sugarcane and Napier grass. These weeds have been of minimal concern in current plantings by the Project Coordinator, and can be controlled by hand weedings when necessary if they emerge through the slits in the weed barrier.

2.2.6 Pruning

After several months of growth, any stems with multiple leaders will be pruned to one dominant leader. Pruning of lower branches will not be necessary as these species are self-pruning.

2.3 Erosion Control Measures

As mentioned above, the freshly cleared land has already been colonized by numerous weedy species. With the presence of vast quantities of aggressive weeds on these properties, it is deemed too costly and risky to attempt to remove this vegetation in order to establish a "friendlier," easily managed or nitrogen fixing permanent groundcover. Instead, the strategy is to exploit and maintain the existing weed flora between the rows as a permanent cover.

It has been shown in Hamakua trials that plantation forests such as those planned for this project have minimal erosion, unless leaf litter is disturbed or removed (Whitesell et al, 1992). It is the intention of the Project Coordinator to leave the leaf litter throughout the duration the project, both for erosion control and the benefits of litter mulch such as addition of nutrients and reduction of soil surface evaporation.

It is the intention of the Project Coordinator to plant on the contour as much as possible. Initial soil cultivation on the contour and application of the plastic mulch creates contour swales at each row capable of slowing surface run-off and erosion. Mowing on the contour between the rows will also be beneficial, as contour bands of permanent ground cover will help reduce erosion. Contour mowing will be feasible on 90% of the area.

2.4 Selection of Plant Material

Most of the seedlings will be grown at Kauai Nursery and other private

nurseries. Where possible, the germplasm will be material selected for outstanding growth in trials in Hawaii or in conditions similar to those of the project site. Germplasm for kamarere and tallowwood will be from sources in Australia, Hawaii, the Philippines and Papua New Guinea. Seedlings will be grown in dibble tubes and hardened for two months before planting.

2.5 Diversity

There is reason to be concerned by the establishment of monocultures in any agriculture. Lack of diversity often leads to a number of problems including increased insect attack and disease. In this project two primary species were selected for interplanting, partly to introduce diversity into the system. Diversity is further contributed to by the interplanting of companion NFTs, as well as the areas planted in hardwoods.

It has been shown that a diversity of soil micro-organisms is supported by plant diversity, and that the microorganisms play an important role in a healthy, productive ecosystem (Shaffer, 1996). Through leaving the diverse weedy groundcover intact for the most part, there is a strong likelihood that diverse and healthy soil micro- and macro-organisms will be encouraged and maintained.

It is also of interest to note that the areas surrounding these parcels, primarily rugged gulches, contain substantial wild areas dominated by hau, Java plum, guava, and albizia. It could be argued that these wild areas form significant buffer zones between the proposed forest stands, adding substantial diversity to the total ecosystem of the region. These wild areas also form buffer zones to the Lihue-Koloa Forest Reserve.

In summary, the following steps have been taken to mitigate the risks inherent in monocultures:

- Three primary species are chosen, both with known resistance to disease and insect attack, and a proven ability to thrive in pure stands in a plantation environment in many areas of the tropics.
- Integrated windbreak trees add diversity.
- Significant numbers of other species (hardwoods) will be planted throughout.
- Plant material representing broad genetic diversity within each species will be used, rather than material selected from a narrow genetic pool or clonal material.
- The diverse weedy groundcover will be left intact between tree rows.
- The parcels are surrounded by diverse wild and fallow areas.

2.6 Interim Harvest and Release

Kamarere/Tallowwood

It is essential to thin *Eucalyptus* stands before stagnation in growth starts (Imoto, 1996). Once eucalyptus stagnates it will not release when thinned, i.e., fast

growth will not resume after thinning if stagnation took place before thinning. As part of good forest management, the Project Coordinator will annually measure height and dbh for a representative block of trees in each parcel, as well as qualitatively observe growth rates. If any sign of stagnation in growth occurs, thinning of the stand will be accelerated.

At the seventh or eighth year 75% of the trees will be removed. As mentioned above, the species composition of the thinned Kamarere/Tallowwood stands will be determined by expected market returns for the various products. At present, it is anticipated that all of the tallowwood and approximately 50% of the kamarere will be removed, reducing tree density from approximately 400 TPA to exclusively kamarere at a density of approximately 100 TPA. The final spacing will be 26' by 16'8". It is anticipated that release of the kamarere will be a commercially viable thinning.

At 6-8 years it is anticipated that the tallowwood will have a 8-12" dbh and a height of 60' and the kamarere a 12-15" dbh and height of 80'. Based on previous experience, the trees are considered to have sufficient heartwood for commercial harvest at this size. Projected yields for the interim harvest are 100 bf per tree, or 10,000 bf/acre, or 1,800,000 bf per 200 acre increment (of which 180 acres are planted in Eucalypts). If this quantity of materials is sold on the stump at 1/20 (5%) of the current market value of the processed lumber, the release could yield an income in excess of $1500/acre after 7-8 years. Proper marketing of harvested wood could increase the financial returns of this thinning harvest considerably.

Because of the high expense of labor, due primarily to large workman's compensation and other insurance costs associated with logging, most harvesting will be done mechanically. Harvesting machines are well equipped to separate the useful wood from branches and leaves, leaving significant mulch on site, which will benefit the remaining trees. The jobs created by this project are likely to be in secondary processing rather than harvesting.

Because it is anticipated that thinning will be economically feasible, release of the 15 year term kamarere is not a cost, but an income producing activity. It will also yield timber which can be used for product introduction and marketing.

Hardwoods

Thinning of these stands will take place in 7-15 years depending on the rate of growth of the species mix. Selective thinning will be done to alter species composition to those with best form, vigor, and expected market value, reducing the density to approximately 100 TPA. Thinnings may have commercial value, depending on the species.

2.7 Final Harvest

Kamarere/Tallowwood/NFTs

It is projected that the species composition after release will be primarily kamarere. At 15 years it is projected that the kamarere will attain a dbh of 24" and a height of 120'. This estimate is based on growth rates of kamarere in Hawaii and elsewhere in the tropics (Groome, et al, 1994 and Little et al, 1989). Harvestable bole length is estimated to be 60' or greater. Using these calculations and an estimate of 22" dbh, the Doyle scale projects a yield of 72,500 board feet per acre.

The above calculations are made using conservative calculations. Yield calculations for a 22" dbh bole are based on the Doyle scale. Yields using today's advanced milling methods, which use modern narrow kerf saws and make more use of wood considered before to be infeasible to extract, are 50-70% higher than the Doyle scale projections.

Hardwoods

The final harvest of the hardwoods will take place in 25-60 years depending on the species mix.

2.8 Reporting of Results

Regular measurements of species growth will be made by the Project Coordinator. These data will be made available to the Forest Stewardship Program on an annual basis for public reference. This database would be valuable for others contemplating forestry projects in Hawaii.

Additionally, the Hawaii Agricultural Research Corporation (HARC) is working with the Project Coordinator to conduct trials of selected provenances of kamarere and tallowwood on the project. The resulting data will be compiled with other trials by HARC throughout Hawaii and published.

2.9 Value-added Products and Marketing

It is estimated that the world tropical hardwood timber supply will not meet world demand within the next few years. For example:

- Malaysia, a major timber exporter for the past century, is likely to be importing timber in the next 4 years.
- Thailand imports more tropical hardwood logs than all of Europe, and has banned logging in its own country.
- Wood products from South America and Canada are already being imported to a number of neighboring Pacific countries such as the Philippines, Indonesia, and South Korea. (Hawaii may be able to meet the timber needs of this market at a lower price to the consumer due to our proximity to the market.) (Groome, 1994)
- Brazil voluntarily suspended exports of its two true mahogany species in 1996. True mahogany species will be CITES listed (banned from international trade) and

nearly unavailable worldwide within four years. (Kamarere is a reasonable replacement wood, with similar characteristics of color, grain, stability, and workability.)

- Tropical hardwood prices rose 40% from 1990 to 1994, according to the International Tropical Timber Organization quarterly magazine.

Therefore, it is reasonable to expect that a strong market will exist at the time of harvest for this project, and that prices will be at least as good as today's, adjusted for inflation.

Even though tallowwood and kamarere are high quality woods, they are not well-known in Hawaii and therefore it is imperative that markets be developed. The virtues of these timbers and their marketability are well supported (Groome et al 1994). The Project Coordinator views this forestry project as the prelude to an active value-added wood-products industry in Hawaii.

Rather than count on the market to consume large quantities of a single species, two primary species are being used allowing for product diversification and therefore economic resiliency. The early harvest from thinning will allow for marketing and product development, particularly for the kamarere which is anticipated to be harvested in large quantities several years after thinning the stands. Additional potential for product diversity will be in harvested NFTs and thinned windbreak species.

It is anticipated that the thinning harvest at 7-8 years, processed and marketed properly, may help cover the owners' costs of establishment and maintenance.

Some recent ventures in plantation forestry in Hawaii have focused on end products such as chips for biomass energy production and for various fiber products. Returns on value-added wood products such as construction grade lumber and craft/furniture grade lumber can be many fold higher (Cowern, 1995).

It is the intention of the Project Coordinator to bring new wood processing facilities onto the island and to market much of the wood produced after value-added processing. In this way, increased returns can be made on products designed for the specific properties of the wood. At the same time, markets are created for these little-used woods. For example, tallowwood is a very durable wood in contact with soil (Grace, 1994). This makes it a replacement for redwood and cedar in outdoor use, with similar or superior durability. Also, tallowwood has a very good reputation in its native Australia, where importation of the now scarce wood is a possibility. The project Coordinator intends to market the products two years before selling, and to establish purchase orders to help leverage the capital costs.

Although inferior to other more expensive (and increasingly rare) hardwoods, the wood of kamarere is suitable for manufacture of cabinets, furniture, moldings, trim, doors, frames, outdoor furniture, etc. Its grain and structural properties resemble that of mahogany, making it suitable as a less expensive replacement.

Potential Products Tallowwood:
termite-resistant flooring
termite-resistant sills
truck beds
ground applications, organic gardens (replacement for redwood and cedar)
stakes, posts, raised beds.

Potential Products Kamarere:
mahogany replacement
furniture
cabinets
interior trim

2.10 Expense Items

This section covers the all costs of the project, even those expenses not covered by state cost-sharing, and concludes with the budget for SIP-2.

Site Preparation Costs

The following land preparation data have been derived from the planting experience of the project coordinator.

Mowing requires 2.2 hours/acre plus 1/2 hour additional hand labor for rock moving. Tractor time is budgeted at $40/hr (including operator) plus attachment at $15/hr.

Spading and tilling requires 5.8 hours/acre tractor time, at the rate of $40/hr (including operator) plus attachments at $15/hr.

Labor for removing rocks which interfere in mowing maintenance is 1.5 hours/acre or $15/acre.

Total cost for site preparation is $460/acre.

Mulching

The laying of plastic mulch requires 2.4 hours/acre, charged at $40/hr (including operator) plus mulch attachment at $15/hr. The cost of the plastic mulch is $101.75 per acre.

Total cost for mulching is $233.75/acre (Kamarere/Tallowwood and Kamarere/Tallowwood/NFT), $269.36 (Hardwood Groups).

Seedling acquisition

Most seedlings for kamarere and tallowwood will be purchased from a private nursery on Kauai at the same pricing as the State Tree Nursery. The average cost per tree comes to 16¢.

Other trees from private nurseries will be grown out at expected average cost of $0.85/tree.

Cost of trees for Kamarere/Tallowwood group: $64.00/acre (16¢ average)
Cost of trees for Kamarere/Tallowwood/NFT group: $133.00/acre (33¢ aver.)
Cost of trees for Mixed Hardwood group: $459.00/acre (85¢ average)

Planting Costs

The tractor mounted planting machine will be used to cut planting holes in the plastic mulch, and dispense the hydrated polymer and fertilizer. Tractor time for this operation is 3 hours/acre or $165/acre.

Planting will be done by hand. It is estimated that 400 trees per 8-hour day per person can be planted. At a base wage of $10/hr, this would yield a planting cost of approximately $80 per acre.

The cost is of hydrated polymer is 3¢ per tree. This adds $12 to material costs

for planting per acre.

The total cost of planting is $257/acre.

Fertilizer material and application costs

The cost of the fertilizer tablets is 10¢ each, including delivery. The cost of distributing the tablets is included above under "Planting Costs."

Both 16-16-16 and urea fertilizers cost about $400 per ton. Application rates are 200 pounds per acre for the first year, and 112.5 pounds per acre through Year 7 (except for the Kamarere/Tallowwood/NFT group). Cost would be $40.00 per acre the first year and $22.50 per acre subsequently, unless the price increases. Application costs are estimated at $40 per acre for all years.

Weed Control

It is expected that one hand weeding will be needed during the first year. The hand weeding will require one hour of hand labor or $10/acre.

Assuming 2 mph on mowing passes, one acre can be covered in 0.75 hrs. at a cost of $41.25. Six mowing passes (at 6 weeks 3, 5, 7, 9, and 11 months after planting) will be made after planting the first year.

Maintenance after First Year

Four mowing passes will be made per year every year after the first year. After two years and closure of the canopy, mowing is used primarily to reduce fire hazard to the trees.

Hand weeding will take place at 18 months. It is estimated that each weeding session will require 4 hours of hand labor per acre, or $40.00/acre.

Lease Rent

Lease rent is $50/acre/year for the first 10 years and $70/acre/year thereafter.

2.11 Budget

This SIP-2 budget applies to the Kamarere/Tallowwood/NFT establishment (680 acres):

SIP-2	Area Cover	Materials/ Equipment	Materials cost	Labor	Labor cost	Cost per acre	Reimbursible	Landowner share	Reimburse amount
seedlings	1.0 acre	400 trees @ $0.3325 (average cost)	$133.00			$133.00	400 trees @ $0.25, (normal rate)	$66.50	$66.50
site prep	1.0 acre	8 hs tractor incl oper. $440.00/ acre	$440.00	2 hrs labor	$20.00	$460.00	$200/acre (med)	$260.00	$200.00
planting cost	1.0 acre	Planting, dispensing fertilizer, polymer	$177.00	400 trees/day —8 hrs @$10/hr	$80.00	$257.00	$120/acre (heavy)	$137.00	$120.00
Initial fertili zation	1.0 acre	800 fert tabs @ $0.10 ea + feath. meal	$120.00	included above	$0.00	$120.00	$100/acre	$60.00	$60.00
subseque nt fertili zation	1.0 acre	$40/ac	$40.00	$40/ac	$40.00	$80.00	$100/acre	$40.00	$40.00
Weed/ moisture control (year 1)	1.0 acre	mulch, 6 mowing @ $41.25	$481.25	Hand weeding	$40.00	$521.25	$150/acre	$371.25	$150.00
SIP 2 Totals per acre (year 1)	1.0 acre		$1391.25		$180.00	$1571.25		$934.75	$636.50

This SIP-2 budget applies to the Hardwood groups (120 acres):

SIP-2	Area Cover	Materials/ Equipment	Materials cost	Labor	Labor cost	Cost per acre	Reimbursible	Landowner share	Reimburse amount
seedlings	1.0 acre	540 trees @ $0.85 (average cost)	$459.00			$459.00	540 trees @ $1.50, (high rate)	$229.50	$229.50
site prep	1.0 acre	8 hs tractor incl oper. $440.00/ acre	$440.00	2 hrs labor	$20.00	$460.00	$200/acre (med)	$260.00	$200.00
planting cost	1.0 acre	Planting, dispensing fertilizer, polymer	$131.11	400 trees/day —10.8 hrs @$10/hr	$108.00	$239.11	$120/acre (heavy)	$119.56	$119.56
Initial fertili zation	1.0 acre	1080 fert tabs @ $0.10 ea + feath. meal	$148.00	included above	$0.00	$148.00	$100/acre	$74.00	$74.00
subseque nt fertili zation	1.0 acre	$40/ac	$40.00	$40/ac	$40.00	$80.00	$100/acre	$54.00	$26.00
Weed/ moisture control (year 1)	1.0 acre	mulch, 6 mowing @ $41.25	$516.86	Hand weeding	$40.00	$556.86	$150/acre	$406.86	$150.00
SIP 2 Totals per acre (year 1)	1.0 acre		$1734.97		$208.00	$1942.97		$1143.92	$799.06

SIP-2 budget maintenance expenses Years 2-4, Kamarere/Tallowwood/NFT grouping:

SIP-2 Main	Area Cover	Materials	Materials cost	Labor	Labor cost	Cost per acre	Reimbursible	Landowner share	Reimburse amount
Weed/ moisture control (yrs 2-4)	1.0 acre	4 mowing @ $41.25	$165.00	Hand weeding labor	$40.00	$205.00	$150/acre	$102.50	$102.50
Fertili zation (yrs 2-4)	1.0 acre	$0/ac	$0.00	$0/ac	$0.00	$0.00	$100/acre	$0.00	$0.00
SIP 2 Totals per acre (yrs	**1.0 acre**		**$165.00**		**$40.00**	**$205.00**		**$102.50**	**$102.50**

SIP-2 budget maintenance expenses Years 2-4, Hardwood grouping (represents higher labor costs in proportion to the higher number of trees):

SIP-2 Main	Area Cover	Materials	Materials cost	Labor	Labor cost	Cost per acre	Reimbursible	Landowner share	Reimburse amount
Weed/ moisture control (yrs 2-4)	1.0 acre	4 mowing @ $41.25	$165.00	Hand weeding labor	$54.00	$219.00	$150/acre	$109.50	$109.50
Fertili zation (yrs 2-4)	1.0 acre	$22.50/ac	$22.50	$40/ac	$40.00	$62.50	$100/acre	$31.25	$31.25
SIP 2 Totals per acre (yr 2-4)	**1.0 acre**		**$187.50**			**$281.50**		**$140.75**	**$140.75**

SIP-2 Expense Summary

Establishment costs per acre (Year 1):

Tree grouping	Establish-ment Total	Landowner share	Reimburse amount
kamarere/tallowwood/NFTs	$1571.25	$934.75	$636.50
high-value hardwoods	$1942.97	$1143.92	$799.05

Maintenance costs per acre (Year 2-4):

Tree grouping	Total	Landowner share	Reimburse amount
kamarere/tallowwood/NFTs	$205.00	$102.50	$102.50
high-value hardwoods	$281.50	$140.75	$140.75

Maintenance costs per acre (total for Years 2-4):

Tree grouping	Maintenance Total	Landowner share	Reimburse amount
kamarere/tallowwood/NFTs	$615.00	$307.50	$307.50
high-value hardwoods	$844.50	$422.25	$422.25

Establishment and maintenance costs per acre over first four years:

Tree grouping	Total	Landowner share	Reimburse amount
kamarere/tallowwood/NFTs	$2186.25	$1242.25	$944.00
high-value hardwoods	$2787.47	$1566.17	$1221.30

2.12 Economic Projections

Although it is the Project Coordinator's intention to process and market the wood grown on this project on Kauai, this projection is based on production of the raw material only. The economics of value-added processing may show much improved results; this section is only meant to give baseline predictions for the project.

The calculations are based on per acre costs and returns for a standard planting within this plan

The following assumptions are made:

Net Present Value Projections for Kamarere/Tallowwood/NFT plantings

1. The nominal yield projections are 10,000 bf/acre in 7 years and 75,000 bf/acre at 15 years (estimated in "Final Harvest" above).
2. Costs for establishment and maintenance, and State cost-sharing are as given in tables included in this plan.
3. Lease costs are $50/yr for the first ten years, then $70/yr for the next 10 years, per acre. This gives a lease rent cost of $1200 per acre. Additionally, 3% of gross market value of the harvest is to be paid to the landowner.
4. Stumpage values are calculated from the minimum price of $0.98/bf, determined as the present average wholesale cost of construction grade lumber in Hawaii. Stumpage values are estimated at 1/20 of wholesale (worst case) to 1/2 of wholesale (best case). It should be noted that kamarere is presently selling for $3.00/board foot (wholesale) in Honolulu. It also should be noted that while the figures reflect 1996 prices, current projections show that price increases in wood products will far outstrip inflation (Groome et al, 1994).
7. The costs and returns (in timber from *Eucalyptus dunnii*) from the windbreak are estimated to cancel each other; i.e., there is no cost for the windbreak figured in.
8. These are all only estimates; overhead costs such as project management, insurance and other related costs are not represented.

NPV per acre: 7% discount (constant 1997 dollars)		Best Case $/bf				Worst Case $/bf
		$0.50/bf	$0.25/bf	$0.15/bf	$0.098/bf	$0.049/bf
Best Yields	Thinning: 15,000 bf, Final: 100,000 bf	19388	8675	4390	2162	63
	Thinning: 10,000 bf, Final: 100,000 bf	17925	7944	3951	1875	-81
	Thinning: 10,000 bf, Final: 75,000 bf	13666	5814	2674	1041	-498
	Thinning: 10,000 bf, Final: 60,000 bf	11111	4537	1907	540	-749
Worst Yields	Thinning: 10,000, Final: 20,000 (hurricane)	4297	1130	-137	-796	-1416

NPV per acre 10% discount (constant 1997 dollars)		Best Case $/bf				Worst Case $/bf
		$0.50/bf	$0.25/bf	$0.15/bf	$0.098/bf	$0.049/bf
Best Yields	Thinning: 15,000 bf, Final: 100,000 bf	13085	5650	2677	1130	-327
	Thinning: 10,000 bf, Final: 100,000 bf	11879	5048	2315	894	-445
	Thinning: 10,000 bf, Final: 75,000 bf	9066	3641	1471	343	-721
	Thinning: 10,000 bf, Final: 60,000 bf	7379	2797	965	12	-886
Worst Yields	Thinning: 10,000, Final: 20,000 (hurricane)	2878	547	-385	-870	-1327

NPV per acre 13% discount (constant 1997 dollars)		Best Case $/bf				Worst Case $/bf
		$0.50/bf	$0.25/bf	$0.15/bf	$0.098/bf	$0.049/bf
Best Yields	Thinning: 15,000 bf, Final: 100,000 bf	8914	3658	1556	462	-568
	Thinning: 10,000 bf, Final: 100,000 bf	7915	3158	1256	267	-666
	Thinning: 10,000 bf, Final: 75,000 bf	6036	2219	692	-102	-850
	Thinning: 10,000 bf, Final: 60,000 bf	4909	1655	354	-323	-960
Worst Yields	Thinning: 10,000, Final: 20,000 (hurricane)	1903	153	-548	-912	-1255

SIP 4—Windbreak Establishment, Maintenance and Renovation

Kamarere/Tallowwood/NFT Plantings:

To reduce the risks of losses due to wind damage, this project will employ windbreaks planted strategically throughout the Kamarere/Tallowwood/NFT plantings. The windbreak trees will also add species diversity.

Another *Eucalyptus* species has been selected for this purpose, Dunn's White Gum, *Eucalyptus dunnii*. Trials by the Project Coordinator show that it can be at least as fast growing as kamarere and tallowwood. It is highly wind tolerant, and has potential to be harvested for timber at 15-20 years.

The windbreak species will be planted at the same spacing as the tallowwood and kamarere (13' X 8'4"). At the time of interim harvest at 7-8 years, it is anticipated that the windbreak will also be thinned by 75% to a spacing of 26' X 16' 8". This spacing is 20% wider than considered appropriate spacing for large windbreak trees (USDA SCS, 1991), but will ease management by maintaining uniform spacing throughout the parcels. Also, by 7 years old, the kamarere should be large enough to withstand heavy winds without being destroyed, as many large kamarere trees withstood hurricane Iniki and are now regrowing well.

The exact location of the windbreaks will be determined by the Project Coordinator based on field topography, layout of planting areas, and presence of existing tall trees growing on the periphery of the parcels. It is estimated that approximately 3% of the Kamarere/Tallowwood and Kamarere/Tallowwood/NFT areas will be planted with the Dunn's White Gum.

Seedling acquisition

Seedlings of Dunn's White Gum will be grown out at a local nursery at an expected average cost of 85¢/tree.

Hardwood Plantings:

Each mixed hardwood planting contains at least one wind hardy species. These will be planted on the edges of the hardwood area to act as a windbreak. This wind-hardy species will also be mixed with the other species on the interior of the planting, which will aid in wind protection.

Budget SIP-4

Since the windbreak trees will be planted on the same spacing as the other trees, and can be considered to be timber species in their own right, the cost of windbreaks is included in the reforestation (SIP-2) budgets.

VII. Practice Implementation Schedule

General summary for 200 acre increment

Year 1.....Land preparation, planting and fertilizing, mow (6X), weed (1X),
Year 2.....Mowing (4X)
Year 3-4.....Mowing (4X)
Year 4-6.....Mowing (4X) (as necessary)
Year 7-8.....Interim harvest and release, weed control
Year 8-9.....Mowing (4X),
Year 10-12.....Mowing (4X) (as necessary)
Year 15-20.....Final harvest, replant after harvest

Ten Year SIP Summary

Year	SIP-1 Plan	SIP-2 Reforest	SIP-2 Maintenance	Number of acres installed per year
Year 1 -1997	3 practices	200 acres		200 acres
Year 2 -1998		200 acres	200 acres	200 acres
Year 3 -1999		200 acres	400 acres	200 acres
Year 4 -2000		200 acres	600 acres	200 acres
Year 5 -2001			800 acres	
Year 6 -2002			800 acres	
Year 7 -2003			800 acres	
Year 8 -2004			800 acres	
Year 9 -2005			600 acres	
Year 10 -2006			400 acres	
Totals		800 acres		800 acres

Number of trees to be planted per 200 acre increment:

species	common name	Trees/ 200 acres
Eucalyptus deglupta	kamarere	16490
Eucalyptus microcorys	tallowwood	16490
Eucalyptus dunnii	Dunn's White gum	2040
Various NFTs		41080
Various hardwoods		8100
Total number of trees		84200

Yearly Implementation and Maintenance Schedule and Budgets:

Year 1 - 1997	Units	Cost per Unit	Total Practice	Landowner	Cost share
SIP-2 - Kam/Tal/NFT Establishment	170 acres	$1571.25	$267,112.50	$158,907.50	$108,205.00
SIP-2 - Hardwoods Establishment	30 acres	$1942.97	$58,289.10	$34,317.60	$23,971.50
Totals			$325,401.60	$250,401.60	$75,000.00
Year 2 - 1998	Units	Cost per Unit	Total Practice	Landowner	Cost share
SIP-2 - Kam/Tal/NFT Establishment	170 acres	$1571.25	$267,112.50	$158,907.50	$108,205.00
SIP-2 - Hardwoods Establishment	30 acres	$1942.97	$58,289.10	$34,317.60	$23,971.50
SIP-2 - Kam/Tal/NFT maintenance	170 acres	$205.00	$34,850.00	$17,425.00	$17,425.00
SIP-2 - Hardwoods maintenance	30 acres	$281.50	$8,445.00	$4,222.50	$4,222.50
Totals			$368,696.60	$293,696.60	$75,000.00
Year 3 - 1999	Units	Cost per Unit	Total Practice	Landowner	Cost share
SIP-2 - Kam/Tal/NFT Establishment	170 acres	$1571.25	$267,112.50	$158,907.50	$108,205.00
SIP-2 - Hardwoods Establishment	30 acres	$1942.97	$58,289.10	$34,317.60	$23,971.50
SIP-2 - Kam/Tal/NFT maintenance	340 acres	$205.00	$69,700.00	$34,850.00	$34,850.00
SIP-2 - Hardwoods maintenance	60 acres	$281.50	$16,890.00	$8,445.00	$8,445.00
Totals			$411,991.60	$336,991.60	$75,000.00
Year 4 - 2000	Units	Cost per Unit	Total Practice	Landowner	Cost share
SIP-2 - Kam/Tal/NFT Establishment	170 acres	$1571.25	$267,112.50	$158,907.50	$108,205.00
SIP-2 - Hardwoods Establishment	30 acres	$1942.97	$58,289.10	$34,317.60	$23,971.50
SIP-2 - Kam/Tal/NFT maintenance	510 acres	$205.00	$104,550.00	$52,275.00	$52,275.00
SIP-2 - Hardwoods maintenance	90 acres	$281.50	$25,335.00	$12,667.50	$12,667.50
Totals			$455,286.60	$380,286.60	$75,000.00
Year 5 - 2001	Units	Cost per Unit	Total Practice	Landowner	Cost share
SIP-2 - Kam/Tal/NFT maintenance	680 acres	$205.00	$139,400.00	$69,700.00	$69,700.00
SIP-2 - Hardwoods maintenance	120 acres	$281.50	$33,780.00	$16,890.00	$16,890.00
Totals			$173,180.00	$98,180.00	$75,000.00
Year 6 - 2002	Units	Cost per Unit	Total Practice	Landowner	Cost share
SIP-2 - Kam/Tal/NFT maintenance	680 acres	$205.00	$139,400.00	$69,700.00	$69,700.00
SIP-2 - Hardwoods maintenance	120 acres	$281.50	$33,780.00	$16,890.00	$16,890.00
Totals			$173,180.00	$98,180.00	$75,000.00
Year 7 - 2003	Units	Cost per Unit	Total Practice	Landowner	Cost share
SIP-2 - Kam/Tal/NFT maintenance	680 acres	$205.00	$139,400.00	$69,700.00	$69,700.00
SIP-2 - Hardwoods maintenance	120 acres	$281.50	$33,780.00	$16,890.00	$16,890.00
Totals			$173,180.00	$98,180.00	$75,000.00
Year 8 - 2004	Units	Cost per Unit	Total Practice	Landowner	Cost share
SIP-2 - Kam/Tal/NFT maintenance	680 acres	$205.00	$139,400.00	$69,700.00	$69,700.00
SIP-2 - Hardwoods maintenance	120 acres	$281.50	$33,780.00	$16,890.00	$16,890.00
Totals			$173,180.00	$98,180.00	$75,000.00
Year 9 - 2005	Units	Cost per Unit	Total Practice	Landowner	Cost share
SIP-2 - Kam/Tal/NFT maintenance	510 acres	$205.00	$104,550.00	$52,275.00	$52,275.00
SIP-2 - Hardwoods maintenance	90 acres	$281.50	$25,335.00	$12,667.50	$12,667.50
Totals			$129,885.00	$64,942.50	$64,942.50
Year 10 - 2006	Units	Cost per Unit	Total Practice	Landowner	Cost share
SIP-2 - Kam/Tal/NFT maintenance	340 acres	$205.00	$69,700.00	$34,850.00	$34,850.00
SIP-2 - Hardwoods maintenance	60 acres	$281.50	$16,890.00	$8,445.00	$8,445.00
Totals			$86,590.00	$43,295.00	$43,295.00
Grand Totals			$2,470,571	$1,762,334	$708,238

References

Barbier, Edward, Joanne C. Burgess, Joshua Bishop, Bruce Aylward. 1994. *The Economics of the Tropical Timber Trade*. Earthscan Publications Ltd., London.

Bootle, Keith R. 1971. *The Commercial Timbers of New South Wales and Their Use.* Angus and Robertson, Sydney, Australia.

Clawson, Marion. 1977. *Decision Making in Timber Production, Harvest, and Marketing.* Resources for the Future, Inc. Washington, D.C.

Cowern, W., 1995. *Common Sense in Forest Figures*. Talk presented at State Planning Conference, Fall 1995.

Cowern, W., 1997. Web site for Hale Kua: http://hoohana.aloha.net/halekua/arboreal.html.

Crabb, Thomas. 1996. Personal communication to resource consultant.

Dudley, Nicklos. 1996. Personal communication to Project Coordinator and Resource Consultant.

Groome Pöyry Ltd. 1994. *Hawaii Forestry Investment Memorandum.* Prepared for The State of Hawaii Dept. of Business, Economic Development, and Tourism. Honolulu, HI.

Groome Pöyry Ltd. 1993. *State of Hawaii Report on Scoping Visit-July 1993*. Prepared for The State of Hawaii Dept. of Business, Economic Development, and Tourism. Honolulu, HI.

Grace, J.K., 1994. Termite Resistance of Woods Grown on Kauai, written communication to Bill Cowern.

Hanson, O.P. 1978. *An Approach to the Market Classification of Tropical Wood Species.* In: Proceedings, Wood Quality and the Utilization of Tropical Species. Forest Products Research and Industries Development Commission, College, Laguna, Philippines; 118-

Hawaii Department of Land and Natural Resources.1995. *State of Hawaii Forest Stewardship Handbook.* Division of Forestry and Wildlife.

Hillis, W.E. and A.G. Brown, eds. 1984. *Eucalypts for Wood Production*. CSIRO, East Melbourne, Australia.

Imoto, Roger. 1996. Personal communication to resource consultant.

Little, Elbert Luther and Roger G. Skolmen. 1989. *Common Forest Trees of Hawaii*. Agriculture Handbook No. 679. U.S. G.P.O.

Meniado, J.A., F.N. Tamolang and B.C. de Vela. 1978. *Wood Quality in the Utilization of Philippine Plantation Species: Eucalyptus deglupta Blume.* In: Proceedings, Wood Quality and the Utilization of Tropical Species. Forest Products Research and Industry

Neal, Marie C. 1965. *In Gardens of Hawai'i*, Bishop Museum Press, Honolulu.

Penfold, A.R. and J.L. Willis. 1961. *The Eucalypts.* University Press, Aberdeen.

Pryor, Lindsay D. 1976. *The Biology of the Eucalypts*. In: The Institute of Biology's Studies in Biology no. 61. Edward Arnold Publishers Ltd., London.

Shaffer, Bob. Certified Crop Advisor, Native Cultures Alternative Agriculture Consulting Group, From the Workshop *Soil Health and Tropical Crops*, January 1996, Kainaliu, HI.

USDA Soil Conservation Service.1972. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.*

United States Dept of Agriculture Soil Conservation Service. 1991. Technical Guide "Field Windbreak."

USDA. 1994. Agroforestry: An Integrated Land-Use Management System for Production and Farmland Conservation, USDA SCS Acct 68-3A75-3-134.

Wager, Warren L., Derral R. Herbst, and S.H. Sohmer. 1990. *Manual of the Flowering Plants of Hawaii, Volume 1 and 2*, Bishop Museum Press, Honolulu, HI

Whitesell, C.D., D.S. DeBell, T.H. Schubert. R.F. Strand, and T.B. Crabb. 1992. *Short Rotation Management of Eucalyptus: Guidelines for Plantations in Hawaii.* Gen. Tech. Rep. PSW-GTR-137. Albany, CA: Pacific Southwest Research Station, Forest Service, USD

Wiersum, K.F. 1984. *Surface Erosion Under Various Tropical Agroforestry Systems.* In: Proceedings, Symposium on Effects of Forest Land Use on Erosion and Slope Stability. Environment and Policy Inst., East-West Center, University of Hawaii, Honolulu, HI

Primary Species Descriptions

Kamarere, *Eucalyptus deglupta*
Family: Myrtaceae, Origin: N. Australia, Indonesia, the Philippines and Papua New Guinea
Climate and Ecology:
- Elevation distribution: 0-6000 ft, Annual rainfall: 60-140 in.
- Typically grows in pure stands (Hillis, 1984)
- Grows in deep, moderately fertile sandy loam soil
- Can grow naturally on soils w/ low nutrients, Light-loving, shade intolerant

Pests and problems:
- Very sensitive to fire
- Young trees brittle, easily damaged by storm wind
- No problems yet from monoculture in HI (Whitesell et al, 1992)

Wood:
- Heartwood: reddish-brown
- Sapwood: white-pink
- Coarse grained, moderate strength
- Plantation wood <15 yrs. old, basic density=270-440 kg m^{-3}

Growth History:
- Has been grown successfully in plantations in the Philippines, Fiji, PNG, Western Samoa, and the Solomon Islands, as well as Central America, Southeast Asia, and Central Africa (Hillis, 1984)
- In Hawaii it has reached a height of 100 feet in 7 years (Little et al, 1989)
- Natural stands: 35-60 m high
- PNG: 44 m. high, 54 cm dbh at 15 years
- self-pruning, clear boles 27 m. long have developed in 12 years (Hillis, 1984)

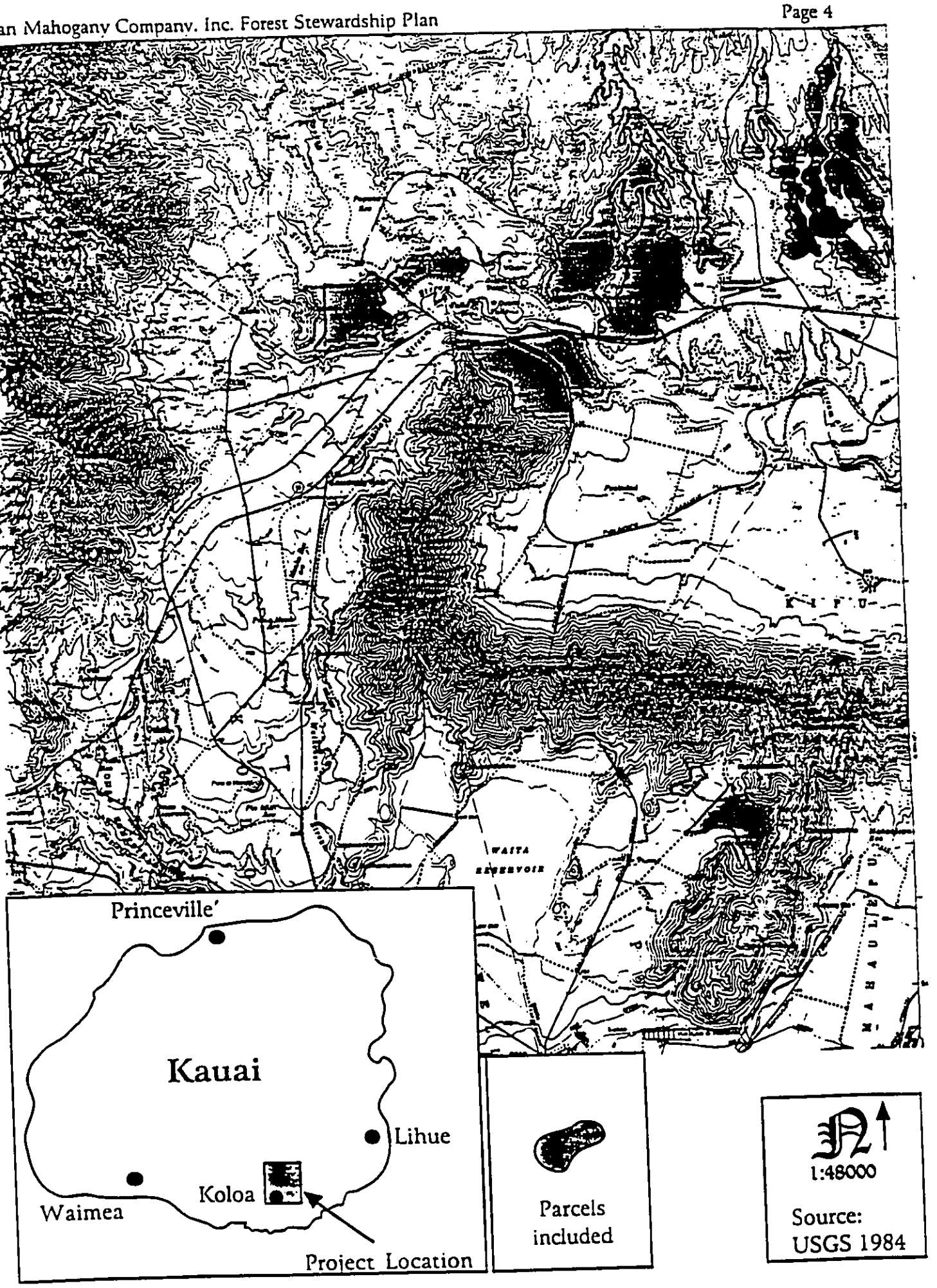
Tallowwood, *Eucalyptus microcorys*
Family: Myrtaceae, Origin: Australia
Climate and Ecology:
- Elevation distribution 0-2500 ft. , Annual rainfall: 35-60 inches
- Found in tall open forests, sometimes associated with *E. saligna*
- Tolerant of partial shade
- Found on a wide variety of soils, including sandy and poor

Pests and problems:
- Planting is W. Australia has been reduced due to damage by *Cryphonectria (*formerly *Phorancantha) spp.* bark beetle
- Susceptible to wind throw at an early age (up to 3 years)

Wood:
- Heartwood yellow-brown
- Sapwood pale yellow
- Moderately coarse-grained
- Basic density: 50 lb/cu ft.

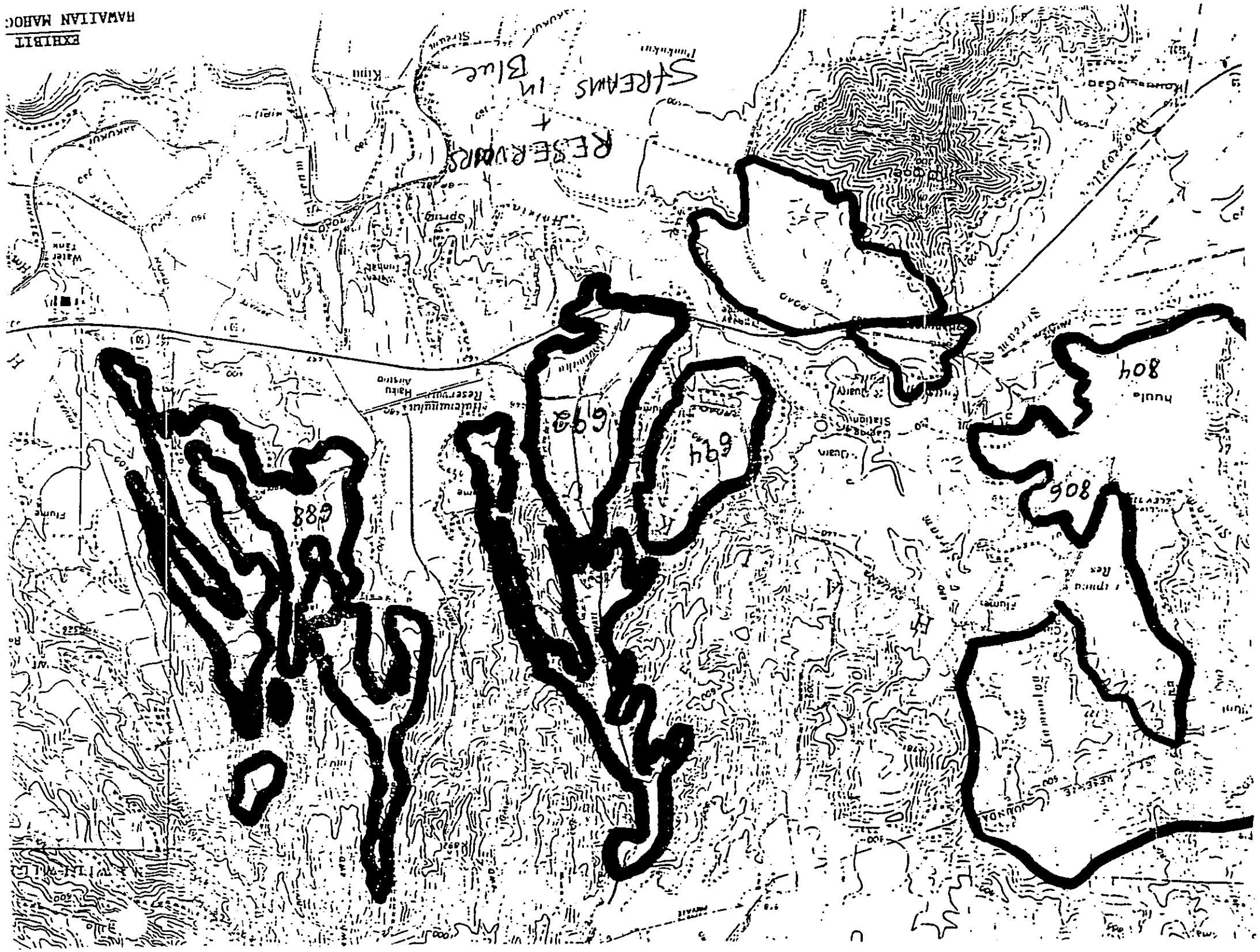
Growth History:
- Has been grown successfully in plantations in Australia, Sri Lanka, Brazil, and South Africa (Hillis, 1984)
- Height to 150', 7 ft. diameter

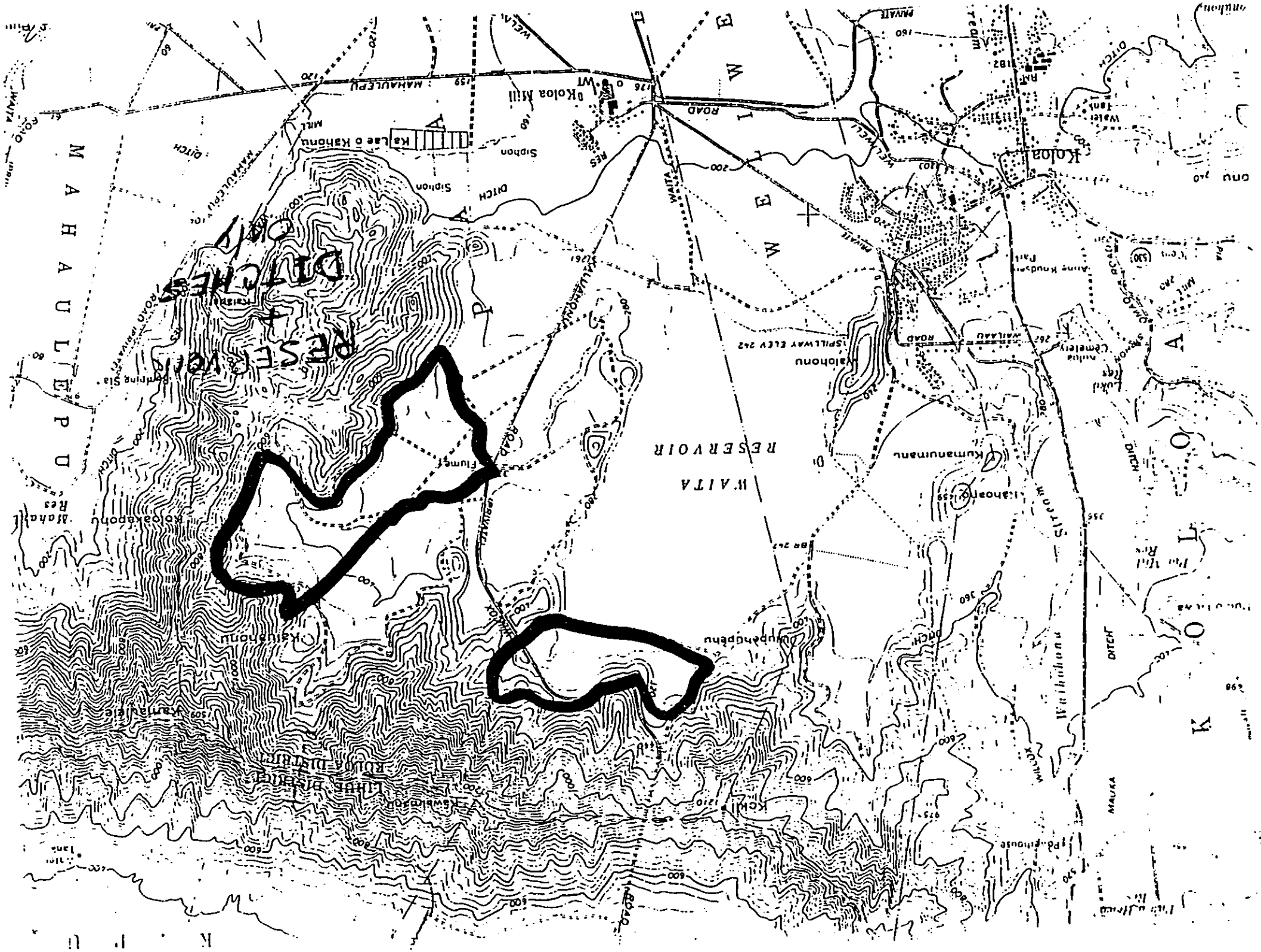
APPENDIX A - MAPS



EXHIBIT

HAWAIIAN MAHOG



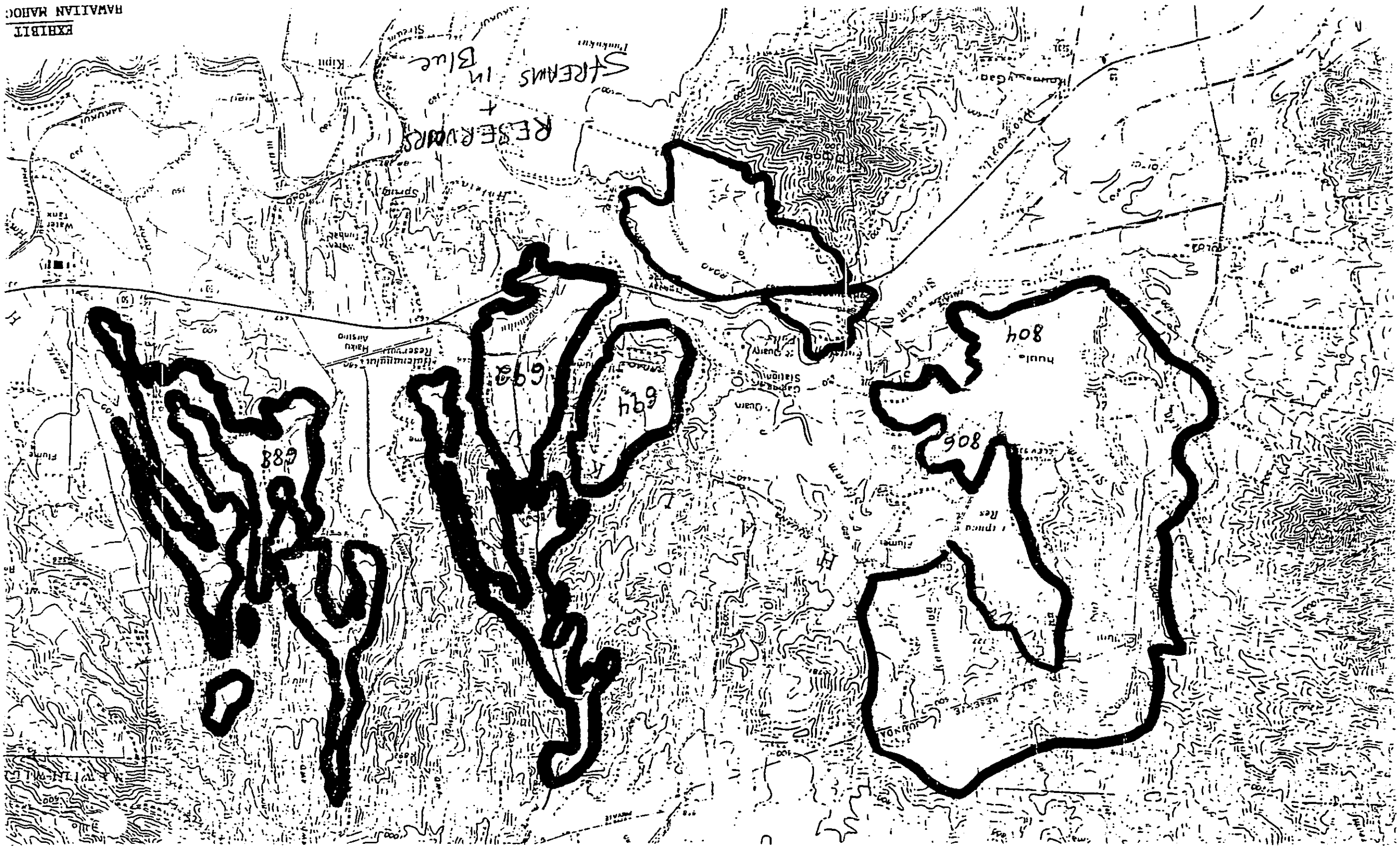


DOCUMENT CAPTURED AS RECEIVED

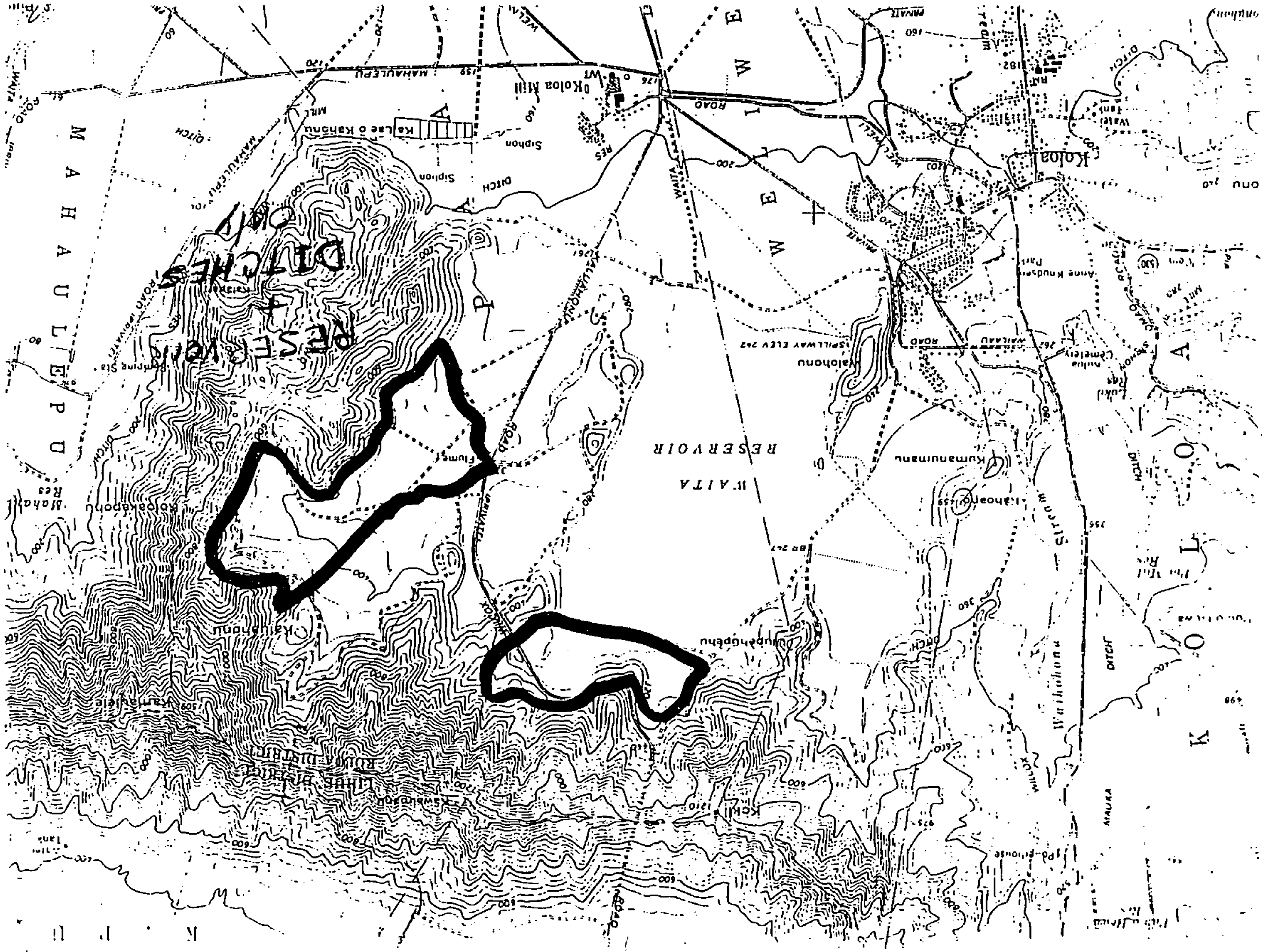
CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

EXHIBIT
HAWAIIAN MAHOG



DOCUMENT CAPTURED AS RECEIVED



DOCUMENT CAPTURED AS RECEIVED

APPENDIX B

COMMENTS RECEIVED FROM REVIEWERS OF DRAFT ENVIRONMENTAL ASSESSMENT

BENJAMIN J. CAYETANO
[redacted]
GOVERNOR

STATE OF HAWAII
ENVIRONMENTAL COUNCIL
225 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

HARLAN H. HASHIMOTO
CHAIRPERSON
BARBARA ROBESON
VICE-CHAIRPERSON

December 9, 1997

Michael Buck, Administrator
Department of Land and Natural Resources
Division of Forestry & Wildlife
P.O. Box 621
Honolulu, Hawaii 96809

Attention: Nelson Ayers

Dear Mr. Buck:

Subject: Draft Environmental Assessment (EA) for Koloa Forest Stewardship Project, Koloa, Kauai

Please include the following in the final EA:

1. Agency and community contacts: Consult with the Kauai Planning Department. Include copies of any correspondence and responses made with this and any other agencies during the pre-consultation and consultation phases of this project.

2. Funding: The EIS rules require all state or county funds involved to be disclosed, including any federal funds flowing through the state or county. The total federal-state cost share is given at $708,238. Please provide a breakdown of this amount that shows funding sources.

3. Maps: Include an area map (close-up map) for each of the parcels that clearly shows roads, streams, etc.

4. Zoning: Indicate the state land use designation and the county zoning for all land involved in this project.

5. Harvesting: After harvesting, the issue of the long duration required for stump removal, or non-removal of stumps, is a concern. Other impacts occur in the post-harvest period as well. Please discuss the impacts of harvesting and the mitigation measures planned to reduce these impacts. Also discuss the impacts of the post-harvest remains and what will be done to mitigate these effects. Impacts include, but are not limited to:

   - fire hazards during growth, harvest and post-harvest periods
   - noise impacts from the cutting equipment
   - air quality impacts from burning
   - traffic impacts from logging trucks during the harvest period
   - lack of availability of this land in the post-harvest period

If you have any questions, please call Nancy Heinrich at 586-4185.

Sincerely,

GARY GILL
Director

c: Bill Cowern, Hawaiian Mahogany

MARYANNE W. KUSAKA
MAYOR

PLANNING DEPARTMENT

DEE M. CROWELL
PLANNING DIRECTOR
IAN K. COSTA
DEPUTY PLANNING DIRECTOR

TELEPHONE (808) 241-6677
FAX (808) 241-6699

December 30, 1997

Mr. Karl R. Dalla Rosa
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

SUBJECT: Forest Stewardship Project by Hawaiian Mahogany Co., Ltd. at Kauai, Hawaii

Thank you for forwarding the Draft Environment Assessment to our office for comment.

Overall, our office has no objections relating to the proposed project. The proposed use is permitted within the portions which are in the State Land Use Agricultural District and zoned either Agriculture District (A) or Open District (O). The County has no jurisdiction within the Conservation District portion.

Should you have any questions, please feel free to contact our office at 241-6677.

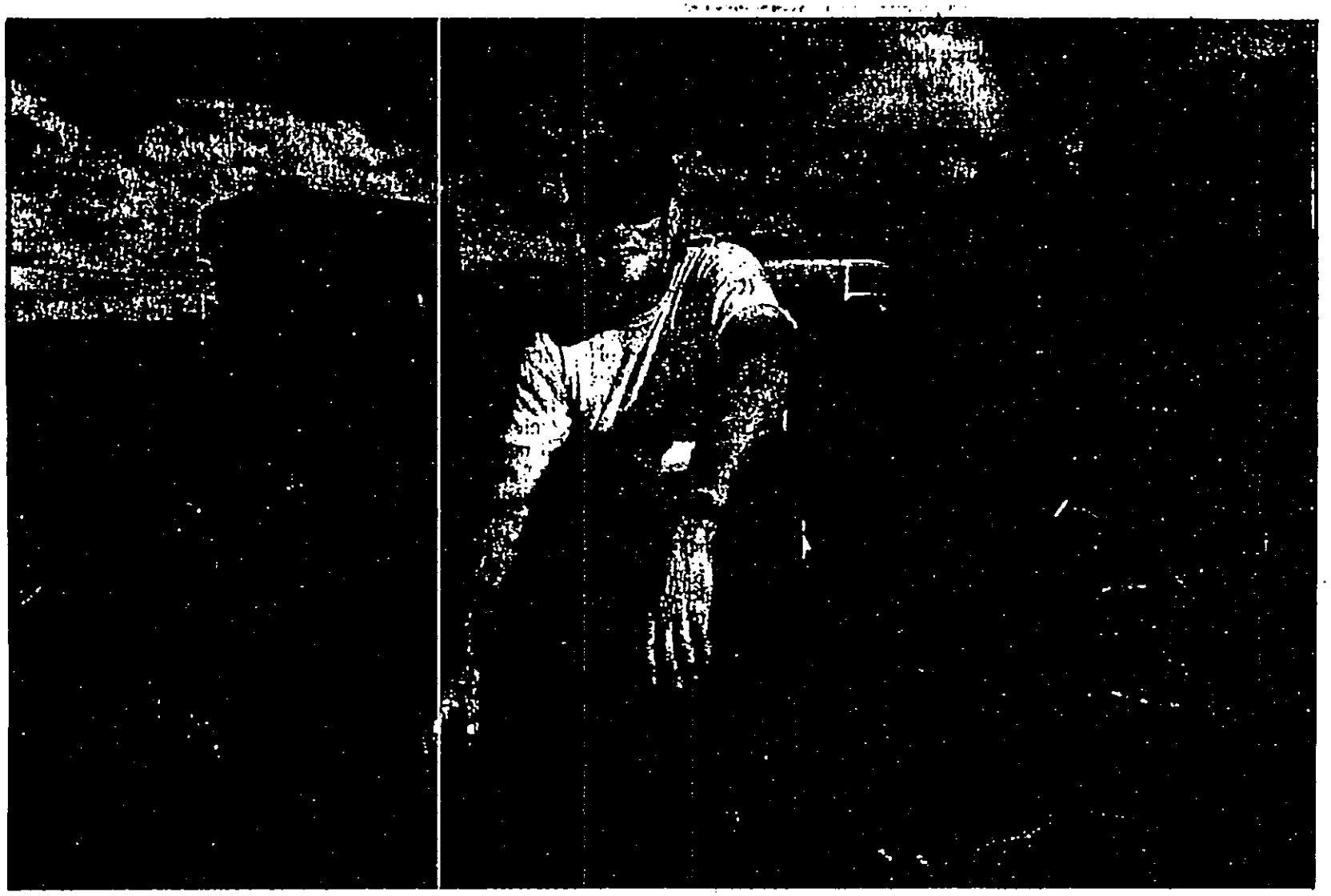
IAN K. COSTA
Deputy Planning Director

Kapule Building • 4444 Rice Street, Suite 473 • Lihu'e, Kaua'i, Hawai'i 96766

THE GARDEN ISLAND

Ni'ihau since 1902 "A Pulitzer Community Newspaper" Home Delivery Price 30 Newsstand 50

Innovative tree farm under review



BILL COWERN, president of Hawaiian Mahogany, a Kaua'i com- crement of planting, which is expected to begin next month.

Support high for 800-acre plantation

By LESTER CHANG
Staff Writer

LAWA'I — A draft environmental assessment supporting what's being called an innovative and environmentally sound 800-acre tree farm near here is working its way through government agencies.

If the draft EA is approved, Hawaiian Mahogany Co. expects to receive a $75,000 repayable grant from the Hawai'i State Forest Stewardship Program to help cover start-up costs for the venture.

Hawaiian Mahogany president Bill Cowern said his company expects to put $225,000 into the project next year — $80,000 from primarily Kaua'i investors, $75,000 from the grant and the remainder out of his pocket.

The tree plantation will be established on former McBryde Sugar land, leased from Grove Farm, and will be planted in four yearly increments of 200 acres each.

(See Trees on Page 2)

Trees (Continued from Page 1)

Cowern, optimistic that the grant will be approved by the end of January, is already putting in trees and looking down the road to the 20 million board feet of timber he expects to harvest in 15 years and market for $3 a board foot.

The State Forest Stewardship Committee has already recommended funding for Hawaiian Mahogany's project primarily because of its innovative and environmentally sound forest management strategies and because of its economic potential.

What will distinguish this project from the standard Mainland-style tree farm operation is the method of planting and harvesting, Cowern said.

Rather than plant the trees randomly, Cowern will plant in rows. And that, he said, will mean no clear-cutting, which in the Pacific Northwest denudes enormous swaths of mountainside and causes erosion, which in turn decimates streams and rivers.

"It's going to be a whole lot easier to harvest than on the Mainland because we plant in rows, and we'll be able to drive between them to harvest," Cowern said.

It's called selective harvesting. It's even more important because he'll be planting more than 100 varieties of trees, meaning some will be harvested individually due to their different growth rates.

What's more, he said, row-planting means he can use rubber-tired machinery rather than bulldozers, and the ground-cover between trees not being harvested will remain undisturbed.

"Erosion should be relatively zero," he said.

The project is getting good reviews from environmental agencies as well.

"I applaud the guy for the innovative things he is doing," said Rob Culbertson, who heads the Sierra Club's Kaua'i group. "I say give him the benefit of the doubt and let him do what he wants to do."

Cowern said he plans to incorporate nitrogen-fixing trees, weeds and contour planting schemes to prevent soil runoff.

Though Cowern's erosion plan has been well received, he said nothing can totally prevent erosion.

"We will use the planting process to mitigate the erosion problems to the greatest extent possible. And when we harvest, we will do the same. We don't want to ruin the land."

The company's selective harvesting plan calls for 150 acres of a 200-acre increment to be cut down eight years after it is planted. Most of the remaining 50 acres will stay in the ground for about 16 years.

Between harvesting of the first and second batch, new trees will be planted beside the remaining stumps, which will help keep the soil in place.

The use of weeds and nitrogen-fixing trees, which will help provide nutrients to make the roots of trees strong, also will serve to keep [illegible] down.

Cowern's plans have come under the scrutiny of the DNLR, the U.S. Fish and Wildlife Service, the Hawai'i Forest Industry Association Board, the Hawaiian Agricultural Research Corporation and the Kaua'i County Farm Bureau.

The State Forest Stewardship Program, which is administered by the Department of Land and Natural Resources, was established in 1990. The program provides technical and financial help to farmers to develop forestry management plans on private property.

Stewardship Committee member Katie Friday said she favors Cowern's erosion mitigation plan.

"Compared with sugar harvesting, tree harvesting is a much, much less source of erosion," she said. "Sugar is a crop that is uprooted and is harvested every 1 1/2 years. These trees will be harvested in about eight years, and the trees would be cut, not uprooted. Hence there would be less erosion."

Ron Peyton, a district conservationist with the Natural Resources Conservation Service of the U.S. Department of Agriculture, which is one of a slew of govern-

Insurance (Continued from Page 1)

Allstate Indemnity: $888, $665 (-25 percent)

GEICO Indemnity: $479, $281 (-41 percent)

Trustees (Continue

by beneficiaries of the trust, according to the lawsuit.

ing means he can use rubber-tired machinery rather than bulldozers, and the ground-cover between trees not being harvested will remain undisturbed.

"Erosion should be relatively zero," he said.

The project is getting good reviews from environmental agencies as well.

"I applaud the guy for the innovative things he is doing," said Rob Culbertson, who heads the Sierra Club's Kaua'i group. "I say give him the benefit of the doubt and let him do what he wants to do."

Cowern said he plans to incorporate nitrogen-fixing trees, weeds and contour planting schemes to prevent soil runoff.

Though Cowern's erosion plan has been well received, he said nothing can totally prevent erosion.

"We will use the planting process to mitigate the erosion problems to the greatest extent possible. And when we harvest, we will do the same. We don't want to ruin the land."

The company's selective harvesting plan calls for 150 acres of a 200-acre increment to be cut down eight years after it is planted. Most of the remaining 50 acres will stay in the ground for about 16 years.

Between harvesting of the first and second batch, new trees will be planted beside the remaining stumps, which will help keep the soil in place.

The use of weeds and nitrogen-fixing trees, which will help provide nutrients to make the roots of trees strong, also will serve to

Cowern's plans have come under the scrutiny of the DNLR, the U.S. Fish and Wildlife Service, the Hawai'i Forest Industry Association Board, the Hawaiian Agricultural Research Corporation and the Kaua'i County Farm Bureau.

The State Forest Stewardship Program, which is administered by the Department of Land and Natural Resources, was established in 1990. The program provides technical and financial help to farmers to develop forestry management plans on private property.

Stewardship Committee member Katie Friday said she favors Cowern's erosion mitigation plan.

"Compared with sugar harvesting, tree harvesting is a much, much less source of erosion," she said. "Sugar is a crop that is uprooted and is harvested every 1 1/2 years. These trees will be harvested in about eight years, and the trees would be cut, not uprooted. Hence there would be less erosion."

Ron Peyton, a district conservationist with the Natural Resources Conservation Service of the U.S. Department of Agriculture, which is one of a slew of government agencies reviewing Cowern's plan, said he believes the tree farmer's proposal has merit.

"It is an excellent transition from sugar," he said. "Everybody would like him to do something with the land."

Hawaiian Mahogany has a 20-year lease on the land and an option for another 20 years.

Cowern and his 16 investors, primarily from Kaua'i, are high on the $2.5 million project. They have hopes of expanding the farm to 3,000 acres, all of which would be leased from Grove Farm.

"The whole idea here is that we have a resource — land — but there's a limit to how much can be used for diversified agriculture," he said. He estimates diversified ag probably couldn't use up more than 25,000 to 30,000 acres of land before the limitations of marketing produce are reached.

Timber, on the other hand, can have both very high yields and be an environmentally sound industry, Cowern believes.

The endeavor, Cowern hopes, will open the door to new opportunities for Kaua'i — more jobs due to what he calls the "value-added" nature of the business: furniture making, cabinetry, trim, moldings, and the expansion of an industry that could send products to world markets.

Planting and harvesting are not labor intensive, he said, but transforming the trees into products could create up to 500 new jobs for the island. Even in what he calls the "worst-case scenario" — using the lumber for construction — the operation could be financially feasible, Cowern said.

About 680 acres will be planted with Eucalpytus deglupta and Eucalpytus microcorys, both high-value hardwoods that grow quickly, can be processed easily and have sold well in the Pacific.

The two trees are two of nine species on the list of "preferred species" for Hawai'i's foresty industry, according to documents Groome Poyry Ltd., a forestry consulting firm, sent to the state's Department of Business, Economic Development and Tourism.

The other 120 acres will be planted with longer-rotation timber species that include koa, mahogany, Brazilian rosewood, Queensland maple and silk oak.

Cowern leased areas that are between 450 and 1,200 feet in elevation and have an average rainfall of 70 to 80 inches, the sole source of irrigation.

The nitrogen-fixing trees provide nutrients to the trees, relieving Cowern of having to spend a lot of money on chemical fertilizers, although some will be used initially in the early tree plantings, he said.

Most of the project trees will be provided and planted by Kaua'i Nursery & Landscaping, the largest nursery on Kaua'i and one of th investors in the project.

When the microcorys an deglupta trees are trimmed in eigl years, they will reach a height of 6 and 80 feet, respectively.

Cowern said he would be sittin on a gold mine if he were able t harvest at one time all 320,0C trees that would be grown on tl 800 acres.

"If all goes well, and I c produce everything I think I can, might get into 20 million board fe a year," Cowern said. "The U.S market alone for cabinets and furn ture is 25 billion board feet. doesn't take a rocket scientist to se that if we harvested 20 millio board feet and sold it for three dol lars a board foot, there is a lot c money there."

How fast that industry grow would depend on the demand fo such products and their quality, h said.

Gerald Dela Cruz, who heads th county's Office of Econom Development, said Cowern' proposal could be economic bles ing, but only if the wood produc made on Kaua'i have consiste quality and meet the buyin demands of the world market.

"As investors in this project, w will make our money. But think c the longterm benefit for the islan for the residents," Cowern sai "We all benefit."

ıued from Page 1)

GEICO Indemnity: $479, $281

Trustees (Continued from Page 1)

by beneficiaries of the trust, ac- done their homework," said Daw- that kind of work," he said. personal or financial interest;

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

COPY

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

Gilbert Coloma-Agaran

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

April 30, 1997

MEMORANDUM

LOG NO: 19369
DOC NO: 9704NM10

TO: Karl R. Dalla Rosa, Forest Stewardship Coordinator
Division of Forestry and Wildlife

FROM: Don Hibbard, Administrator
Historic Preservation Division

SUBJECT: Historic Preservation Review -- Forest Stewardship Management Plan - Reforestation for Value Added Wood Products
(Bill Cowern, Hawaiian Mahogany Co. Inc.)
TMK: 2-8-01: 3,4, 5; 2-7-01: 4, 5; 2-9-02: 1; 3-4-01: 2; 3-4-05: 3
Kaua'i

Thank you for submitting the above document for our review. We concur with your initial assessment that the planting area is in the former sugar cane land and it is unlikely that significant historic sites are still present. Therefore, we believe that this project will have "no effect" on significant historic sites.

If you have any questions please call Nancy McMahon at 742-7033.

NM:amk

APPENDIX C

RESPONSES TO COMMENTS

Nelson Ayers
D.L.N.R.
Div. of Forestry and Wildlife
P.O.Box 621
Honolulu, Hi. 96809

Dear Nelson,

Enclosed are the comments concerning the Draft E.A. for Hawaiian Mahogany in reply to the Environmental Council. I follow their order.

1. We will include the Kauai Planning Dept. in all correspondence and responses as well.
2. This is all State funds.
3. Maps are sent under separate cover.
4. County zoning is agricultural for all parcels, The state land use designation is also agriculture.
5. Harvesting

Post Harvest-The stumps will be cut close to the ground so as to not interfere with replanting. The leases allow at least three plant, harvest cycles and we fully intend to use them all. The stumps hold soil while the new trees are establishing and rot to provide nutrients during the growth cycle of the subsequent planting. The tops and trees unusable for lumber, what might be referred to as post harvest remains, are to be chipped and used as mulch for the subsequent planting instead of plastic mulch. This not only replaces the cost of the plastic but also allows significantly less soil preparation prior to replanting, minimizing the erosion concern. It should also promote faster initial growth.

Burning- The mowing in this project is not only to reduce weed competition, but also to eliminate the fire hazard. The trees themselves are not apt to burn but they are very susceptible to damage from brush or grass fires due to thin bark. The sites we are planting in, are all in high rainfall areas (minimum of 70 inches per year), and as such do not have a history of fires other than cane burning at harvest. We do not intend to burn at any time, which should eliminate air quality concerns.

Noise-The sites are quite remote with the closest neighbor being a rock quarry and crushing site about a half mile away. I do

not believe noise is an issue. There is no habitation within a mile of any of these sites.

Traffic- There is an extensive complex of cane haul roads connecting all of these sites. At maximum it would be necessary to cross the highway, at one location, to access the sawmill, about 300 times per year. This would happen from 1 to 3 times in fifteen years, depending on where we locate our sawmill. Obviously this could be scheduled at slow traffic times but since it averages less than one crossing per day, every five years at the most, this is probably unnecessary. For comparison, Lihue Plantation sugar trucks cross the same highway, during harvest, in four separate locations, that many times in a week. In addition, the hauling of lumber would add about 850 truckloads per year or less than three trucks per day to the islands traffic flow. Where these trucks go would depend on to whom that lumber is eventually sold. Obviously we hope it will be sold on island to generate more value added jobs. This is the whole intent of the project. Getting a raw material to a site where it allows the creation of good permanent employment for the islands residents is the kind of traffic we should welcome. However, if it is sold off island, we can get to within two miles of Nawiliwili harbor on the same cane haul roads, limiting any traffic impacts, which would be minimal to begin with, to less than 12 road miles per day.

Bill Arakawa

c.c. Kauai Planning Dept.
Karl Dalla Rosa

HAWAIIAN MAHOGANY CO. INC.

"GROWING A SUSTAINABLE FUTURE FOR KAUAI"

P.O. Box 649 · Lawai, Hawaii · 96765
Phone: (808) 332-8570 · Fax: (808) 332-9325 · E-mail: halekua@aloha.net

Michael Buck
Div. of Forestry and Wildlife
1151 Punchbowl St.
Honolulu, Hi. 96813

Dear Mike,

This is in regards to our conversation last week about the Stewardship Grant for Hawaiian Mahogany. I would like to propose the following, in the hope it will be acceptable to the board. I propose to pay back the entire grant. The payments would start at the first commercial harvest, anticipated to be at 12 to 15 years into the project.

The payment amount would consist of 1/2 of the yearly amount paid into the project. Payments would continue until the entire sum has been returned. I realize this is in excess of what you requested, but I belive it is fair and would help out the overall goals of the Stewardship program. Please let me know if you would like to discuss this further.

Sincerly, Bill Cowern

cc: Nelson Ayres, Karl Dalla Rosa