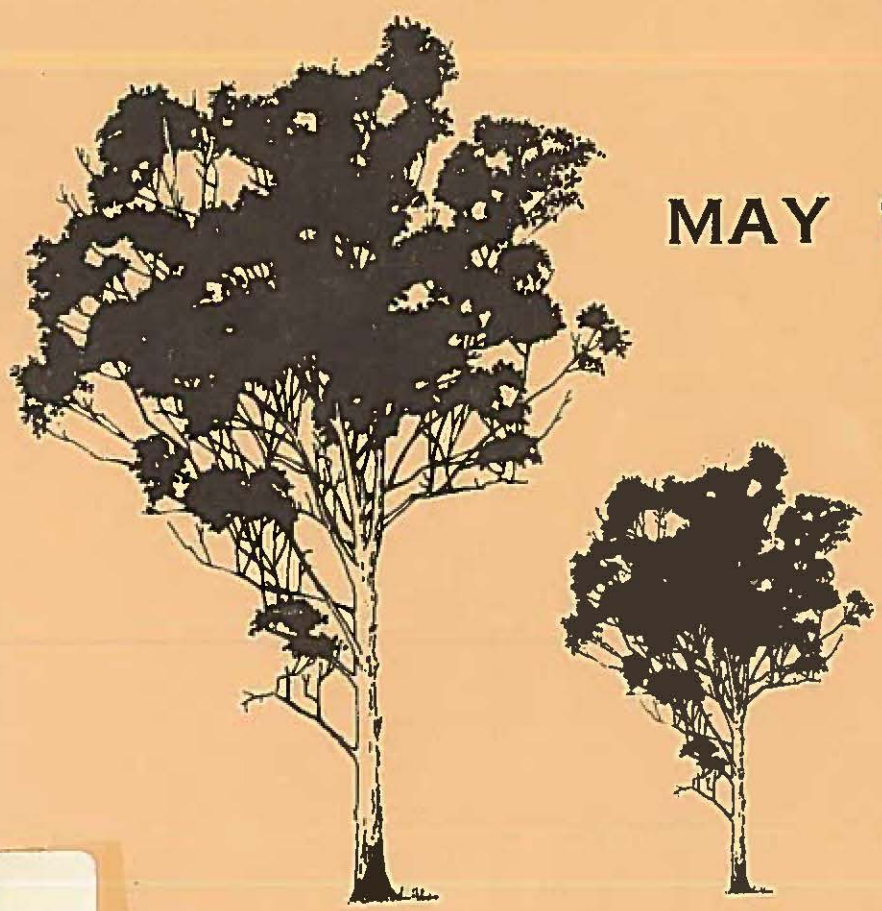
DRAFT

ENVIRONMENTAL IMPACT STATEMENT

for

Eucalyptus Biomass Farm Development

at Pu'u'eo, South Hilo, Hawai'i



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PROJECT:	Eucalyptus Biomass Farm Development at Pu'u'eo, South Hilo, Hawaii
PROPOSING AGENCY:	BioEnergy Development Crop. P.O. Box 1801, Hilo, Hawaii 96720
ACCEPTING AUTHORITY:	Board of Land and Natural Resourses State of Hawaii
CONTACT:	Thomas B. Crabb, Vice President and Project Manager, BioEnergy Development Crop. P.O. Box 1801, Hilo, Hawaii 96720
CONSULTANT:	Juvik & Juvik, Environmental Consultants 223 Makani Circle, Hilo, Hawaii 96720

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SUMMARY

This environmental Impact Statement (EIS) was prepared for submission to the State Office of Environmental Quality Control, pursuant to Chapter 343, HRS. The approving agency is the Board of Land and Natural Resrouces (BLNR). The BLNR is considering a request by BioEnergy Development Corp. (a subsidary of C. Brewer and Co. Ltd.) for authorization to undertake eucalyptus biomass farming on 341 acres of Conservation designated land in the Hilo Forest Reserve. The request is identified as: "Conservation District Use Application for Eucalyptus Biomass Farm Development at Pu'u'eo, South Hilo, Hawaii" C. Brewer and Co. Ltd. is the landowner of record.

This EIS was prepared by Juvik and Juvik, Environmental Consultants, whose mailing address is 223 Makani Circle, Hilo, Hawaii 96720.

Proposed Action:

In February, 1978 C. Brewer and Co., Limited submitted to the U.S. Department of Energy's (DOE) a research and development proposal to explore the potential of large-scale eucalyptus plantings in Hawaii for use as biomass fuel. The subsequent approval and funding of that proposal has taken form today in the BioEnergy Development Corporation (BDC), a new C. Brewer Biomass Energy Project. BDC is a planned 5 year, 900-acre demonstration project on the Big Island of Hawaii to determine the economic and technical feasibility of using eucalyptus trees for biomass plantations in Hawaii. During the Period 1978-1980 approximately 300 acres of agriculturally zoned marginal or abandoned cane land were planted in eucalyptus. It is planned to plant an additional 600 acres of eucalyptus over the period 1981-84 in order to fulfill obligations under the DOE funded demonstration biomass project.

BDC would like to meet part of this additional 600 acre commitment by developing a eucalyptus Biomass plantation on 341 acres of Conservation zoned land at Pu'u'eo, South Hilo.

Project Location:

The proposed project area lies between the 1600 and 2400 ft contours on the windward slopes of Mauna Kea, approximately 5 miles above (west) Hilo, Hawaii. The site is at the boundary between mauka cane fields of Mauna Kea Sugar Company and the Hilo Forest Reserve. Disturbed forest, planted eucalyptus forest (established in the 1930s), sugar cane cultivation and a recently established eucalyptus biomass farming project occupy lands immediately adjacent to the proposed project area at Pu'u'eo. Cane haul roads reach the makai boundary of the parcel.

Affected Environment:

Pu'u'eo forest currently supports a vegetative cover dominated by strawberry guava, uluhe fern and scattered 'ohi'a. Exotic, weedy species are dominant in the flora of the project area, although numerous native species also occur at the site. No currently endangered or threatened plant species have been found at the site, however, one species (the native mint Stenogyne scrophularioides) currently "proposed" for federal endangered species status has been found within the project area. The single individual occurs within a natural drainage gulch which will not be disturbed by the proposed action.

Avifauna seen on the project site includes predominately exotic species. Only one native bird species, the 'Elepaio, was observed in the project area. Two federally endangered species, the Hawaiian Hawk (I'o) and Newell's race of the Manx Shearwater (A'o), may utilize the project area periodically.

Probable Impacts and Mitigating Measures

1. Minor soil erosion and compaction will be associated with land clearing and periodic timber harvesting and replanting. Increased runoff and some siltation of minor drainage channels may also occur periodically. These adverse impacts will be minimized with proper soil conservation practices. In addition, the existing vegetation will be left intact along steep-sided stream gulches in the project area to protect unstable slopes and surface water quality.

2. Both native and exotic elements of the existing vegetation will be destroyed by the proposed development, however, the watershed values of the site will be largely maintained by the eucalyptus plantation established over the area. Existing vegetation will be left intact in buffer zones along gulches and above the 2300ft contour. These buffer zones will protect noteworthy native species such as the endemic mint Stenogyne scrophularioides, a plant under consideration for endangered species status.

3. Existing avifauna of the project area will be displaced by the development (except in buffer zones), including a population of the native 'Elepaio. Potential impacts on the Endangered Hawaiian Hawk and Newell's Shearwater are thought to be minimal.

4. The socio-economic impact of the development (and the larger demonstration eucalyptus biomass project of which it is a part) is expected to be positive if the feasibility of large scale biomass development is proven. Dependence on imported fuel oil will be reduced, local jobs will be created and the economic base of the County diversified.

I PROJECT DESCRIPTION

A. PROJECT LOCATION

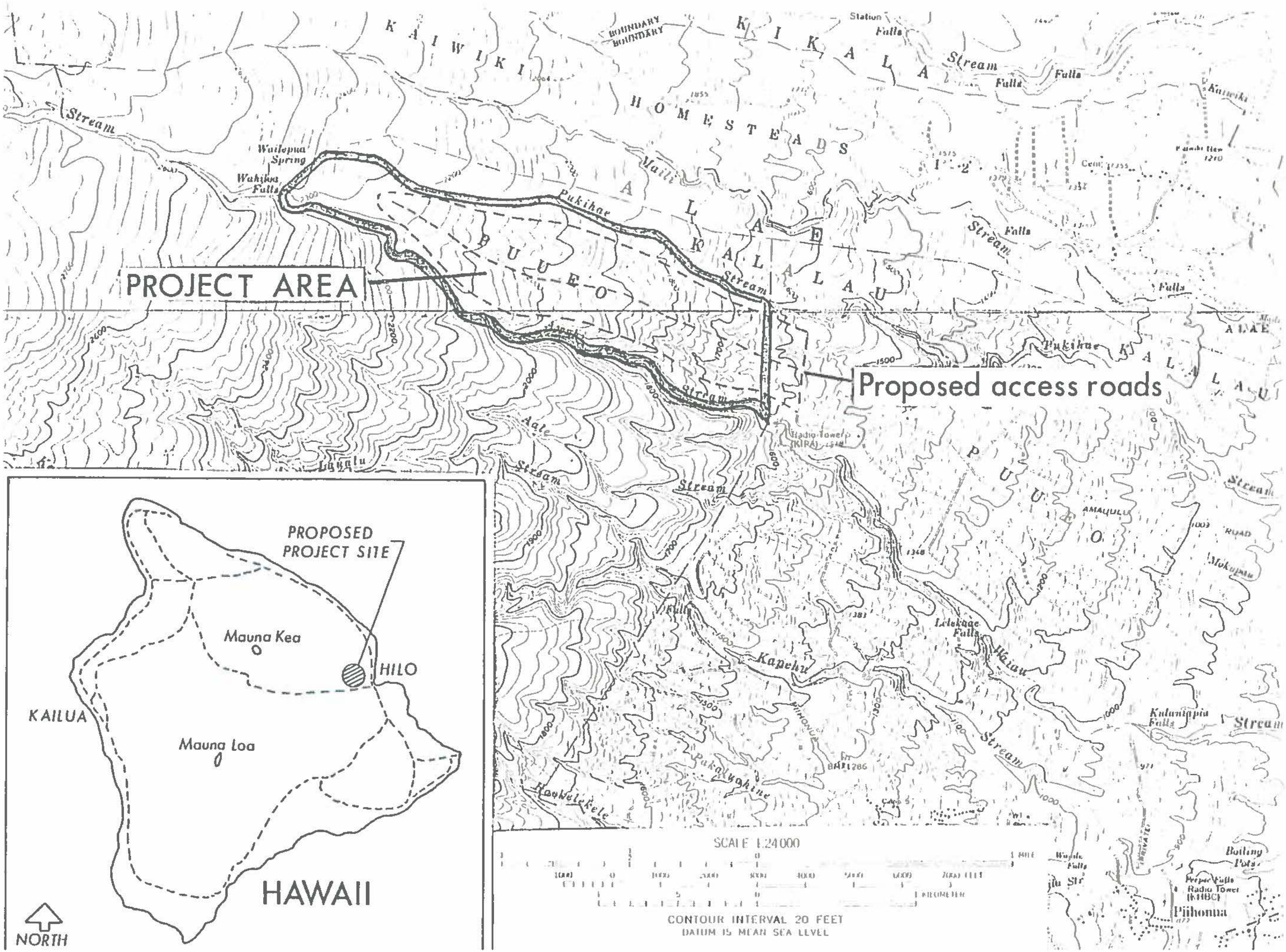
Eucalyptus biomass farming is proposed for a 341 acre parcel of land located within the Hilo Forest Reserve. The site lies between the 1600 and 2400 ft countours, approximately 5 miles above Hilo on the Island of Hawaii. Figure 1 shows the location of the project area at Pu'u'eo mauka.

B. PROJECT OVERVIEW

1. Biomass Potential

Because Hawaii lacks any form of, indigenous fossil fuels it imports 100% of its oil to meet 92% of its energy needs. As most of this oil is foreign crude oil, Hawaii is particularly vulnerable to any international political conflicts, such as that which produced the OPEC oil embargo of 1973-1974.

Acknowledgement of this vulnerability by the public, the private sector and government has led to the ongoing, vigorous search for alternative sources of energy for the State. As a consequence several potentially viable replacements for fossil fuels are currently in various stages of research and development. The energy potential from Hawaii's indigenous (non-fossil fuel) energy resources is considered to be high and presently the most promising of these is biomass energy.


PROJECT AREA
Proposed access roads
KAIWIKI
KIKALA
HOMESTEADS
ALAE
KALALAU
PUUEO
Pukihae Stream
Maili Stream
Aale Stream
Kapehu Stream
Wailepua Spring
Wahiloa Falls
Radio Towers (KIPA)
Piihonua
Boiling Pots
SCALE 1:24000
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
PROPOSED PROJECT SITE
Mauna Kea
Mauna Loa
HILO
KAILUA
HAWAII
NORTH

Biomass energy is often referred to as a form of solar energy because it is stored chemical energy that is primarily derived from the sun through photosynthesis. Simply defined, "biomass" is organic material--growing matter or waste--which can be used to produce energy.

Biomass energy is not a new concept in Hawaii. For many years sugar companies have burned bagasse, the fibrous residue that remains after cane juice extraction, to generate the electricity required for their in-house operations. Today bagasse is the sugar factories' main source of fuel. In addition to electricity generation for their own operations, several raw sugar factories throughout Hawaii presently sell excess electricity to the local utility for resale to the public. It is estimated that 13-14% of the electricity consumed in the state is supplied by these sugar companies.

On the Island of Hawaii approximately 40% of the public's electricity requirements is supplied by raw sugar factories burning mostly bagasse. The Pepeekeo Sugar factory's power plant, run by the Hilo Coast Processing Co. (HCPC), produces steam for its sugar production and in-house electricity generation, as well as electricity generation for sale to the local Hawaii Electric Light Company (HELCO). HCPC is an agricultural cooperative owned 50% by 325 independent farmers and 50% by Mauna Kea Sugar Company.

The Pepeekeo factory power plant produces approximately 23-24% of the Island's electricity, being one of only two sugar companies on the island with a contract to sell "firm power" to HELCO. Other companies sell their excess power when available as "dump power". Pepeekeo uses an estimated 26-40 million KWH of electricity yearly for its own operations and has a contract with HELCO to produce 100 million KWH per year.

Pepeekeo's daily output then ranges between 335,000 and 340,000 KWH--25,000 KWH for the factory and auxiliary power, and 309,000 plus KWH for HELCO. In its contract with HELCO, HCPC has the option to produce not less than 2% less than the contractual amount of 100 million KWH per year. Conversely, HELCO will buy any excess electricity that the power plant can produce. Pepeekeo power plant's generator is rated at 23.8 MW at a power factor of 85%, and its boiler capacity is 330,000 pounds of steam/hr. at 1250 psig and 825 F.

Although bagasse is Pepeekeo's major fuel source to produce steam and generate electricity, oil must be burned when the bagasse supply is insufficient. When the mill stops grinding, the supply of bagasse is affected--first, the stored supply must be relied upon, sometime to the point of depletion and second, no bagasse is being produced to replenish the supply. When this occurs, the power plant must rely largely on fuel oil in order to fulfill the terms

of the HELCO contract. C. Brewer and Company, Limited is currently spending nearly $2 million annually for this supplemental oil.

Many factors affect the supply of bagasse including any mechanical breakdowns, scheduled weekly shutdowns, harvesting schedules and breakdowns, and the weather. Because of these variables and because the mill's schedule simply does not always coincide with that of the power plant, it is estimated that the maximum rate of power generation the power plant will ever achieve on bagasse as sole fuel source is 90-92%. Alternate fuel sources will always be needed.

One promising source of alternative fuel is wood fibre supplied from fast-growing, commercially-managed forests. Hawaii, with its year-round growing season provides an ideal environment for biomass production. In particular, Australian eucalyptus renown for its high fuel value and rapid growth rate, grows well on most sites in the State. As energy plantations, eucalyptus tree farms can help relieve Hawaii of its petroleum dependency. Chipping of the trees produced along the Hilo Coast will most likely occur at HCPC, as will testing to obtain the optimum bagasse/wood chip fuel mix. As a research and development project, several energy related possibilities will be investigated for such a mix and for the wood chips alone. Either in a mix or as a pure fuel source, these eucalyptus chips may

first of all aid in alleviating and perhaps eventually eliminating HCPC's need for fuel oil. Secondly, a large and reliable supply may be used to eventually generate more electricity for sale to HELCO. These chips may also prove to be a viable fuel source for other industries.

These and any other possibilities are naturally contingent upon a variety of factors including further technical research and a thorough economic analysis of the situation--fuel costs, marketability, operational and production costs, energy outlook-in 5-7 years when the trees will be harvested. To illustrate this point, the possibility of using the chips to generate more elctricity for sale to HELCO can be used. One factor that must be considered before pursuing this would be that the boiler at the Pepeekeo power plant is already operating close to its maximum capacity, necessitating the installation of an entire new generating unit in order to produce a larger amount of electricity. Estimated costs for such a facility are $1,000/KW or $1,000,000/MW, thus much research would be required to weigh the economic pros and cons of such a project.

2. BioEnergy Development Corporation

In February, 1978 C. Brewer and Co., Limited submitted to the U.S. Department of Energy (DOE) a research and development proposal to explore the potential of large-scale eucalyptus plantings in Hawaii for use as biomass fuel. The

subsequent approval and funding of that proposal has taken form today in the BioEnergy Development Corporation (BDC), a new C. Brewer Biomass Energy Project. BDC is a planned 5 year, 900-acre demonstration project on the Big Island of Hawaii to determine the economic and technical feasibility of employing eucalyptus trees for biomass plantations in Hawaii and similar subtropical regions. The Dept. of Energy funding will be in annual increments, with a $335,000 grant for the first fiscal year, Sept. 1978-Sept. 1979. BioEnergy Development Corporation's (C. Brewer) contributions in that first year total $502,000 in land, equipment and managerial resources. Agencies directly cooperating with BDC include the Institute of Pacific Islands Forestry and the U.S. Dept. of Agriculture.

In attempting to determine the viability of the energy plantation concept in Hawaii, BDC has sought to answer these 8 broad questions:

1) How do different sites, cutting cycles, spacing and intensive cultural practices to maximize production affect the growth, yield, rotation, length, and profitability of short-rotation eucalyptus?

2) What are the relative cost/benefits of growing pure stands of eucalyptus with various fertilizers vs. admixtures of eucalyptus with nitrogen fixing species on different sites?

3) Will crop-logging (monitoring growth through chemical and physical measurements throughout the rotation) provide

management guidelines to produce maximum yields?

4) Can genetically superior eucalyptus planting stock be identified and mass produced within a short time frame, through phenotypic selection, in seed orchards?

5) Which provenances of Eucalyptus grandis, E.Saligna, and E.camaldulensis will prove best adapted on planting sites differing greatly in elevation, rainfall, and soil properties?

6) Can existing company equipment be modified at minimal cost for the purpose of close planting and cultivating eucalyptus seedlings, and hauling wood fiber to the generating plant?

7) To what extent are soils and terrain conditions limiting factors, acreage-wise, in the large scale commercial forest biomass production operations on company lands? and,

8) What is the optimum mixture of eucalyptus wood chips and other biomass fuel sources?

A yearly plan of objectives and operations has been devised for each of the five grant years through which BDC will seek the answers to these questions. Research will be conducted in silviculture, engineering and economics and specifics include: spacing, fertilizer and herbicide trials, cost analyses of site preparation and intensive cultivation practices, progeny trials, land use capability appraisals, and evaluations of biomass mixes at the power plant.

Eucalyptus was selected as the biomass crop for the project for several reasons:

1) Proven adaptability to a wide range of site conditions, all classified as average to very poor,

2) Fast growth from time of planting--average growth rate is a foot per month,

3) High heat content,

4) Favorable response to fertilizer at time of planting,

5) Coppicing ability--the ability to produce shoots from old stumps, and

6) Indefinite shoots, naked buds and accessory buds. Although concentration will be on four species - Eucalyptus saligna, E.grandis, E.globulus, E.camaldulensis - others will be tested as well.

Except for the initial 10,000 trees, all seedlings planted for the project will be propagated at BDC's nursery. A variety of land clearing, planting, weed control, and fertilizing techniques will be examined during the 5-7 year growing time, after which the trees will be harvested, chipped then burned at the power plants of Hilo Coast Processing Co. and Ka'u Sugar Co. for electricity generation. BDC will conduct its operations in two different geographic areas of the island, Hamakua and Ka'u for two reasons. First, these two C. Brewer facilities are readily available to utilize the wood chips and such cooperation between these companies and BDC is anticipated

to be mutually beneficial. HCPC and Ka'u Co. will be aided in moving toward energy self-sufficiency and BDC will have market/testing sites in close proximity to its operations. Second, Hamakua (east coast of Hawaii) and Ka'u (southern point on island) provide two extremely different environment areas, ideal for BDC as a research and development project. Along the Hilo coasts the soil is deep and rain is plentiful while in Ka'u, the soil is very rocky and moisture is not abundant. Operational data gathered in both areas should eventually provide a solid information base on the establishment of terrestrial biomass plantations.

BDC's administrative offices are presently located in the Waiakea Office Plaza in Hilo and its operations office is located in Wainaku. The operations complex is comprised of an office building, a potting shed where seeds are sown and supplies are kept, and two hothouses each 2,100 sq.ft. with the capacity to accommodate 52,000 seedlings. The nursery will produce 450,000 seedlings annually with seed gathered from wild eucalyptus pods.

Economic impacts are evaluated at every level of the project. Cost accounting is strictly adhered to by BDC and economic data recorded to accurately gauge the cost/benefit ratio of large scale biomass energy production. There must be a net energy gain and a net financial savings relative to the cost of fuel oil for the project to be judged successful.

BDC is staffed with a project manager, an accountant, a secretary, an operations supervisor, and agronomist/soil scientist, 2 forestry technicians, 2 nursery workers, 6 field hands and 4 field workers.

3. Current field operations

After two years in operation, BDC has set up standard field practices for all phases of production: nursery, clearing, planting, weed control, and fertilization. These practices are being constantly evaluated for potential reductions in cost and increases in efficiency, yeild and employee safety. Mechanization, in particular, is being looked at for future operating improvements.

a) Nursery

Eucalyptus seedlings are grown in plastic dibble tubes called "Ray Leach Cone-tainers" [1]. Raising containerized stock is a conveneient, economical way to grow large numbers of seedlings with minimal root damage at time of planting.

The seedlings are removed from the containers shortly before planting and the containers are recycled after sterilization. The potting media used is a 2:1 mix of vermiculite and peat moss. Osmocote (14-14-14), dolomite, and MicroMax (a source of micronutrients) are mixed

1. Trade names mentioned throughout this report are used solely to provide specific information. Mention of a trade name does not imply an endorsement.

thoroughly into the media by hand.

The seedlings are moved from the greenhouse to the hardening area when they are 3 to 4 inches in height, or 4 to 6 weeks after sowing. Depending on the size of the container, the plants are ready for outplanting at 10 weeks to 4 months after sowing, when they are 12-15 inches tall.

Fungicides and insecticides are not necessary in Hawaii for the cultivation of eucalyptus seedlings. Occasionally, aphids or Japanese rose beetles become a problem, and diazinon or malathion are used for control. Damping off only becomes a problem when the plants are watered too frequently, and thus timing of irrigation is sufficient control of this fungal problem.

BioEnergy's nursery consists of two greenhouses capable of holding 52,000 seedlings each, and the outdoor hardening area which has the capacity for 64,000 seedlings. With a rotation of 3 to 4 months, the nursery is capable of producing 450,000 seedlings per year, a number more than adequate to plant 200 acres per year at a 5 x 5 foot spacing.

The nursery staff consists of two hourly paid employees, who carry out all phases of nursery operations. Economic data has been carefully monitored and BDC's current nursery practices will produce eucalyptus seedlings for $36 per thousand.

b) Clearing

The planting sites can be classified into 3 main groups, abandoned cane land: wasteland and forest. Along the Hamakua coast, the abandoned cane land is trampled matted down and cross harrowed. In Ka'u, the abandoned cane land is simply crushed down with a Krajewski roller to form a mat of vegetation. At both locations, Roundup is applied twice prior to planting, with the first shot at 0.75 gal/A and the second shot at 0/50 gal/A.

The wasteland classification consists of areas either in cane or abandoned long ago. The brush is trampled and matted down then two applications of Roundup are made prior to planting at the same rates as on abandoned cane land.

In forested areas, any commercially harvestable trees will probably be removed prior to bulldozing and windrowing of the vegetation. Two shots of Roundup will be applied before planting.

Clearing abandoned cane land takes about 3 tractor-hours, or 1 hour each for two tractor passes over the area plus 1 hour for Soil Conservation ditch maintenance work. At $80 per hour to rent a D-6 tractor, costs will be about $240 per acre for abandoned cane land.

Wasteland takes about 6 tractor-hours per acre or $480 per acre. Forested areas are being budgeted at 15 tractor-hours per acre or $1200 per acre.

c) Planting

The 3 to 4 month-old seedlings from the nursery are outplanted manually at 5 x 5 foot spacings. The 6-person planting crew works in pairs, with one person using a metal or wooden dibble to opern a hole, and the other following behind to place a seedling in the hole then covering it.

BioEnergy's 6-person planting crew can plant 600 trees per man-day along the Hamakua coast and 300 trees per man-day in Ka'u where the ground is rocky. At 1742 trees per acre (5 x 5 foot spacing), the 6-person crew can plant 2 acres per day along the Hamakua coast or 1 acre per day in Ka'u. By December 1980, BDC had 298.5 acres under eucalyptus biomass cultivation in both Ka'u and Hamakua (see Table 1).

TABLE 1

BDC lands under eucalyptus cultivation as of December 31, 1980.

Field	Classification	Acres
Ka'u 780	Cane land	15.0
Ka'u 755	Cane land	41.5
Amauulu	Waste land	23.0
Onomea V05A	Cane land	20.3
Onomea V09A	Cane land	2.4
Akaka 54C	Cane land	24.4
Kamae 25A	Cane land	47.7
Kamae 25B	Cane land	28.6
Kamae 26A	Cane land	66.1
Kamae 26B	Cane land	9.0
Kamae 27D	Cane land	20.5

TOTAL 298.5 Acres

Future research will look at increasing the efficiency of planting through improved manual tools or mechanization. BDC is planning to borrow a mechanized transplanter from the Hawaii State Division of Forestry to try along the Hamakua coast.

The advantages and disadvantages of mechanized planting need to be evaluated. Potential problems are the initial cost of investment, the higher costs of tractor rental, and the limitations due to terrain and weather conditions.

d) Weed Control

Weed control begins with two Roundup applications prior to planting. Roundup has no residual effect, so that 2 to 3 months after outplanting, the fields are again filled with weeds competing with the eucalyptus seedlings for sunlight and nutrients.

In the past, sickling was done to prevent shading of the trees, but the effect was very short term, sometimes less than a month. Sickling costs depend on the density of weed growth, but it can run up to $60 per acre or 15 man-hours per acre.

BioEnergy is currently experimenting with pre-emergent herbicides that can be applied as a preplanting treatment, either separately or combined with the Roundup application. Pre-emergent herbicides will control the seeding grasses and broad leaf weeds for up to 3 to 4 months. The most

promising pre-emergent herbicide tested to date is Simazine.

BioEnergy has also begun testing post-planting herbicide treatments. The rhizomatous grasses are spot-sprayed with Round up, and then after 4 weeks a mixture of Paraquat - Simazine is sprayed over the entire area.

Ongoing weed control research at BDC is a continuous screening of herbicides for pre-emergent and post-emergent activity combined with minor phytoxicity towards eucalyptus. Future research will include additional herbicide evaluation as well as determining the most effective methods of application. The dangers of Paraquat are recognized, and less dangerous contact poisons will be tested in 1981.

e) Fertilizer and Crop Logging

The trees are fertilized immediately after planting and 6 months later. Metal or wooden dibbles are used to bury 4 ounces of DC-153 (12-24-12) fertilizer about 6 inches away from the tree.

During the first year of establishment, eucalyptus trees receive 104 lbs/acre of nitrogen, 208 lbs/acre of phosphorus, and 104 lbs/acre of potassium.

Crop logging, or monitoring tree growth through plant tissue analysis will be carried out through the entire cropping cycle. Data from the ongoing fertilizer experiments will be used as a guideline for establishing

critical plant nutrient levels.

After the first year of plantation establishment, foliar analysis will be used to determine fertilizing schedules. BioEnergy is testing aerial application of A-1 fertilizer (25-0-27) at a rate of 50 lbs/A of nitrogen and 54 lbs/A of potassium (K_2O).

Ongoing research will examine the effects of varying levels of nitrogen, phosphorus, and potassium on the growth of eucalyptus seedlings. Future research will focus attention on the possible merits of rock phosphate and liming. Further work also needs to be done on crop logging procedure, since the problems of leaf sampling increase proportionately with the height of the trees. Finally, more economical methods of fertilizer application need to be looked at to reduce man-hours required.

f) Harvesting

A computer search on harvesting equipment has been carried out by the Institute of Pacific Islands Forestry, and literature on this subject is being compiled. Also, all major harvesting equipment companies in the United States have been contacted for equipment specifications and recommendations. BDC is looking to the U.S. Forest Service for technical expertise in this area. A visit by an equipment specialist is being examined for 1981 or 1982.

As currently planned harvested logs will be transported to the Pepe'ekeo power plant by conventional logging trucks where the wood will be chipped and stockpiled for use.

C. DEVELOPMENT OF THE PU'U'EO SITE

In order to meet its 900 acre commitment to eucalyptus biomass farming under terms of the DOE funded demonstration project, BDC proposes to clear and plant eucalyptus on a 341 acre parcel at Pu'u'eo mauka within the Hilo Forest Reserve. This land (TMK: 2-6-18:08) is owned by C. Brewer and Co. Ltd. and currently support a disturbed forest of exotic and native species. Development of the parcel for eucalyptus biomass farming will involve clearing of existing vegetation and the construction of three access roads approximately 2 miles in length commencing from the lower boundary of the forest reserve and extending upward looping and connecting in the upper area of the parcel. These roads will take off from existing roads in the adjacent (makai) agricultural zoned lands of 'Amauula (see Figure 1) which have previously been cleared and planted to eucalyptus. The roads will be 12 ft. wide and 18 in. in depth and constructed by an outside contractor with material purchased in Hilo. The AA aggregate will be in the sizes 12-18 in. to fines. Necessary culverts will be installed as required and sized according to Soil Conservation Service recommendations.

Clearing and eucalyptus planting of the project area will be phased over a three to four year period. Eucalyptus planting will commence at the makai boundary of the project area near 'Awehi Stream. It is planned to clear and plant 30 acres in 1982, followed by 110 acres in 1983. The remaining acreage will be cleared and planted in 1984 or later. This schedule is contingent upon federal funding from the DOE to continue the ongoing cooperative project.

II. DESCRIPTION OF THE ENVIRONMENT

A. GENERAL SITE CONDITIONS AND SURROUNDING LAND USES

The proposed project area at Pu'u'eo mauka lies 5 miles above Hilo, in a rural agricultural setting at the boundary between mauka cane fields (Mauna Kea Sugar Company) and the Hilo Forest Reserve. The 341 acre parcel proposed for eucalyptus biomass farming is within a State Conservation District and presently supports a disturbed forest cover dominated by strawberry guava (waiawi), uluhe fern and 'ohi'a. The area is characterized by gently sloping terrain (6-10 %), except where stream channel dissection has given rise to steep sloped gulches such as along 'Awehi and Pukihae Streams on the southern and northern boundaries of the project site respectively (Figure 1). Immediately adjacent to the Pu'u'eo forest parcel on the makai boundary is a recently established (by BDC) eucalyptus plantation on 23 acres of abandoned pasture land. Sugar cane fields also abut the makai boundary of the project area near 'Awehi Stream. Along the southern boundary of the parcel (across 'Awehi Stream) eucalyptus forests planted during the 1930s grow on both State and private lands within the Hilo Forest Reserve. The planted eucalyptus forest extend to approximately the 2000 ft elevation, giving way to mixed exotic native forest above. A narrow belt of land (600-900 ft wide) immediately to the north of the project area (across Pukihae Stream) is also within the Forest Reserve and supports vegetation very similar to that of the subject parcel. Further to the north, beyond Maili Stream, is the Kaiwiki Homesteads area, which has been extensively cleared for pasture (see Figure 1).

Above the project site the disturbed character of the forest gradually diminishes with increasing elevation giving way to intact native forest dominated by 'ohi'a and koa on the higher windward slopes of Mauna Kea.

The nearest residential developments to the project site are in the Pi'ihonua area approximately 2.5 miles to the southeast. Additionally, rural residences also occur along the Kaiwiki Homestead Road 1-2 miles east of the makai boundary.

B. GEOLOGY / HYDROLOGY

The eastern slopes of Mauna Kea are underlain by successive lava flows of Pleistocene age. Within the project area the rocks are predominately alkalic basalts classed as upper members of the Hamakua volcanic series (Stearns and MacDonald, 1946). Over much of windward Mauna Kea these upper Hamakua basalts are capped by a deep Pahala Ash layer (named for the type section locality in Ka'u). This ash is also of Pleistocene age and in the Pu'u'eo mauka area averages about 7-10 ft thick (MacDonald and Abbott, 1970). On the Hamakua coast the gentle slopes of the Mauna Kea shield have been moderately dissected by youthful ("V-shaped") drainage channels which are incised through the Pahala Ash and subjacent basaltic lavas. The project area is bounded on the South by 'Awehi Stream, a major tributary of the Wailuku River, originating on the upper slopes of Mauna Kea (8000 ft level). In the vicinity of the project area the gulch formed by 'Awehi Stream is 100-120 ft deep. By contrast, Pukihae Stream on the northern boundary is much smaller and empties directly into Hilo Bay. Both streams flow year-round.

There are no discharge data available for either 'Awehi or Pukihae Streams, however, flow rates have been recorded for Honoli'i Stream just to the north of the project area. Honoli'i has a drainage basin area and gulch size similar to 'Awehi stream, and during a twelve year monitoring period, discharge averaged 31 million gallons/day (State of Hawaii, 1970). Discharge rates from 'Awehi Stream are expected to be of a similar order of magnitude.

Because of the generally high porosity of volcanic substrates much of the abundant rainfall on windward Mauna Kea infiltrates directly to the basal lens as ground water (Lau, 1973). However, numerous springs also occur in the project vicinity where there are perching members (e.g. Pahala Ash) to prevent or retard percolation. In size, these perched springs range from mere seeps to high volume sources discharging in excess of 1 million gallons/day. Kapehu Spring located approximately 1.3 miles south of the project area has an estimated flow of 2 million gallons/day (State of Hawaii, 1970). No major springs occur within the project area, although Wailepua Spring (flow rate unknown) is located just outside the mauka boundary of the project area and discharges into Pukihae Stream (Figure 1).

C. SOIL

A soil survey of the project area was undertaken during June 1981 by the U.S. Soil Conservation Service (SCS). A copy of the SCS report is included as Appendix A in this EIS. The following information is extracted from this report and other sources.

In the Pu'u'eo mauka area soils have developed on a deep (7-10 ft) Pahala Ash layer that overlies basaltic bedrock. The soils are silty clay loams of the Akaka series.

The Akaka series consists of deep, moderately well drained silty clay loam soils formed from volcanic ash. They occur at the upper fringe of the sugar-cane land, but primarily within the forested area. Elevations range from 1,000 to 4,500 feet. Mean annual rainfall ranges from 150 to 300 inches. Cloud and fog are prevalent throughout the year.

In a typical profile, the surface layer is dark reddish brown silty clay loam about 15 inches thick. The subsoil is reddish brown to dark reddish brown silty clay loam more than 57 inches thick. The surface layer is strongly acid and the subsoil is strongly acid to medium acid. The subsoil is moderately to strongly smeary. Water moves through the soil rapidly (6 to 20 inches per hour). Roots can penetrate to a depth of over 5 feet.

This soil is usually moist. When allowed to dry, it hardens irreversibly to fine gravel-size aggregates. This soil has low bearing capacity. Heavy equipment will tend to bog down.

Within the project area slopes are dominately 6-10%, but may reach 35-70% (or more) along the steep sided gulches of 'Awehi and Pukihae Streams. Site soil conditions very with slope conditions:

Akaka silty clay loam, 6 to 10 percent slopes (AkaC).

This is moderately sloping soil. The erosion hazard is slight. Included are small boggy areas. Also included are small areas with up to 15 percent slopes. This soil is suited to grow trees.

Akaka silty clay loam, 10 to 20 percent slopes (AkD).

This soil occurs on moderately steep to rolling topography and is dissected by streams. There are small depressions which remain water-logged for long periods. The erosion hazard is moderate. Small areas are moderately eroded. Included are areas of steeper slope along gulches. This soil is suited to grow trees. Use of machinery and planting should be across the slope or on the contour. The slope angle and low load bearing capacity make the use of machinery somewhat difficult.

Akaka silty clay loam, 35 to 70 percent slopes (rAkF).

This soil occurs on very steep gulch sides. In places, slopes are steeper than 100 percent. Rock outcrop occurs in a few places. The erosion hazard is severe. Disturbance of the natural vegetation and the soil should be avoided.

The potential for timber growing on Akaka soils is generally high (Soil Conservation Service, 1973), and they have been rated "good" for eucalyptus biomass production (Yang, et.al., 1977). In undisturbed conditions Akaka soils of the Hamakua coast support native 'ohia forest.

D. CLIMATE

The project site, located on the windward slopes of Mauna Kea, is exposed to the prevailing north-east trade wind flow throughout the year. Orographic lifting and condensation of moisture laden trade wind air yields abundant, precipitation year-round in the Pu'u'eo mauka area. Although no rain gages are situated at the project site, there are longterm rainfall records available for a U.S. Weather Bureau station at Pi'ihonua located approximately 0.8 miles south of the project area. This station possesses a similar aspect, elevation (1730 ft.) and exposure to prevailing winds as that characterising the project area. Annual rainfall at Pi'ihonua for the 42 year period 1925-1966 ranged between 166 inches (in 1926) and 386 inches (in 1937), with average yearly rainfall for the period equal to 246 inches (State of Hawaii, 1970). In this region of the Hamakua coast there is no strong seasonality in the distribution of precipitation, which, on average is abundant in every month. The driest month at Pi'ihonua is June with a mean rainfall of 13.9 inches, while March is the wettest month with mean rainfall of 26.1 inches. These Pi'ihonua data probably characterise fairly accurately rainfall conditions at comparable elevation in the nearby project area. However, in the general region annual rainfall increases fairly rapidly with increasing elevation, and at the upper boundary of the project (elev. 2400 ft) yearly rainfall is likely to exceed 300 inches (State of Hawaii, 1970). Annual evapotranspiration in the project area is estimated at approximately 55 inches, or less than one-quarter of the annual rainfall (Juvik, Singleton and Clarke, 1978). This results in a large annual moisture surplus (i.e. rainfall minus

evapotranspiration) which is expressed as surface runoff (streamflow) and ground water recharge.

No air temperature data have been collected at the Pu'u'eo mauka site, however, records (1950-1966) are available for Papa'ikou mauka (elev. 1400 ft.), a station located approximately 2 miles north-northwest of the project area. The mean annual temperature at Papa'ikou mauka is 68.2°F. February is the coolest month with a mean temperature of 65.8°F, and September is the warmest at 71.0°F (State of Hawaii, 1970). Because air temperature in Hawaii decreases with increasing elevation at the rate of approximately 3° F per 1000 ft (Price, 1973), actual temperatures within the project area (altitude range 1600-2400 ft.) can be extrapolated to average 1-3°F lower than the values cited above for Papa'ikou mauka.

E. FLORA

A botanical survey of the Pu'u'eo forest was conducted by Botanists Winona Char and Layne Yoshida during the period November 6-9, 1980. Their report is included as Appendix B in this EIS. In order to address the potential problem of seasonal differences in plant species presence, a second, follow-up survey of the flora was undertaken during the period May 24-June 3, 1981 by G. Clarke, Botanist. During the initial November 1980 botanical investigation a total of 85 vascular plant taxa (including species, subspecies and varieties) were recorded within the project area (Appendix B). The follow-up survey in May-June 1981 added a further 30 taxa for a total flora of 115 species and varieties. Table II lists, by family, all vascular plants recorded from the project area. Of this total flora,

TABLE II

VASCULAR PLANTS FROM PU'U'EO FOREST

BOTANICAL NAME	COMMON NAME	STATUS [1]
PTERIDOPHYTA AND FERN ALLIES		
ADIANTACEAE		
Adiantum capillus-veneris L.	'Iwa'iwa	I
Adiantum cuneatum Langsd. & Fisch.	'Iwa'iwa	X
ASPIDIACEAE		
Athyrium sandwichianum Presl	Ho'i'o	E
Elaphoglossum alatum var. parvi-squameum (Skottsb.) Anderson & Crosby	'Ekaha	E
Elaphoglossum hirtum (Swartz) Christensen	'Ekaha	E
ASPLENIACEAE		
Asplenium contiguum Kaulf.		E
Asplenium lobulatum Mett.		E
BLECHNACEAE		
Blechnum orientale L.	Blechnum	X
DAVALLIACEAE		
Nephrolepis cordifolia (L.) Presl	Ni'ani'au,'okupu-Kupu, narrow sword fern	I
Nephrolepis exaltata (L.) Schott	Pamoho	I
DICKSONIACEAE		
Cibotium chamissoi Kaulf.	Hapu'u 'i'i	E
Cibotium splendens (Gaud.) Krajina	Hapu'u pulu, pepe'e	E
GLECHENIACEAE		
Dicranopteris emarginata (Brack.) Rboinson	Uluhe	I
Hicriopteris pinnata (Kunze) Ching	Uluhe-lau-nui	I
GRAMMITIDACEAE		
Adenophorus hymenophylloides (Kaulf.) H. & G.	Pai, palai-la'au	E
Adenophorus sarmentosus (Brack.) Wilson		E
Adenophorus tamariscinus (Kaulf.) H. & G.	Wahine-noho-mauna	E
Grammitis hookerii (Kaulf.) Copel.	Maku'e-lau-li'i	I
Grammitis tenella Kaulf.	Kolokolo, mahina-lua	E

[1] STATUS: I = Indigenous; E = Endemic; X = Exotic; P = Plynesian introduction

TABLE II (continued)

VASCULAR PLANTS FROM PU'U'EO FOREST

BOTANICAL NAME	COMMON NAME	STATUS
HYMENOPHYLLACEAE		
Callistopteris baldwinii (D.C. Eaton) Copel.		E
Mecodium recurvum (Gaud.) Copel.	'Ohi'a ku	E
Sphaerocionium obtusum (H. & A.) Copel.	Palai-lau-li'i	E
Vandenboschia davallioides (Gaud.) Copel.	Kilau	E
LINDSAEACEAE		
Sphenomeris chusana (L.) Copel.	Pala'a, pala-pala'a	I
LYCOPODIACEAE		
Lycopodium cernuum L.	Wawae-iole	I
Lycopodium phyllantum H. & A.	Wawae-iole	I
OPHIOGLOSSACEAE		
Ophioglossum pendulum L.	Laukahi, puapua-moa	I
POLYPODIACEAE		
Pleopeltis thunbergiana Kaulf.	'Ekaha-akolea, pakahakaha	I
PSILOTACEAE		
Psilotum complanatum Swartz	Moa, pipi	E
Psilotum nudum (L.) Beauv.	Moa	I
SELAGINELLACEAE		
Selaginella arbuscula (Kaulf.) Spring	Lepelepe-a-moa	E
THELYPTERIDACEAE		
Christella dentata (Forssk.) Brownsey & Jermy	Downy woodfern	X
MONOCOTYLEDONAE		
ARACEAE		
Colocasia esculenta var. antiquorum (Schott) Hubb. & Rhed.	Taro, Kalo	P
COMMELINACEAE		
Commelina diffusa Burm. f.	Honohono	X

TABLE II (continued)

VASCULAR PLANTS FROM PU'U'EO FOREST

BOTANICAL	COMMON NAME	STATUS
CYPERACEAE		
Carex pluvia R.W. Krauss		X
Cyperus brevifolius L.	Kyllinga, Kili 'o'opu	X
Cyperus haspan L.		X
Cyperus polystachyus Rottb.		X
Eleocharis obtusa var. gigantea (Clarke) Fern.	Kohekohe, pipi-wai	I
Machaerina mariscoides (Gaud.) Kern	Uki, 'ah-nui	I
GRAMINEAE		
Andropogon virginicus L.	Broomsedge	X
Andropogon affinis Chase	narrow leaved carpet grass	X
Axonopus compressus (Sw.) Beauv.	Broad-leaved carpetgrass	X
Brachiatria mutica (Forsk.) Stapf	Californiagrass, paragrass	X
Coix lachryma-jobi L.	Job's tears, kukae-kolea	X
Microlaena stipoides (Labill.) R.Br.	Puu Lehua, meadow rice grass	X
Oplismenus hirtellus (L.) Beauv.	Basketgrass, hono-hono-kukui	X
Panicum repens L.	Quackgrass	X
Paspalum conjugatum Berg.	Hilo grass, mau'u-Hilo	X
Paspalum orbiculare Forst. f.	Ricegrass, mau'u-laiki	X
Pennisetum clandestinum Hochst. ex Chiov	Kikuyugrass	X
Sacciolepis indica (L.) Chase	Glenwoodgrass	X
Setaria glauca (L.) Beauv.	Yellow foxtail	X
Setaria palmifolia (Koen.) Stapf	Palmgrass	X
JUNCACEAE		
Juncus tenuis Willd.		X
LILIACEAE		
Astelia menziesiana Sm.	Pa'iniu	E
Cordyline terminalis (L.) Kunth	Ti, ki	P
Silax sandwicensis Kunth	Hoi-kuahiwi, aka-'awa	E
MUSACEAE		
Musa X paradisiaca L.	Mai'a, banana	P

TABLE II (continued)

VASCULAR PLANTS FROM PU'U'EO FOREST

BOTANICAL NAME	COMMON NAME	STATUS
ORCHIDACEAE		
Arundina bambusaefolia (Roxb.) Lindl.	Bamboo orchid	X
Epidendrum sp.	Epidendrum	X
PANDANACEAE		
Freycinetia arborea Gaud.	'Ie'ie	E
ZINGIBERACEAE		
Hedychium flavescens Carey	Yellow ginger, 'awapuhi melemele	X
DICOTYLEDONAE		
AQUIFOLIACEAE		
Ilex anomala H. & A.	Kawa'u	E
ARALIACEAE		
Cheirodendron trigynum (Gaud.) Heller	'Olapa	E
BIGNONIACEAE		
Spathodea campanulata Beauv.	African tulip	X
CARYOPHYLLACEAE		
Drymaria cordata (L.) Willd.	Drymaria, pipili	X
CELASTRACEAE		
Perrottetia sandwicensis Gray var sandwicensis	Olomea	E
COMPOSITAE		
Ageratum conyzoides L.	Ageratum, maile-hohono	X
Erechtites valerianaefolia (Wolf) DC.		X
Eupatorium riparium Regel	Pamakani	X
Hypochoeris radicata L.	Hairy cat's ear	X
Pluchea odorata (L.) Cass.	Pluchea	X
Youngia japonica (L.) D.C.	Oriental hawksbeard	X
CONVOLVULACEAE		
Ipomea tuboides Deg. & van Ooststr.	Hawaiian moon flower	E

TABLE II (continued)

VASCULAR PLANTS FROM PU'U'EO FOREST

BOTANICAL NAME	COMMON NAME	STATUS
ERICACEAE		
Vaccinium calycinum Sm.	'Ohelo-kau-la'au	E
Vaccinium sp.	'Ohelo	E
EUPHORBIACEAE		
Antidesma platyphyllum Mann var. platyphyllum	Hame, Mehame	E
GUTTIFERAE		
Hypericum mutilum L.	St. Johnswort	X
LABIATAE		
Stenogyne scrophularioides Benth. var. aff. scrophnularioides		E
LEGUMINOSAE		
Acacia koa Gray	Koa	E
LOBELIACEAE		
Clermontia parviflora Gaud.	Papa'a-hekili	E
Cyanea sp.	'Oha	E
LOGANIACEAE		
Buddleja asiatica Lour.	Dogtail, huelo-'ilio	X
LYTHRACEAE		
Cuphea carthagenensis (Jacq.) MacBride	Cuphea, Puakamoli	X
MALVACEAE		
Malvaviscus arboreus Cav.	Turk's cap	X
MELASTOMATACEAE		
Melastoma malabathricum L.	Malabar melastome	X
MELIACEAE		
Toona ciliata M. Roem.	Toon	X

TABLE II (continued)

VASCULAR PLANTS FROM PU'U'EO FOREST

BOTANICAL NAME	COMMON NAME	STATUS
MYRTACEAE		
Eucalyptus citriodora Hook.	Lemon-scented gum	X
Eucalyptus robusta Sm.	Swamp mahogany	X
Eugenia jambos L.	Rose apple, ohi'a loki	X
Metrosideros collina ssp. polymorpha (Gaud.) Rock	'Ohi'a-lehua, lehua	E
Psidium cattleianum Sabine	Strawberry guava	X
Psidium cattleianum f. lucidum Deg.	Waiawi, yellow strawberry guava	X
Psidium guajava L.	Guava, Kuawa	X
ONAGRACEAE		
Ludwigia octivalvis (Jacq.) Raven	Primrose willow, kamole	X
Ludwigia palustris (L.) Ell.	Water purslane	X
OXALIDACEAE		
Oxalis corniculata L.	Yellow wood sorrel	X
PASSIFLORACEAE		
Passiflora edulis f. flavicarpa Deg.	Yellow lilikoi	X
Passiflora edulis Sims f. edulis	Purple granadilla, lilikoi	X
Passiflora ligularis Juss.	Sweet granadilla, lemiai	X
PIPERACEAE		
Peperomia hawaiensis C.D.C.	'Ala'ala-wai-nui kane	E
Peperomia macreana CDC	'Ala'ala-wai-nui kane	E
Peperomia tetraphylla (Forst. f.) H. & A.	'Ala'ala-wai-nui kane	I
POBYGONACEAE		
Polygonum sp.		X
ROSACEAE		
Rubus rosaefolius Sm.	Thimbleberry, 'ola'a	X

TABLE II (continued)

VASCULAR PLANTS FROM PU'U'EO FOREST

BOTANICAL NAME	COMMON NAME	STATUS
RUBIACEAE		
Coprosma sp.	Pilo	E
Psychotria hawaiiensis (Cray) Fosberg var. hawaiiensis	Kopiko	E
RUTACEAE		
Pelea volcanica Gray var. volcanica	'Alani	E
SOLANACEAE		
Physalis peruviana L.	Poha	X
TILIACEAE		
Heliocarpus popayaensis HBK.	White moho	X
UMBRELLIFERAE		
Centella asiatica (L.) Urban	Asiatic pennywort, pohekula	X
URTICACEAE		
Pipturis sp.	Mamaki	E
Urera sandyicensis Wedd. var. sandvicensis	Opuhe	E
VERBENACEAE		
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain, owi, oi	X

58 taxa (50.4%) are exotic forms, that is, plants introduced to the archipelago (either accidentally or intentionally) subsequent to European contact (1778); 39 taxa (33.9%) are plants endemic to Hawaii; and 15 taxa (13.0%) are indigenous, occuring naturally both in Hawaii and other parts of the world. A final 3 species (2.6%) in the total are of Polynesian (pre-european) introduction.

None of the plants listed in Table II are currently designated as endangered or threatened species under the U.S. Endangered Species Act of 1973 (Federal Register, 1980). However, two taxa encountered within the project area, Cyanea sp. and Stenogyne scrophularioides warrant further discussion in relationship to federal endangered species legislation.

There are approximately 80 species of endemic Cyanea (Family Lobeliaceae) in the Hawaiian Islands, of which 36 species and varities have been "proposed" by the U.S. Department of Interior as likely candidate species for future endangered species status, subject to ongoing review and documentation. In November 1980, Char and Yoshida found several small seedlings belonging to the genus Cyanea growing ephemerally in the rocky bottom of a small drainage tributary of Pukihae Stream, within the project area (location shown in Figure 2). These plants could not be classified to the species level because of their immature growth stage. This area was thoroughly re-investigated by Clarke in June 1981 in an effort to find the population and clarify their taxonomic status. The Cyanea sp. were no longer present at their previous stream bed location and it is hypothesized that the seedlings were dislodged from the site during intervening high, winter

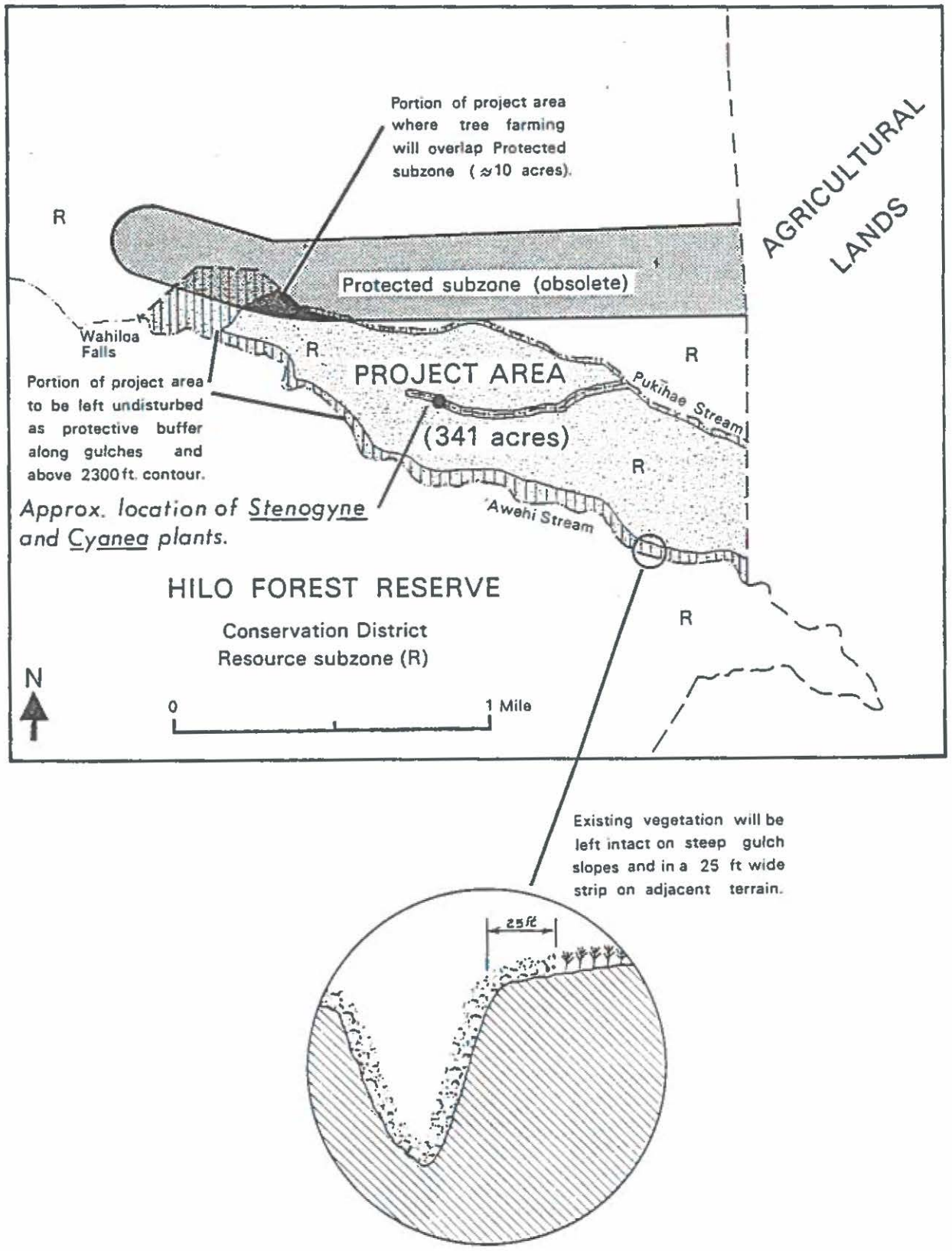


FIGURE 2. Land use classification and land management plan.

streamflow. No other Cyanea populations or individuals were encountered elsewhere within the project area.

The native Hawaiian mint Stenogyne scrophularioides var. aff. scrophularioides (Family Labiatae) has also been listed by the Department of Interior as a species currently under review for possible endangered species designation (Federal Register, 1980). Within the project area a single individual of Stenogyne scrophularioides var. aff. scrophularioides was found on the bank of the same Pukihae tributary from which Cyanea was reported (location shown in Figure 2). On June 3, 1981 the Stenogyne had a basal stem diameter of 3/8 inch, and was growing to a height of approximately 5 feet. The creeping stems of the plant spread sparcely over an area 20ft square. The plant appeared to be in fair condition although some pig damage was evident. This was the only specimen encountered within the project area.

F. VEGETATION

The vegetation of the project area is highly disturbed (i.e. modified from its presumed natural state), reflecting the impact of both direct and indirect past human disturbance. Although Pu'u'eo forest is currently included within a conservation zoned forest reserve/watershed district, such designation did not pretain earlier in the century when the forest reserve and the project area were exploited for limited cattle grazing, selective timber cutting and exotic tree planting (eucalyptus). A water diversion ditch was constructed along the southern boundary of the property. In recent years the project area has not been utilized other than for its

watershed value. Additionally, pig hunting is allowed and encouraged within the area. At present a matrix of dense waiawi (Psidium cattleianum) thickets (canopy height 25-30 ft.) and patches of uluhe fern (Dicranopteris emarginata) form the major vegetation type in the project area. Within this dominant vegetation type few other plant species are able to establish themselves in abundance. Larger trees such as 'ohi'a (Metrosideros collina polymorpha) and planted eucalyptus (Eucalyptus robusta) are found scattered throughout the area along with some koa (Acacia koa). Tree stocking is not sufficient to produce a closed canopy and there were very few trees with large trunk diameter (>3 ft).

Because of the dense understory of waiawi and uluhe, other elements in the shrub and herbaceous layer are not well developed. However, the following species are fairly common throughout the project area: hapu'u 'i'i (Cibotium chamissoi), 'olapa (Chierodendron trigynum), 'alani (Pelea volcanica), hame (Antidesma platyphyllum), Papa'a hekili (Clarmontia paraiflora), thimbleberry (Rubus rosaefolius), palmgrass (Setaria palmifolia), and yellow foxtail (Setaria glauca).

Small patches of California grass (Brachiaria mutica), forms a distinctive, though limited vegetation type in forest openings scattered throughout the project area.

The gulches of 'Awehi and Pukihae Streams (and the minor tributary of Pukihae), although dominated by uluhe, do support some of the more noteworthy native plants. In addition to the Cyanea and Stenogyne discussed earlier a patch of Hawaiian moon flower (Ipomea

tuboides) was observed on the banks of 'Awehi Stream.

G. VERTABRATE FAUNA

1. Amphibians and reptiles

The herpetofauna of the Hawaiian Islands consists entirely of recently introduced species. There are no native or endemic forms, nor are any of the various introduced frogs, toads, lizards, snakes or turtles considered to be threatened or endangered species. Within the project area frogs (Rana sp.) and their tadpoles were observed along 'Awehi Stream. The South American "cane toad" (Bufo marinus) is also known to inhabit the general area.

2. Birds

A survey of the avifauna at the project site (and adjacent areas) was conducted by zoologist Matthew D. Hess during the period September 29 through November 9, 1980. A copy of this report is included as Appendix C in this EIS. The following discussion is excerpted from the report. Information was also obtained by field observations during May-June 1981, and a review of the relevant ornithological literature.

The September-November 1980 Bird survey was undertaken using two different sampling methods: i) birds were censused using a systematic, circular plot technique involving 50 sample points on 12 transects covering the project site and

adjacent areas (see Appendix C, Figure 1 page 13); and ii) random searching of the area for incidental sitings of endangered bird species.

The combined systematic and random sampling of the avifauna involved 54 man-hours of direct field observations.

During the survey 10 bird species were encountered (Table III), including 9 exotic species and the endemic 'Elepaio (Chasiempis sandwichensis). Table III also presents statistical estimates of species densities within the project area based on the results of the systematic circular plot sampling. The Japanese White-eye (Zosterops japonica japonica) had the highest estimated density (67.01 birds/100 acres), followed by the 'Elepaio (Chasiempis sandwichensis) with 12.89 birds/100 acres. Other species present had densities ranging from less than 1 to near 6 birds/100 acres. In general the project area was found to be poor in resources for native birds, either for food, shelter or breeding, and the area does not resemble in any context what could be viewed as prime habitat for endemic or endangered bird species. The highest elevation in the project area (2,400 ft.) is approximately 500 feet (altitude) lower than the predominantly native forest where endangered birds are thought to occur. However, these results can not be taken to infer that there are no endangered bird species utilizing the project area, since habitats in these elevations may be differentially utilized in other seasons of the year. A

brief follow-up reconniassance survey of avifauna was conducted and again in May, 1981, the Japanese White-eye and Elepaio were the most frequently observed species. No new species, beyond those recorded previously (Table III) were encountered in the follow-up survey.

TABLE III. Birds Recorded From Pu'u'eo Mauka During September-November 1980.

SPECIES	Status	Individuals sighted	Estimated Density		95% Confidence Levels For Population Density Estimates In Project Area (341 acres)	
			Birds/ 100 Acres	Birds/ 341 Acres	Lower	Upper
House Sparrow (Passer domesticus)	X	23	4.90	16.71	10.57	24.22
N. American Cardinal (Richmondean cardinalis)	X	53	4.33	14.77	11.06	19.000
Japanese White Eye (Zosterops japonica japonica)	X	232	67.01	228.51	200.05	258.86
Elepaio (Chasiempis sandwichensis)	E	40	12.89	43.94	31.38	58.62
Spotted Munia (Rice Bird) (Lonchura punctulata)	X	13	4.03	13.73	7.28	22.21
Red-billed Leiothrix (Leiothrix lutea)	X	7	0.45	1.54	0.61	2.89
House Finch (Carpodacus mexicanus frontalis)	X	5	0.66	2.24	0.70	4.64
Laughing Thrush (Garrulax sp.)	X	2	0.16	0.55	0.05	1.55
Kalij Pheasant (Lophura leucomelana)	X	1	0.03	0.09	0.000037	0.36
Helemeted Guinea Fowl (Numida meleagris galeata)	X	2	5.73	19.53	1.84	55.98

X = Exotic; E = Endemic
Statistical estimates generated from circular plot sampling (see text and Appendix C)

Although not observed within the project area during the surveys two additional bird species with threatened or endangered status must considered in relation to the proposed development.

The Hawaiian Hawk (Buteo solitarius) or I'o is a federally endangered species found only on the island of Hawaii. The bird ranges widely between sealevel and the 8,500 ft elevation on both Mauna Loa and Mauna Kea (Berger, 1972). The species is frequently seen soring over agricultural and forest lands along the Hamakua coast and even over urban areas of adjacent Hilo. The Hawk feeds opportunistically on a variety of both native and exotic insects, birds and small mammals (Berger 1972). Hawks may occur periodically within the project area, however, no evidence was found of hawk nesting nor other specialized use of the Pu'u'eo mauka area by this species.

Newell's race of the Manx Shearwater (Puffinus puffinus newelli), or A'o is a seabird endemic to the Hawaiian archipelago. It is designated as a "threatened subspecies" under the U.S. Endangered Species Act (1973). The A'o nests on steep-sided uluhe covered slopes between the months of June and November (Berger, 1972). As a ground nesting species it is particularly vulnerable to introduced predators (rats, mongoose, etc.). It is thought to have originally nested on all the main Hawaiian Islands, however,

Munro (1944) concluded that introduced predators had exterminated the birds from Hawaii, Maui and Molokai. More recently the bird has been found on the Island of Hawaii. Kepler, Jeffrey and Scott (1979), have summarised the recent sightings of this species on the Hamakua coast.

During a 1977 survey of Hamakua coast forest birds A'o were heard calling along 'Awehi stream at an elevation of 1640 ft (near the lower boundary of the project area). A'o were also heard calling at Hakalau Stream approximately 8 miles to the north of the project area, and at two locations in the Kohala Mountains. Several sightings of A'o have also been reported between Papa'ikou and Laupahoehoe, where birds have been attracted to the lights of night-harvesting sugar cane equipment. Kepler, et al., (1979) concluded:

> The records, however, do suggest that A'o colonies exist within the Hamakua and Kohala forests, but that these colonies are very dispersed and probably contain few individuals...
>
> There are thousands of hectares of steep, muddly uluhe-covered stream banks within the forest on a windward slopes of Mauna Kea. Much of the ohia forest has died and is covered of additional hectares. Within this area pig densities are relatively low, and mongooses, dogs, cats, and rats are rarely seen, in constrast to forested areas at both higher and lower elevations. We suggest that A'o colonies will be found in this area and in the Kohalas. However, they will be exceedingly difficult to find, and locating them will require luck, hard work, and clues provided by pig hunters and others familiar with the remote forested areas. The location of a possible colony at Makaopuhi Crater (Banko, unpublished manuscript) suggests that pit craters might be reasonable locations in which to search for additional colonies.

During the September-November 1980 bird survey (Appendix C) two evenings were spent in the project area (6:30 - 9:30 pm) looking and listening for nocturnal species such as the A'o, Pue'o (Hawaiian short-earded owl: Asio flammeus sandwichensis), and the Hawaiian Hoary Bat (see following section). Two additional evenings during late May 1981 were also spent listening for A'o along 'Awehi stream. No A'o vocalizations or sightings were recorded during these observation periods. However, this can not rule out the periodic presence of A'o within the project area, or the possibility that the species may nest on the steep, uluhe clad gulches of 'Awehi Stream.

3. MAMMALS

A list of the mammal species potentially occuring within the project area and surrounding agricultural lands is presented in Table IV.

Hawaii's only native land mammal, an endemic race of the North American Hoary Bat (Lasiurus cinereus semotus), may occur within the project area, although it was not seen during the nocturnal avian survey. This species is widely distributed along the Hamakua coast, and is sometimes observed in urban areas of adjacent Hilo. The species also occurs on Kauai and

TABLE IV

Checklist of Mammals Potentially Occuring In The Pu'u'eo Mauka Area

Common/Scientific name	Hawaiian Name	Status [2]
Hawaiian Horary Bat *Lasiurus cinereus semotus*	O Pe'a Pe'a	E
Black Rat [1] *Rattus rattus*	Iole	X
House Mouse *Mus musculus*	Iole li'ili'i	X
Feral Dog *Canis familiaris*	Ilio	X
Indian Mongoose *Herpeste auropunctatus*	Ilio mana Kule	X
Feral Cat *Felis catus*	Popoki	X
Feral Pig *Sus scrofa*	Pua'a	X

Source : Tomich (1969)

[1] The Polynesian Rat (*Rattus exulans*) may also occur in the project area although it has generally been excluded from areas disturbed by man due to competition with the more agressive *Rattus rattus*.

[2] E = endemic subspecies; X = exotic species introduced by man in Polynesian or modern period.

has been seen occasionally on other islands in the archipelago (Tomich, 1973).

With respect to impact on the local ecosystem, the feral pig (Sus scrofa) is probably the most significant mammalian species present in the project area. Pig trails, vegetation destruction and soil disturbances are evident throughout the project area. Pig hunting is encouraged and actively pursued in Pu'u'eo mauka and adjacent forest lands.

H. ARCHAEOLOGICAL/HISTORICAL

An archaeological survey of the project area was conducted by Paul H. Rosendahl, Ph.D., Inc., Consulting Archeologist, on May 27-28, 1981. Dr. Rosendahl and a team of three field archaeologists spent 64 man-hours in a walk-through, reconnaissance survey of the project area searching for surface archaeological features. The following information is excerpted from Dr Rosendahl's survey report which appears as Appendix D in this EIS.

Despite the dense vegetation cover that made it difficult to traverse the survey area--often it was impossible to see more than ten meters ahead--the method utilized to carry out the survey was relatively simple. Beginning at the southeast corner of the area, near 'Awehi Stream, the initial inspection of the survey was made on May 27 by proceeding inland along the main hunter trail adjacent to the abandoned ditch. At irregular intervals, secondary hunter trails and feral pig runs that branched off were followed and the proximate land inspected. In this fashion, the portion of the survey area nearer 'Awehi Stream was explored to the approximate location of the 2200-foot elevation limit. At one point--estimated to be about the 2000-foot elevation--the survey team dropped down to the stream bed of Awehi Stream and inspected the side of the stream area for several hundred meters.

Survey work on May 28 began by heading inland along the same main trail from the southeast corner of the survey areas, but proceeded by bearing further to the north, cutting through the central portion of the survey area. The unnamed tributary of Pukihae Stream was crossed and a trail continued to be broken on into the northwest corner portion of the survey area. The survey team gradually turned and began heading seaward, in the area near Pukihae Stream.

The total number of acres inspected during the reconnaissance cannot be estimated with any degree of accuracy, but it is felt that the two days spent traversing the survey area from the sea-ward to the approximate inland limits, and through both the southern nad northern portions of the survey area, comprised a good sampling of the project area. Anymore formal sampling strategy would have required considerably greater expenditure of man-hours, and most likely would not have produced significantly different results.

No archaeological remains of any kind were found within the site of the proposed Eucalyptus Biomass Farm during the two days of reconnaissance survey field work. A check of records on file in the Hawaii County Planning Department in Hilo failed to reveal the presence of any previously recorded or known archaeological sites within or immediately adjacent to the survey area. Based on the completely negative results of the reconnaissance survey, it is concluded that no further archaeological work of any kind is necessary of justified, and it is recommended that full

archaeological clearance be granted.

There are no historical buildings or other structures of any kind within the project area. The only man-made feature present on the property (beside hunting trails) is an old sugar plantation diversion ditch which extends for approximately one-half mile along the north edge of 'Awehi Stream. This ditch was constructed around the turn of the century to divert water for cane fluming to Wainaku Mill (closed in 1975), and to provide potable water for mauka cane camps. The ditch has been out of service for almost a decade, is partially collapsed in many places and overgrown by waiawi.

I. EXISTING SOCIO-ECONOMIC CONDITIONS AND INFRASTRUCTURE

At present the project area is not economically utilized except to the extent that watershed values of the site may offer some protection to makai agricultural lands from flooding or erosion.

With the exception of the abandoned water diversion ditch there are no existing structures at the site, nor are utilities available.

'Amauulu Road, a privately owned (Mauna Kea Sugar Co.) gravel base cane haul road extends from sealed county roads in the Pu'u'eo area to the makai boundary of the project site (see Figure 1).

III THE RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES AND CONTROLS FOR THE AFFECTED AREA

The 341 acre Pu'u'eo area (TMK 2-6-18:08) proposed for eucalyptus biomass farming is within the Hilo Forest Reserve, and is designated a Conservation District by the State Land Use Commission. The present Regulation 4, administered by the Department of Land and Natural Resources provides for land use within the Conservation District, sub-zones, uses, appeals, enforcement and penalty, pursuant to Chapter 183-41 HRS, as amended, and identifies the 341 acre area as occupying two sub-zones, Protective (P) and Resource (R). Most of the parcel is in the Resource subzone of the Conservation District (see Figure 2), and the growing and harvesting of forest products is a conditionally permitted use in this subzone. According to Department of land and Natural Resources maps (Figure 2) a small portion of the project area (approx. 25-30 acres) is included within the Protected subzone of the Conservation district. This Protected subzone was declared in earlier years to insure the quality of potable, surface water sources utilized by mauka cane camps in the 'Amauula - Wainaku area. Today these camps have either been abandoned or are now serviced by County well-water. Surface water sources in this area of the Hilo Forest Reserve are no longer utilized for domestic supply.

In addition, it appears that cartographic errors may have been incorporated in the delineation of this Protected subzone, since the subzone boundaries do not conform to the major drainage

alignments in the area (see Figure 2). In any event, this Protected subzone designation now appears obsolete. Because the existing forest will not be cleared from a buffer zone along 'Awehi and Pukihae Stream, or above 2300 ft. elevation, very little of the Protected subzone (less than 10 acres) would be affected by the biomass project (Figure 2).

IV THE PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT AND MITIGATION MEASURES PROPOSED

The impacts of the proposed eucalyptus biomass farming on the site environment, surrounding lands, and general socio-economic conditions are discussed below along with measures proposed to mitigate adverse environmental impact.

A. IMPACT ON SOIL AND WATER RESOURCES

The project area lies within a high rainfall zone, and steep sided gulches with permently flowing streams border the site. Clearing of the site for eucalyptus planting could be expected to increase the soil erosion hazard, and any modifications to the existing drainage system could pose a threat of downstream flooding, erosion or water quality deterioration (e.g. siltation), unless adequate soil and water conservation measures are adopted.

In order to protect the soil and water resources of the project area the steep sided gulches of 'Awehi and Pukihae Streams (and the Pukihae tributary) will not be cleared or distrubed. In addition a 25ft wide vegetation buffer will also be left in place on the gentle sloping terrain immediately adjacent to the gulch tops to insure that clearing and grading operations do not inadvertently disturb potentially unstable gulch slopes (see Figure 2). That portion of the project area above the 2300 ft contour (approximately 25-30 acres) will also be left as a natural vegetation buffer protecting the area makai of Wailepua Springs (just outside the project boundary) and

Wahiloa Falls. It is important to emphasize that clearing and tree planting of the project area will proceed incrementally over a 3-5 year period (see page 20), so that at no time will the entire site be devoid of vegetative cover. Likewise subsequent timber harvesting and replanting will proceed incrementally and the project area will be characterized by a mosaic of different aged eucalyptus stands. Complete canopy closure of the rapidly growing eucalyptus seedlings is achieved in 9-12 months, substantially reducing the soil erosion hazard.

Either tree or herbaceous non competitive legumes (such as Albizia falcataria or Vicia desycarpa) may be interplanted with the eucalyptus, both for ground cover erosion control and nitrogen fixation. Studies as to the benefits of such interplanting are as yet inconclusive (BioEnergy Development Corp. 1980). In order to minimize soil compaction and the short term erosion hazard during the actual clearing and grading phase specialized filed equipment will be utilized. A D-6 low ground pressure crawler tractor or comparable unit with swamp shoes or track growsers 36" in width, for improved flotation, will be used to clear and windrow vegetative material across the slope. Natural drainage features of the site will not be obstructed and windrows will be positioned to enhance any conservation ditches recommended by the Soil Conservation Service as agreed to in a cooperative work plan required to obtain a grading permit under County Ordinance.

A month to six weeks after land clearing the area will be sprayed with the herbicide Roundup, a systemic herbicide which is taken in through foliage and roots. Regrowth is allowed for another 5-6 weeks before another application of Roundup is applied. The use of Roundup and other herbicides and pesticides for plant, insect and animal control causes short-term contamination of the soil. All agricultural chemical usage is strictly regulated by policies of the U.S. Department of Agriculture and only certain approved chemicals may be used at approved application rates. While this in itself does not provide total safeguard against any adverse environmental effects, it does minimize the chances of it occurring. It is anticipated that planned weed control will be most needed during the first year of tree growth, after which time shading from tree limbs and fallen leaves would provide a natural control.

Planting of eucalyptus seedlings will begin approximately two weeks after the second spraying of Roundup and will be done by hand. Tools called dibblers are used by the planters to create a hole into which the seedling is placed. Planting by hand should have no adverse impacts on the soil.

Harvesting may involve two methods of tree felling. A unit called a feller buncher is proposed for trees under 18" in diameter and located on suitable ground. It consists of a large loader with a tree-shear attached to the front. The unit pulls up to a tree, clamps it, then shears it off. Because BDC's trees are not expected to be much larger than 10" or 11" in diameter at the time of harvest, the feller-buncher can accumulate several trees before laying the load

down in a pile.

The second method of felling trees would be to use chain saws for trees in areas not suitable for the feller-buncher.

Transporting the felled trees to be loaded onto waiting trucks may be accomplished through two means. A skidder or brush hog, either tracked or wheeled, can pick up a load of trees with its grapple and drag them out. If the area is not suitable for skidders then a high-line or cable-skidder can be used. For cable skidding, a portable tower is used from which cables are laid out over the logging area. The logs are attached to the cables and then pulled back to the tower area.

As ground disturbance will occur at harvesting time, BDC in cooperation with SCS will develop a harvesting plan prior to any logging. Some compaction and erosion may result from heavy equipment usage. Also, should skidders be used to drag the trees out, some erosion, compaction and displacement of soil will occur. Cable-skidding would cause less ground distrubance. The eucalyptus and the legumes to be interspersed both have the ability to coppice thus the stumps left after cutting and subsequent shoots will aid in controlling erosion by reducing the time that the soil is exposed to direct rainfall. The mat of leaves, the cover crop, if planted, and other vegetation left in the field will also help to minimize erosion.

The effect of BDC's field operations on water quality and availability is expected to be minimal. As no impoundments, irrigation or stream diversions are planned for either Ka'u or

Hamakua, there should be no effect on water availability should there be any downstream users. During periods where little or no vegetative cover exists in the fields, some increased runoff, sedimentation and turbidity may occur in the few streams that immediately bound the project area, however, the proposed vegetation buffer zones within and along gulches should minimize this adverse environmental impact. Other potentials for water quality degradation may exist, for example, localized algae bloom on streams caused by runoff from nitrogen fertilizers, and stream and water table contamination from any chemical runoff or absorption. However as previous, more intensive usage of agricultural chemicals and fertilizers for adjacent sugarcane cultivation resulted in no such problems, it is anticipated that no deleterious effects on water quality will be caused by BDC's operations. Again chemical usage is strictly controlled by USDA regulations with only approved chemicals permitted and only at recommended application rates.

B. IMPACT ON AIR QUALITY

The proposed biomass farming and woodchip combustion is not expected to have any adverse, longterm effect on regional air quality, however, temporary, localized and generally minor negative impacts may occur during the development and operation of this project. Fugitive dust associated with land clearing and timber harvesting is expected to be slight due to the continuously wet ground conditions in the project area. Smoke from prescribed burning would result in temporary localized air pollution, however, little or no burning is anticipated in any of the clearing or harvesting phases at Pu'u'eo mauka so the threat to air quality is expected to be minimal. Should any occasional burning be required, agricultural burning permits would be sought in complience with State Department of Health regulations.

Windblown dust from driving on haul roads, and vehicle and field equipment exhaust will contribute to minor temporary air pollution which is unavoidable, but generally remote from residential areas.

When the wood chips are burned at the Pepe'ekeo Sugar Factory several particulate emissions control systems are available for air pollution abatement.

Wood chip energy will be used to lessen dependence on imported fuel oil at the Pepe'ekeo factory. As wood chips are comparatively low in sulfur, burning this material would result in fewer sulfur oxides being emitted into the atmosphere.

C. IMPACT ON NOISE

Noise pollution should not be a significant factor in the proposed operation as the project area is situated away from residential areas. Adjacent forest and canefields will serve as a noise buffer. Logging trucks transporting trees to the Pepe'ekeo power plant will be a periodic source of noise along haul roads and public highways. All relevent State and Federal noise abatement regulations will be followed.

D. IMPACT ON NATIVE FLORA AND VEGETATION

Pu'u'eo mauka does not support a unique, distinctive or intact native forest ecosystem, rather exotic plant species predominate in the project area. Clearing of the site and replanting with eucalyptus will result in the removal of a number of native plants inhabiting the area, except in the gulch and mauka buffer zones (see Figure 2) where the existing vegetation will be left undisturbed. No currently endangered plant species occur within the project area. However, two species under consideration for possible endangered species status are reported from the site. One individual of the native mint Stenogyne scrophularioides and possibly a few individuals of Cyanea sp. occur in the small tributary gulch of Pukihae Stream (see Figure 2). These habitats and plants will not be disturbed by the proposed development as gulch vegetation (and a 25 ft wide buffer zone on either side) will be left intact.

Of additional environmental concern is the extent to which the proposed development might compromise the ecological integrity of adjacent ecosystems within the Hilo Forest Reserve. The impact of the development in this regard is expected to be minimal for the following reasons:

1. Undisturbed native forest does not occur immediately adjacent to the project area, rather these adjacent forests are either planted eucalyptus forest or distrubed forest similar to that of the project area.

2. The agressive exotic waiawi currently dominant in the project area will be replaced by eucalyptus which does not rapidly invade native forest.

3. The natural buffer zones of 'Awehi and Pukihae Streams and the mauka buffer zone above 2300 ft will help to minimize the impact of the project on surround plant communities (either native or exotic).

4. Weed control programs (herbicide application) and the natural suppression of weed species under closed canopy eucalyptus forest will restrict the area as a seed source for weedy species.

A further, long-range consideration of the project's impact on native forest relates to the fact that it is part of a larger, joint BDC - USDA research and development demonstration project to determine the economic and technical feasibility of employing eucalyptus biomass plantations for energy production in Hawaii. Should this demonstration phase prove successful there is the implication of large scale (thousands of acres) eucalyptus planting in the future to meet growing local energy needs and lessen dependence on imported oil. Such an eventuality could increase pressure in the future for the conversion of native forest lands to biomass plantations. However, existing State and Federal regulations, as well as strict EIS requirements on a case by case basis, seem adequate to insure that any future development proposals would be unlikely to proceed if shown to seriously compromise the integrety of native ecosystems, or the critical habitats of endangered species. The Pu'u'eo mauka parcel, although within the Hilo Forest Reserve, does not support (or abut) an intact native forest ecosystem. As such, its development for eucalyptus biomass farming would not represent a precedent for future large scale native forest conversion.

E. IMPACT ON NATIVE FAUNA

Only a single species of native bird, the 'Elepaio (Chasiempis sandwichensis) is know to be resident within the project area. During September-November 1980 the total population of this species within the subject parcel was estimated to range between 31-59 individuals (see Table III). The 'Elepaio is one of the most common species in the ramaining native avifauna, and is still widely distributed on the

island of Hawaii and other islands of the archipelago. Most 'Elepaio will be unavoidably displaced by the proposed development, although reduced populations of this species are likely to maintain themselves in the various vegetation buffer zones provided for in the project.

The impact of the proposed development on the endangered Hawaiian Hawk (Buteo solitarius) is thought to be minimal. The Hawk is known to hunt over both native forest and agricultural lands on the Hamakua coast. The project area will ultimately be characterized by a mosaic of different aged ecualyptus stands, and as a potential hunting ground for this avian preditor will probably be no better or worse than the existing waiawi-uluhe dominant vegetation.

The A'o, or Newell's Shearwater (Puffinus puffinus newelli), a federally designated threatened subspecies of the Manx Shearwater has on two occasions (in 1977) been heard calling along 'Awehi Stream. Whether this secretive species may currently nest in the area is unknown. The bird feeds at sea during the day, departing before dawn and returning after dusk. Nesting burrows appear generally restricted to steep-sided uluhe clad gulches. These factors make detection of the species difficult. Any impact on the A'o resulting form the proposed development is expected to be minimal because the gulch vegetation along both 'Awehi and Pukihae Streams will be left intact. If A'o are currently nesting in the area, they are doing so in spite of the fact that eucalyptus forest already dominate the southern edge of 'Awehi Stream, and sugar cane fields also abut the gulch. It is perhaps significant that the eucalyptus biomass field operations, unlike sugar cane harvesting, will not involve night-time field

activities. Thus, night time noise, light, and vibration associated with field equipment will not be a distrubance factor for any possible A'o breeding colonies in the area. Should A'o breeding sites be discovered in the future in gulches bordering the project area, it would be a relatively easy matter to adjust field work schedules to minimize disturbance adjacent to such sites during the breeding season.

F. SOCIAL/ECONOMIC IMPACT OF THE PROJECT

The proposed eucalyptus biomass farming at Pu'u'eo mauka is part of a larger 5 year joint co-operative program between BDC and the USDA to development 900 acres (in Ka'u and Hamakua) as a biomass demonstration project. During 1979 and 1980, 300 acres of marginal sugar cane land and pasture have been planted to eucalyptus with no visible impact on the islands social infrastructure, except that jobs have been generated. BDC budgetary expenses in 1980 were $533,875 including $240,288 in salaries, wages and payroll benefits for 19 employees. The proposed expansion of eucalyptus farming at Pu'u'eo mauka will provide for continuing employment of BDC staff over the next three years and facilitate continuation of the Joint BDC-USDA biomass demonstration program.

More significant by far is the possible outcome of a larger commercially viable bioenergy resource development that could grow out of the present research and development project. The following section considers the benefits and costs of biomass energy development on the Hamakua coast at large and is not limited to the impact on the proposed project site at Pu'u'eo.

1. Potential social benefits

a) An indigenous energy source

Because Hawaii imports 92 per cent of its energy needs from foreign crude oil sources, Hawaii is particularly vulnerable to the recurrence of an oil crisis or to any similar international political ramification. In addition, the geographical isolation of Hawaii from continental U.S. negates many advantages which other states have. There is no electric power grid with adjacent regions or states; there are no oil or gas pipelines connected to other localities. For these reasons Hawaii should pursue the development of indigenous energy resources. An indigenous power source, such as biomass energy conversion, would substitute for oil thereby possibly reducing costs of energy and reducing economic uncertainty.

b) Economic growth: more jobs, more state revenue

The extent to which the commercial forest resource development would contribute to the economic growth of the County of Hawaii and create jobs and income for the residents of the Hamakua district largely depends on the level of the development effort. It is entirely possible that the forest industry can be developed for three types of final products: commercial lumber, wood chips for pulp, and biomass fuel for energy conversion. All three products, however, will require land clearing, planting, harvesting, chipping, and transportation activities. Because forest production is land and capital intensive, it offers greater opportunities both in the initial development stage and

after the full development of the industry.

Direct economic benefits would be gained by those who are employed in land clearing, planting, harvesting, etc. Benefits would also be gained by owners of forest lands, by state and local governments in various revenues, and by the customers of Hawaii electric and light companies through lower cost of power. Indirect stimulation of employment and income from such sectors as transportation and construction would be particularly helpful in broadening the narrow economic base of the island's economy. Most importantly a significant biomass energy program could help to maintain an economically healthy sugar industry on the island of Hawaii.

2. Potential social costs

Any expanded forest resource development project will invariably require increased expenditures for intrastructure requirements. This public expenditure may, at least initially, offset any increase in public revenue realized from the development.

V PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

The probable adverse environmental effects of the proposed eucalyptus development project are identified in Section IV along with mitigation measures proposed. These unavoidable adverse effects are summarized below.

1. Some soil compaction and soil erosion will be associated with clearing and harvesting operations in the project area. Temporary increased siltation of minor drainage tributaries will also be unavoidable during these field operations. After initial tree planting, however, disturbance associate with harvesting in any specific area will occur only at 5-7 year intervals.

2. Although the project area is dominated by an exotic flora and fauna, native plants and animals present in the area will be destroyed or displaced by land clearing and eucalyptus replanting, except in those buffer zones where the existing biota will be left undisturbed.

3. Short term temporary air, water, and noise pollution will result from vehicle and field equipment use, hauling of trees to Pepe'ekeo Sugar Factory, and the use of prescribed herbicides, and fertilizers.

VI ALTERNATIVES TO THE PROPOSED ACTION

A. NO ACTION

A no-action alternative would place in jeopardy the continuation of the ongoing, joint BDC-USDA eucalyptus biomass demonstration project, as only 300 of the programmed 900 acres are as yet developed. The subject parcel at Pu'u'eo mauka is planned to provide for about half of the remaining 600 acres to be planted over the next three years. A no-action alternative would remove one important option (eucalyptus biomass) in the quest for alternative energy development and make it more difficult to achieve goals established by the State and County Goverrment to increase energy self sufficiency for Hawaii.

B. ALTERNATIVE LOCATIONS FOR EUCALYPTUS BIOMASS FARMING

Other areas of marginal cane land and wasteland under the ownership or control of BDC (and its parent Company C. Brewer Ltd.) are already being developed into demonstration and experimental eucalyptus plantations. It is a BDC objective to get as much of this marginal land as possible into productive tree farming use over the years ahead. During 1979-80, 11 land parcels in both Ka'u and Hamakua, ranging in size from 2.4 - 66.1 acres (totalling 298.5 acres; see Table I) were planted to eucalyptus. However, the definition of "marginal cane land" can change with the fluctuating economics of the sugar industry, and variable sugar prices coupled with plans for a large scale ethanol plant on the Hamakua coast have increased pressure to maintain "marginal" fields in cane production for the forseable future. These events have restricted the available alternative

locations for expanding eucalyptus biomass farming. No other BDC controlled land parcels possess the combination of positive attributes which make the Pu'u'eo mauka site so ideal for eucalyptus biomass farming. These positive attributes include:

1. large size of parcel
2. idle land brought into productive use
3. adjacent to ongoing eucalyptus biomass farming operations
4. proximity to the Pepe'ekeo power plant
5. no conflict with other agricultural interests (i.e. does not involve removing cane land from production).
6. under general zoning restrictions the proposed activity (tree farming) is a conditionally permitted use of lands within the Conservation District.
7. unique or endangered native Hawaiian ecosystems/species are not significantly threatened.

VII THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY.

The proposal for eucalyptus biomass farming on 341 acres at Pu'u'eo mauka, because it is part of a demonstration project, can be considered a local short-term use of our environment. However if the demonstration phase proves successful then sustained yield eucalyptus biomass farming of the parcel would continue into the future enhancing the longterm productivity of the area. Since the eucalyptus biomass farming will also generally maintain the watershed values of the subject area the proposed action does not represent a significant trade-off of short term exploitation at the expense of long-term productivity and environmental quality. In the event the Biomass Project is terminated at some point in the future, the applicant assures that the parcel will be left in a forested condition to insure protection of basic watershed values.

VIII IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Land, federal funds, human labor, herbicides and fertilizers, heavy equipment, construction materials (e.g. for roads) and fuel will be committed to the project. Energy commitments will be retrievable through the sustained yield of eucalyptus biomass at the site. Use of the site for commercial forestry will continue for as long as eucalyptus biomass is a viable energy source in Hawaii. The existing exotic and native plants and animals at the project site will be to a large degree irretrievably lost as a consequence of the proposed Biomass Project (except for designated buffer zones).

IX OTHER INTERESTS AND CONSIDERATIONS THOUGHT TO OFFSET ADVERSE ENVIRONMENTAL EFFECTS

The goal of the proposed action as part of a project to demonstrate the feasibility of eucalyptus biomass farming, conforms with stated Federal, State and Hawaii County government objectives of developing alternative energy resources that would reduce dependence on fossil fuel imports, thus encouraging greater energy self-sufficiency. Additionally, a viable eucalyptus biomass industry on the Island of Hawaii would increase employment opportunities and reduce economic uncertainty. These potential benefits are considered to offset the relatively minor adverse environmental effects of the proposed action.

X LIST OF NECESSARY APPROVALS

1. Conservation District Use Permit - Department of Land and Natural Resources

2. Grading Permit - County of Hawaii

The project area does not fall within a Special Management Area (SMA), so requirements established under Chapter 205-A, HRS, and Rule 9 of the Hawaii County Planning Commission are not Applicable (see Appendix E).

XI AGENCIES ORGANIZATIONS AND PERSONS CONSULTED IN THE PREPARATION OF THIS EIS

The following persons, firms and agencies were contacted for professional services and/or specialized advise on the various aspects of this EIS:

Paul H. Rosendahl, Ph.D. Archaeologist	Archaeological Reconnaissance survey
Matthew D. Hess, Zoologist	Bird Survey
Winona Char, Layne Yoshida and Garvin Clarke, Botanists	Flora/Vegetation survey
Y.K. Hahn, Ph.D. Economist	Socio-economic impact
Jerry Williams, Conservationist U.S. Soil Conservation Service	Soil survey
Sydney Fuke, Director Planning Department, County of Hawaii	General comments
State of Hawaii Dept. of Land and Natural Resources	Environmental concerns and guidelines for EIS preparation, status of Protected subzone.

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APPENDIX A: SOIL SURVEY

United States Department of Agriculture

Soil Conservation Service

P. O. Box 1089
Kamuela, HI 96743

SUBJECT:

DATE: 6-25-81

TO: Mr. Thomas Crabb, Project Manager
Bioenergy Development Corporation
P. O. Box 1801
Hilo, Hawaii 96720

Mr. Crabb:

The soil survey report requested by Bioenergy Development Corporation for T.M.K. 2-6-18:8 in Amauulu Mauka is enclosed. Three copies have been prepared for your use. Additional copies can be supplied if you need them.

Please contact this office if you have any questions regarding the report. We trust it provided you with the information you need.

Jerry Williams

Jerry Williams, Conservationist
U.S.D.A., S.C.S.
P. O. Box 1089
Kamuela, Hawaii 96743

Encl.

SOIL SURVEY
AMAUULU MAUKA
BIOENERGY DEVELOPMENT CORPORATION

Prepared by Soil Conservation Service
June 1981

This soil survey is for the 341-acre parcel zoned Conservation and the land below the Forest Reserve boundary currently used for biomass tree planting.

Elevations range from about 1,500 to 2,300 feet. Annual rainfall ranges from 250 to 275 inches. The mean annual soil temperature is estimated between 66°F. and 68°F. Fog and cloud cover are common.

The area within the conservation zone is densely covered with rainforest-type vegetation including tree fern, ohia, uluhe and other ferns. Eucalyptus robusta and a dense growth of waiwe occur in the area just above the Forest Reserve boundary. The soils are almost entirely those of the Akaka series. Dominant slopes are 6 to 10 percent, with steeper slopes along the gulches.

The area currently used for biomass tree planting consists of Akaka and Kaiwiki soils. Slopes are dominantly 3 to 8 percent.

Akaka and Kaiwiki are deep soils. They are formed in volcanic ash under high rainfall. The Akaka soils are somewhat poorly drained and the Kaiwiki soils are well drained. Both Akaka and Kaiwiki soils are suitable for growing a wide variety of trees. They have low bearing capacity and machinery tend to bog down under wet conditions.

SOIL MAP -- AMAUULU MAUKA

UNITED STATES DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

cooperating with

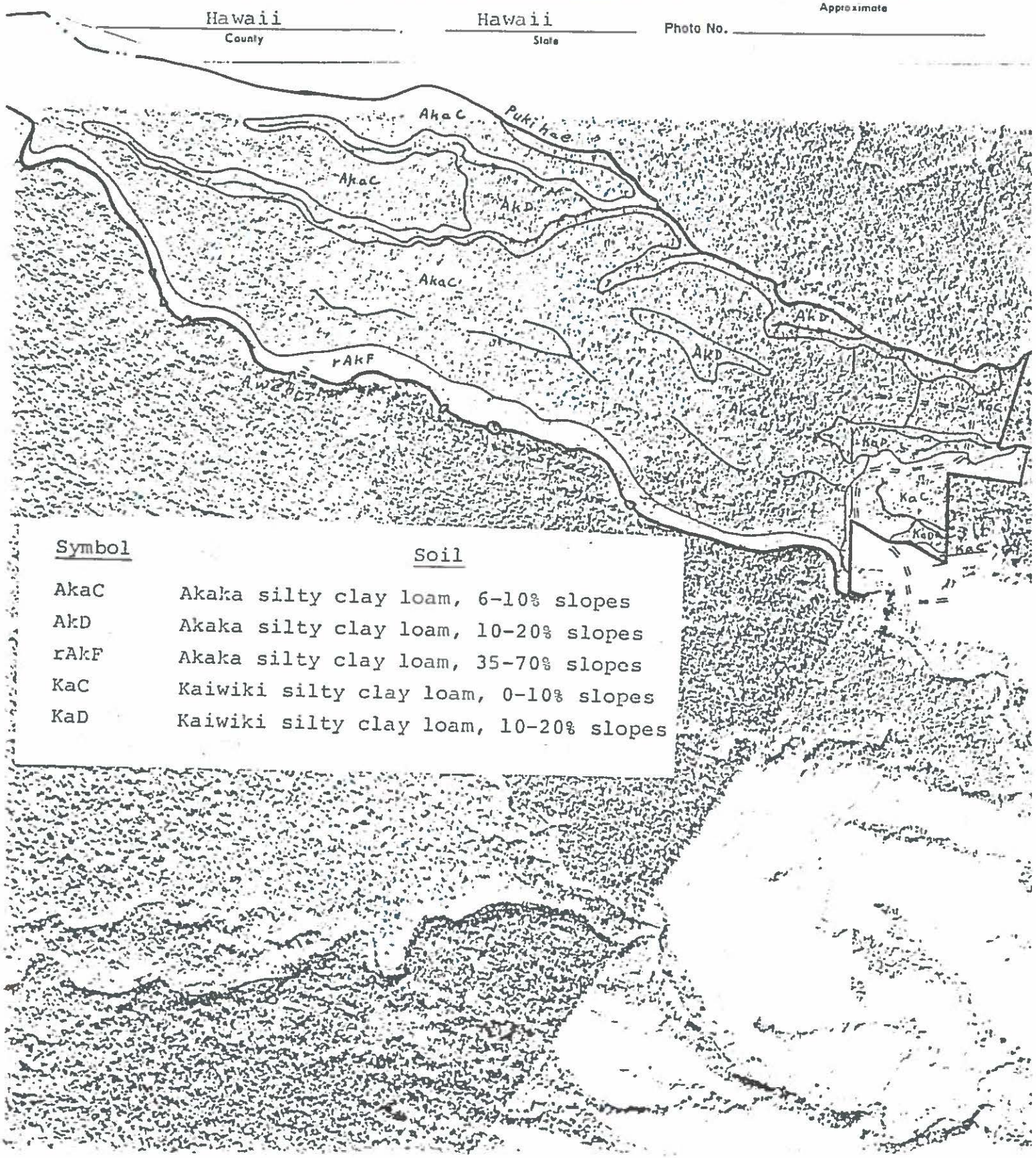
Mauna Kea
Conservation District

OUR SOIL ★ OUR STRENGTH

Owner _____ Plan No. _____ Date June 1981

Operator BioEnergy Development Corp. Scale 1"=1,200' Approximate Acres 341+

Hawaii County Hawaii State Photo No. _____



Symbol	Soil
AkaC	Akaka silty clay loam, 6-10% slopes
AkD	Akaka silty clay loam, 10-20% slopes
rAkF	Akaka silty clay loam, 35-70% slopes
KaC	Kaiwiki silty clay loam, 0-10% slopes
KaD	Kaiwiki silty clay loam, 10-20% slopes

DESCRIPTION OF SOILS

Akaka Series

The Akaka series consists of deep, moderately well drained silty clay loam soils formed from volcanic ash. They occur at the upper fringe of the sugarcane land, but primarily within the forested area. Elevations range from 1,000 to 4,500 feet. Mean annual rainfall ranges from 150 to 300 inches. Cloud and fog are prevalent throughout the year.

In a typical profile, the surface layer is dark reddish brown silty clay loam about 15 inches thick. The subsoil is reddish brown to dark reddish brown silty clay loam more than 57 inches thick. The surface layer is strongly acid and the subsoil is strongly acid to medium acid. The subsoil is moderately to strongly smeary. Water moves through the soil rapidly (6 to 20 inches per hour). Roots can penetrate to a depth of over 5 feet.

This soil is usually moist. When allowed to dry, it hardens irreversibly to fine gravel-size aggregates. This soil has low bearing capacity. Heavy equipment will tend to bog down.

Akaka soils are suited to growing a wide variety of trees.

AkaC Akaka silty clay loam, 6 to 10 percent slopes.

This is moderately sloping soil. The erosion hazard is slight. Included are small boggy areas. Also included are small areas with up to 15 percent slopes. This soil is suited to grow trees.

AkD Akaka silty clay loam, 10 to 20 percent slopes.

This soil occurs on moderately steep to rolling topography and is dissected by streams. There are small depressions which remain waterlogged for long periods. The erosion hazard is moderate. Small areas are moderately eroded. Included are areas of steeper slope along gulches. This soil is suited to grow trees. Use of machinery and planting should be across the slope or on the contour. Slope and low bearing capacity make use of machinery somewhat difficult.

rAkF Akaka silty clay loam, 35 to 70 percent slopes.

This soil occurs on very steep gulch sides. In places, slopes are steeper than 100 percent. Rock outcrop occurs in a few places. The erosion hazard is severe. Disturbance of the natural vegetation and the soil should be avoided.

Kaiwiki Series

The Kaiwiki series consists of deep, well drained silty clay loam soils formed from volcanic ash. Elevations range from 800 to 1,500 feet. Mean annual rainfall ranges from 150 to 200 inches.

In a typical profile, the surface layer is dark brown silty clay loam about 15 inches thick. The subsoil is dark brown and dark reddish brown silty clay loam about 48 inches thick. The surface layer is very strongly acid and medium acid. The subsoil is medium acid to strongly acid. Water moves through the soil rapidly (6 to 20 inches per hour). Roots can penetrate to a depth of over 5 feet.

The soil is usually moist. When allowed to dry, it hardens irreversibly to fine gravel-size aggregates. This soil has low bearing capacity. Heavy equipment will tend to bog down.

Kaiwiki soils are suited to growing a wide variety of trees.

KaC Kaiwiki silty clay loam, 0 to 10 percent slopes.

In most places this soil is gently sloping with dominant slopes of 3 to 8 percent. The soil is dissected by narrow drainageways. The erosion hazard is slight. This soil is suited to growing trees.

KaD Kaiwiki silty clay loam, 10 to 20 percent slopes.

This is a moderately steep soil. The erosion hazard is moderate. Included are steeper slopes along gulches. This soil is suited to growing trees, but use of equipment is somewhat difficult.

APPENDIX B: FLORISTIC SURVEY

FLORISTIC ASSESSMENT
IN THE
PUUEO FOREST RESERVE

November, 1980

Winona Char

Layne Yoshida

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INTRODUCTION

An environmental assessment of the vegetation of the study area was conducted during November 1980. The major portion of the field work was conducted from November 6 to November 9 by Winona Char and Layne Yoshida.

The study site consists of approximately 300 acres in the Puueo Forest Reserve and is bounded on the south by 'Awehi' Stream and on the north by 'Pukihae' Stream. The elevation of the study site is between 1600 and 2400 ft. A trail that parallels 'Awehi' Stream was used to gain access to the southern boundary of the study site, while two minor unnamed streams were used as access trails to the central portion of the study area. There were no recognizable trails to be found on the eastern boundary and access was gained by cutting a trail paralleling 'Pukihae' Stream.

Since the main objective of this study was to provide an assessment of the vegetation in the area, notes were only made on the dominant vegetation types and species present. No attempt was made to estimate the percentage cover of each species within the study site.

METHODOLOGY

Prior to fieldwork, topographic maps were examined for possible access routes and trails. A walk-through survey method covering the most acreage was employed. Notes were made on the vegetation types and on the different species (taxa) encountered. Any vegetative associations appearing to be different were searched for unique or rare taxa.

Collections were made of plants which could not be positively identified in the field and were later determined in the laboratory at the University of Hawaii Herbarium. Voucher specimens of some of the plants collected have been deposited at the U. H. Herbarium.

DISCUSSION

The vegetation in the study area is highly disturbed (adjoining areas were once used for grazing cattle) and the dominant taxa throughout much of the area are waiawi (Psidium cattleianum), an exotic, and uluhe (Dicranopteris emarginata), a native fern. The vegetation types encountered during this survey are similar to other areas of highly disturbed vegetation at the same elevations along the Hamakua coast.

A matrix of closed waiawi scrub and uluhe patches form the major vegetation types within the study area. In these types of vegetation only a few other species are able to establish themselves. Larger trees such as 'ohi'a (Metrosideros collina ssp polymorpha), Eucalyptus (planted) can be found scattered throughout the area, along with some koa (Acacia koa). Several minor vegetation types in the area include small patches of California grass (Brachiaria mutica) and stands of Eucalyptus (mostly Eucalyptus robusta). Besides 'ohi'a and koa other native species found throughout the study area are hapu'u 'i'i (Cibotium chamissoi) hame or mehame (Antidesma platyphyllum) and kopiko (Psychotria hawaiiensis). Papa'a hekili (Clermontia parviflora), a native member of the Lobelia family, becomes occasional at elevations above 2000 ft.

Several taxa encountered during the survey could not be identified to the species level because they were either immature or without flowers. The only one which has a high probability of being on the Proposed Federal Register of Endangered Species is the Cyanea sp., Several individuals of this taxon were located along the small stream that passes through the central portion of the study site. The plant appears to grow only in dense shade along the steep stream bank.

SUMMARY

Only the 'Awehi' Stream area appears to have been botanized in the past and in searching the herbaria at the University of Hawaii, Manoa and Bishop Museum no rare or endangered taxa from the study area were located.

During the course of this survey no rare or endangered species were found and the vegetation types within this 300 acre area are not unique. The planned development of this area will not cause any significant damage to the total island population of any of the species involved.

CHECKLIST OF VASCULAR PLANTS
'AWEHI, HAWAI'I

As the primary objective of this survey was to prepare an environmental assessment of the study area, rather than to make an exhaustive search solely for plant species, the list is not considered to be complete.

Plant families are listed alphabetically within each of three groups: Pteridophyta (ferns) and fern allies, Monocotyledonae, and Dicotyledonae. For each species the following information is provided:

1. Scientific name with the author of that name
2. Common name or Hawaiian name, when known
3. Status of the species

E = endemic to the Hawaiian Islands, i.e. occurring naturally nowhere else in the world

I = indigenous, i.e. native to the Hawaiian Islands but also occurring naturally (without the aid of man) elsewhere

X = exotic, i.e. plants of accidental or deliberate introduction after the Western discovery of the Hawaiian Islands

P = Polynesian introduction; it includes those plants brought by the Polynesian immigrants prior to Captain Cook's discovery of the Hawaiian Islands.

Taxonomy and nomenclature of the pteridophytes follows Wagner's unpublished "Checklist of Hawaiian Pteridophytes" except where more commonly accepted names or more recently published names are listed. Taxonomy and nomenclature of the flowering plants (Monocotyledonae and Dicotyledonae) follows St. John (1973) except where more commonly accepted names are listed. Hawaiian names used in the checklist are in accordance with Porter (1972) or with St. John (1973).

PTERIDOPHYTA AND FERN ALLIES

ADIANTACEAE		
Adiantum capillus-veneris L.	'Iwa'iwa	I
ASPIDIACEAE		
Athyrium sandwichianum Presl	Ho'i'o	E
Elaphoglossum alatum var. parvi-squameum (Skottsb.) Anderson & Crosby	'Ekaha	E
Elaphoglossum hirtum (Swartz) Christensen	'Ekaha	E
ASPLENIACEAE		
Asplenium contiguum Kaulf.		E
Asplenium lobulatum Mett.		E
BLECHNACEAE		
Blechnum orientale L.	Blechnum	X
DAVALLIACEAE		
Nephrolepis cordifolia (L.) Presl	Ni'ani'au,'okupu-kupu, narrow sword fern	I
Nephrolepis exaltata (L.) Schott	Pamoho	I
DICKSONIACEAE		
Cibotium chamissoi Kaulf.	Hapu'u 'i'i	E
Cibotium splendens (Gaud.) Krajina	Hapu'u pulu, pepe'e	E
GLECHENIACEAE		
Dicranopteris emarginata (Brack.) Robinson	Uluhe	I
Hicriopteris pinnata (Kunze) Ching	Uluhe-lau-nui	I
GRAMMITIDACEAE		
Adenophorus hymenophylloides (Kaulf.) H. & G.	Pai, palai-la'au	E
Adenophorus sarmentosus (Brack.) Wilson		E
Adenophorus tamariscinus (Kaulf.) H. &. G.	Wahine-noho-mauna	E
Grammitis hookerii (Kaulf.) Copel.	Maku'e-lau-li'i	I
Grammitis tenella Kaulf.	Kolokolo, mahina-lua	E
HYMENOPHYLLACEAE		
Callistopteris baldwinii (D. C. Eaton) Copel.		E
Mecodium recurvum (Gaud.) Copel.	'Ohi'a ku	E
Sphaerocionium obtusum (H. & A) Copel.	Palai-lau-li'i	E

LINDSAEACEAE		
Sphenomeris chusana (L.) Copel.	Pala'a, pala-pala'a	I
LYCOPODIACEAE		
Lycopodium cernuum L.	Wawae-iole	I
Lycopodium phyllantum H. & A.	Wawae-iole	I
OPHIOGLOSSACEAE		
Ophioglossum pendulum L.	Laukahi, puapua-moa	I
POLYPODIACEAE		
Pleopeltis thunbergiana Kaulf.	'Ekaha-akolea, pakahakaha	I
PSILOTACEAE		
Psilotum complanatum Swartz	Moa, pipi	E
Psilotum nudum (L.) Beauv.	Moa	I
SELAGINELLACEAE		
Selaginella arbuscula (Kaulf.) Spring	Lepelepe-a-moa	E
THELYPTERIDACEAE		
Christella dentata (Forssk.) Brownsey & Jermy	Downy woodfern	X

MONOCOTYLEDONAE

ARACEAE		
Colocasia esculenta var. antiquorum (Schott) Hubb. & Rhed.	Taro, kalo	P
COMMELINACEAE		
Commelina diffusa Burm. f.	Honohono	X
CYPERACEAE		
Cyperus haspan L.		X
Cyperus polystachyus Rottb.		X
Eleocharis obtusa var. gigantea (Clarke) Fern.	Kohekohe, pipi-wai	I
GRAMINEAE		
Axonopus compressus (Sw.) Beauv.	Broad-leaved carpetgrass	X
Brachiaria mutica (Forsk.) Stapf	Californiagrass, paragrass	X
Coix lachryma-jobi L.	Job's tears, kukae-kolea	X
Oplismenus hirtellus (L.) Beauv.	Basketgrass, hono-hono-kukui	X

GRAMINEAE (continued)		
Panicum repens L.	Quackgrass	X
Paspalum conjugatum Berg.	Hilo grass, mau'u-Hilo	X
Paspalum orbiculare Forst. f.	Ricegrass, mau'u-laiki	X
Sacciolepis indica (L.) Chase	Glenwoodgrass	X
Setaria glauca (L.) Beauv.	Yellow foxtail	X
Setaria palmifolia (Koen.) Stapf	Palmgrass	X
LILIACEAE		
Astelia menziesiana Sm.	Pa'iniu	E
Smilax sandwicensis Kunth	Hoi-kuahiwi, aka-'awa	E
MUSACEAE		
Musa X paradisiaca L.	Mai'a, banana	P
ORCHIDACEAE		
Arundina bambusaefolia (Roxb.) Lindl.	Bamboo orchid	X
Epidendrum sp.	Epidendrum	X
PANDANACEAE		
Freycinetia arborea Gaud.	'Ie'ie	E
ZINGIBERACEAE		
Hedychium flavescens Carey	Yellow ginger, 'awapuhi melemele	X
DICOTYLEDONAE		
AQUIFOLIACEAE		
Ilex anomala H. & A.	Kawa'u	E
ARALIACEAE		
Cheirodendron trigynum (Gaud.) Heller	'Olapa	E
BIGNONIACEAE		
Spathodea campanulata Beauv.	African tulip	X
CARYOPHYLLACEAE		
Drymaria cordata (L.) Willd.	Drymaria, pipili	X
COMPOSITAE		
Ageratum conyzoides L.	Ageratum, maile-hohono	X
Erechtites valerianaefolia (Wolf) DC.		X
Eupatorium riparium Regel	Pamakani	X
Pluchea odorata (L.) Cass.	Pluchea	X

ERICACEAE		
Vaccinium calycinum Sm.	'Ohelo-kau-la'au	E
Vaccinium sp.	'Ohelo	E
EUPHORBIACEAE		
Antidesma platyphyllum Mann var. platyphyllum	Hame, mehame	E
LEGUMINOSAE		
Acacia koa Gray	Koa	E
LOBELIACEAE		
Clermontia parviflora Gaud.	Papa'a-hekili	E
Cyanea sp.	'Oha	E
LYTHRACEAE		
Cuphea carthagenensis (Jacq.) MacBride	Cuphea, puakamoli	X
MELASTOMATACEAE		
Melastoma malabathricum L.	Malabar melastome	X
MELIACEAE		
Toona ciliata M. Roem.	Toon	X
MYRTACEAE		
Eucalyptus citriodora Hook.	Lemon-scented gum	X
Eucalyptus robusta Sm.	Swamp mahogany	X
Metrosideros collina ssp. polymorpha (Gaud.) Rock	'Ohi'a-lehua, lehua	E
Psidium cattleianum Sabine	Strawberry guava	X
Psidium cattleianum f. lucidum Deg.	Waiawi, yellow strawberry guava	X
ONAGRACEAE		
Ludwigia octivalvis (Jacq.) Raven	Primrose willow, kamole	X
Ludwigia palustris (L.) Ell.	Water purslane	X
PASSIFLORACEAE		
Passiflora edulis f. flavicarpa Deg.	Yellow lilikoi	X
PIPERACEAE		
Peperomia tetraphylla (Forst. f.) H. & A.	'Ala'ala-wai-nui kane	I
Peperomia sp.	'Ala'ala-wai-nui kane	E
ROSACEAE		
Rubus rosaefolius Sm.	Thimbleberry, 'ola'a	X

RUBIACEAE		
Coprosma sp.	Pilo	E
Psychotria hawaiiensis (Gray) Fosberg var. hawaiiensis	Kopiko	E
RUTACEAE		
Pelea volcanica Gray var. volcanica	'Alani	E
TILIACEAE		
Heliocarpus popayaensis HBK.	White moho	X
UMBRELLIFERAE		
Centella asiatica (L.) Urban	Asiatic pennywort, pohekula	X
VERBENACEAE		
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain, owi, oi	X

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APPENDIX C: AVIAN SURVEY

AVIAN ASSESSMENT SURVEY

for

BioEnergy Development Corporation

By Matthew D. Hess
Bachelor of Science in Zoology

Avian Disease Laboratory
Hawaii Volcanoes National Park

University of Hawaii Research Corporation

1980 Earthwatch Teams Assistant

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INTRODUCTION

A biomass energy organization is proposing the clear cut logging of an area involving 341 acres which is in an area known to have endermic Hawaiian birds. At the request of BioEnergy Development Corporation, the author, Matthew Hess was contracted to undertake an avian assessment survey. The primary objective in this Avian survey of a small geographic area of 341 acres, called Puueo, in the Hilo district on the island of Hawaii, was to establish the presence of any endangered bird species. In addition, quantitative data on all the bird species present was found collected, to give a view of the species diversity and density. In this 54 man-hour study beginning September 29, 1980 and ending November 9, 1980, attention was directed toward the detection of endemic and endangered bird species.

HISTORICAL REVIEW

HABITAT

A number of factors have led to the degeneration of this area's native forest, which now has a direct bearing on the resources available for the native and endangered bird species. The native trees found were widely scattered Koa, Hapuu, and Ohia in largely the same abundance as the scattered exotic Eucalyptus. The succession of the thick guava tree stands results in mostly older Ohia and Koa trees with little apparent regeneration. The geographic elevation is between 1600 ft. and 2400 ft., where at the highest elevation the guava is still consistently dense. In the elevations above, a vegetation gradie begins that gradually becomes more continuous with the predominently native forest at approximately 3000 ft.(1) The rainfall is variable throughout the year, but this is considered a wet, low elevation forest with from 250 to 300 in. average rainfall annually.(2)

In this low elevation the night biting mosquito, Culex, is known to thrive, therefore this is now a habitat with vectors for such avian diseases as malaria and fowl pox. The native bird species and many of the endangered birds have little genetic resistance to these exotic diseases and this is believed to be another factor why many endemic species, with former ranges here, now are found in higher elevations.(3)

Experimental evidence has demonstrated the high susceptability of existing endemic species to avian malaria, an exotic disease. (Charles Van Riper III, personal communication) In a preliminary study to determine this drepanid distribution near Hilo, an abrupt lower edge of population density occurred at about the 2000 ft. level, the approximate upper level of the Culex mosquitos' breeding belt.(4) However, this avian malaria vector has now been known to breed in localized areas as high as 6000 ft.(5)

An endangered species presently known to occur in these elevations is the Hawaiian Hawk. (Curtis Griffin, personal communication) The other endemic Hawaiian drepanids found on Hawaii are believed to occur only in the forest elevations above 600 - 900 m, approximately 2000 ft. as a lower edge.(6) The Hawaiian Owl and the Elepaio are other endemic species known to occur in these elevations.(7)

Endangered species, as any endemic species, may, frequent the area by day if their elevational ranges are close enough. They may also use these elevations at different months of the year, migrating vertically or laterally. Therefore, practically all endangered species are treated as possibly occurring in the area, even though most are not proable to be found here.

The U. S. Fish and Wildlife Service investigation of the Hilo districts has not yet been published for reference. Refer to Table 1 for the individual endangered species accounts of the known elevational ranges and habitat descriptions, derived largely from Berger(8) and Munro(9).

STUDY METHODS

Census Method

Selection of a particular census method took many hours of consideration. The first method chosen not only gives a fair accuracy of the species diversity at the time of this survey, but also a more thorough view of the species density and relative abundances in this area. The variable circular-plot technique used by Dr. Michael Scott of the Hawaii Fish and Wildlife Service and the U. S. Forest Service Ornithologists was selected to generate the data.(10) Several line transects, parallel to the contour were set with flagging tape. This technique was used on four mornings, from dawn till about 10:30 a.m., during the period of maximum bird activity and singing in order that observations at later stations were not biased as activity gradually decreased.

The starting and ending stations on each of the 4 days were different, and the transects ran in opposite directions, and from different elevations each day so that any bias was eliminated. Since a large influence in bird activity and singing was the weather, each morning the survey was conducted, was consistent in being calm and sunny.

A second method used in the field each day was a random search for incidental sightings of endangered species. In conjunction with the first method this should determine whatever populations of endangered birds were present. A total of 34 hours were spent in random searching and this was important since direct attention could be given to watching and listening for the several possible, endangered species. (Table 1)

A tape recorder was carried at all times to attempt to record any of these vocalizations, but its use was empahsized in this incidental sightings method. In addition, 3 hours from 6:30 p.m. to 9:30 p.m. on 2 nights were spent listening for diurnal and nocturnal species that may be present; the Hawaiian Owl, the threatened Newell's Shearwater and the endangered Hawaiian Hoary Bat.

STUDY METHODS

Transect Selection

In selecting the transects on a topographic map the distances between the transects had to be as close as possible for the required thoroughness, yet remain statistically independent of the other transects' detection distance. A distance of 400 m. between transects was selected since the detection distance of the most conspicuous species is usually not more than 125 m. This habitat is fairly uniform in vegetation, therefore the transect lines were decided to run parallel to the contour of the gradual slope. The magnetic North-South axis happened to approximate the transect direction therefore was utili to place the primary transect at the lower boundary and placed the following transects parallel and 400 m apart. Placement of the transects in some areas had to be irregular to accommodate the barriers of thick guava stands and steep ravines.

STUDY METHODS

Placement of Stations

A decision to survey just 100 m beyond all borders of the 341 acre parcel was accomplished by first placing stations at the ends of all transects near the boundaries. With the first transect placed at the lower border, stations were selected at least 200 m. apart and farther in a few instances. This is to insure the statistical independence of each station and still be as precise in locating the rarer or less obvious endangered species.

The field forms used were the standard U. S. Fish and Wildlife forms for use with the Variable Circular Plot Method for estimation of species density.

LIMITATIONS

In such an avian survey there are limitations to the desired accuracy which must be considered and stated in the report. The 54 man-hours spent in the methods of this survey's fieldwork would be sufficient to detect whatever populations of endangered or threatened species are present, but may not determine those species that occur in the area in other seasons of the year. Following is a number of factors that may contribute to scattered individuals escaping detection as would be the case with endangered species whose abundance is scarce:

A. The accessibility of this area was limited in a few places due to the thick guava tree stands and steep ravines.

B. Near the higher elevations in the 341 acres the area is narrow and may be utilized by endangered species in adjacent areas at this elevation. Effort was taken to survey outside the higher area by the addition of 10 stations placed at the upper boundaries.

C. A number of the endangered species in Hawaii have extensive foraging ranges that would make detection difficult.

D. Again, this survey, conducted largely in the month of October was but one month of the year, and the species found in the area may fluctuate seasonally.

These limitations therefore allow the author only to state what was encountered during the 54 man-hours in the fieldwork. Also, the author can suggest which endangered species possibly utilize this area that were not detected for any of the above stated factors. This survey was not intended as a representation of this elevation or any other adjacent area, but the 341 acres called Puueo, in Amauulu, Hawaii.

SUMMARY

During the entire 54 man-hours in the fieldwork, no endangered species were detected. This area does not resemble in any context what could be viewed as a prime habitat for endemic or endangered bird species. Indeed, this area was found to be poor in resources for native birds, either for food, shelter, or breeding. However, this does not infer that there are no endangered species utilizing this 341 acres now, or at other times of the year. All that can be said is that during this survey, none were detected. The Variable Circular Plot method generated useful data that gives a fair estimate of the species diversity and density.

Again it is known that the Endangered Hawaiian Hawk does utilize the elevation and area of the Hilo district, as might be found the threatened Newell's Shearwater at other times of the year.(11) The Consultant Botanist reported sighting the Hawaiian Hawk near the lower boundary of the survey area.

Other endemic species also known to inhabit these elevations is the Hawaiian Owl and the Elepaio according to Munro.(12) It would be fairly accurate to state that no populations of endangered avian species exist here with the exception of the Hawaiian Hawk. If an endangered species is residing, or foraging in this 341 acres, called Puueo, it would have to be as isolated individuals or pairs.

ACKNOWLEDGEMENTS

The author would like to thank Dr. Michael Scott of the U. S. Fish and Wildlife Service at Volcano National Park for his help in compiling the data collected in the field with the use of his computer program for the Variable Circular Plot Method and for his suggestions in the selection of the methods for this Avian Assessment Survey.

Also, thanks to Howard Sakai of the Forestry Service for his aide with the designing of the study methods and transects for this survey.

Thanks to Mark Collins with the U. S. Forestry Service for his suggestions about the format and his guidance in preparation.

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APPENDIX

In this section is included all the data compiled during the 100 count periods, generated by the Variable Circular Plot method.

Table 1 is a comparison of Habitat descriptions and elevational ranges of the endangered birds of Hawaii according to the publishings of A. J. Berger and G. C. ~~Berger~~ Munro. These species accounts of the endangered species of Hawaii is to review of some of the published information on their distributions and abundance.

Table 2 shows the species actually observed during the count periods, and those species estimated densities in number of birds/100 acres, number of birds/341 acres and the 95% confidence levels of the latter, as computed from the data generated. The estimation of species densities and related computations were made by the Variable Circular Plot computer program as used by ornithologists with the U. S. Fish and Wildlife Service and the U. S. Forestry Service. Where minute numbers of a species are encountered density estimation may appear unusual.

Table 3 is the calculated species frequency, the species incidence, and relative abundance of those species located during the count periods to give three additional indicators relating to abundance.

Figure 1 is a map of the 341 acres called Puueo with the transect and station positions selected for this survey.

FIG. 1

TRANSECT AND STATION POSITIONS

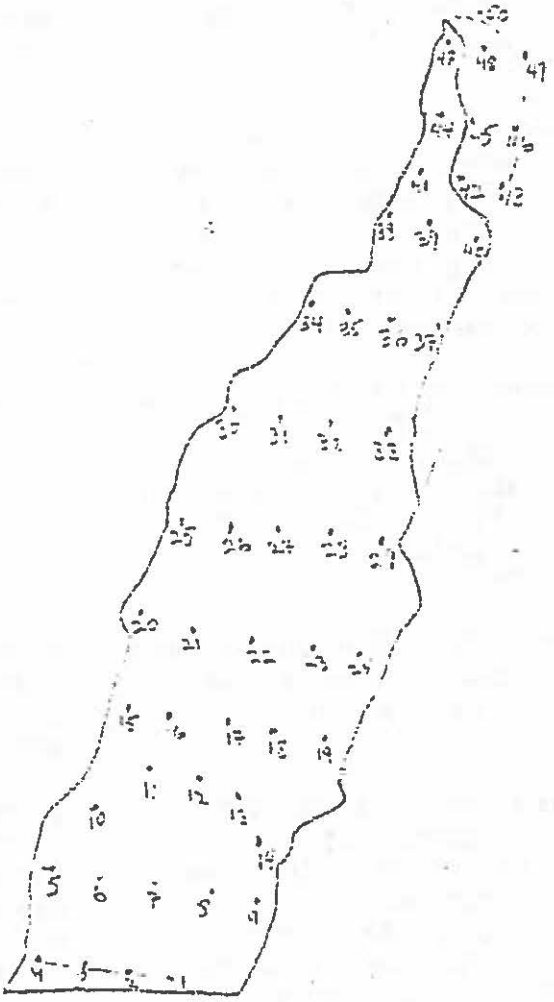


TABLE 1

ENDANGERED SPECIES HABITAT ACCOUNTS ON HAWAII

	Berger (8)	Munro (9)
HAWAIIAN HAWK *Buteo solitarius*	Primarily occurs in wet, native forest from sea level to 8500'.	Widely distributed, generally from 2000' to 500 prefers open forest rath than a wet dense one.
HAWAIIAN CROW *Corvus tropicus*	Sighted Baldwin as being above 3700' rough AA lava with undisturbed native vegetation. Only on Hualalai at present. Tomich sighted a nest at 2300' near Puuwaawaa Ranch.	Seems confined to Hualal and Kona. Formerly rang from 1000' to 8000' in t 1890's. Now habitat is graded and population is almost extinct.
HAWAIIAN CREEPER *Loxops maculatas mana*	Uncommon on Hawaii. Perkins stated that distribution was puzzling. Could be found above 3500' in South Kona. Food sources of insects primarily from large Koa trees.	No apparent reasons why numerous in some locatio and scarce in others.
HAWAIIAN COOT *Fulica americana alai*	Prefer more open water, but often found in brackish marshes in low land areas.	Seen in fresh and bracki water, but prefers areas of open water, particula shore lagoons.
HAWAIIAN STILT *Himantopus himantopus knudseni*	Prefers marsh areas and ponds. Generally abundant where reseding tides leave exposed marine animals in the mud. Can occur short distances from the sea, but keeps to open plains.	Found in marshy areas anc swamps, but mostly in tidal mud flats. Munro states that there seems to be no record of it on Hawaii.
HAWAIIAN DUCK *Anas wyvilliana*	In recent years found only on Kauai, more recently reintroduced on Hawaii.	Originally common in coas lagoons, marshes and moun tain streams. Perkins reports it in small pools on mountain streams on th main islands.
HAWAIIAN GOOSE *Branta sandvicensis*	Found in open lava flows with suitable vegetation. Breeding habitat here also at elevations about 5000'.	Accustomed to semiarid waterless high country acquiring moisture from the berries. Thought to winter in low land lava flows. Some collected at 2000' in early 1900's.

	Berger (8)	Munro (9)
AKIAPOLAAU Hemiganthus wilsoni	Recently only found in Mamane-Naio forests and some koa from 3500' and above. Perkins in 1903 reports commonly sighted in Koa trees from 1500' and above in the Hilo forests.	Generally found above 3500' however reported in Kilauea and Olaa Forest Reserves.
AKEPA Loxops coccinea coccinea	Perkins notes that it is widely distributed on Hawaii occurring in Koa, Ohia, and Naio trees for food sources. Specimens found between 3000' and 5000'. Baldwin reports in 1950 observing them in South Hilo districts.	Note on Hawaii and can be found above 4000'. On Mauna Kea above 5000'.
OU Psittirostra psittacea	At low elevations certain diseases may have caused destruction there. The OU on Hawaii is seldom seen. Richards reports several in the upper Olaa forest at 4000'.	Did formerly forage in low elevations but, diseases carried it to near extinction. High Flier, migrate over large areas of forest now predominately native.
PALILA Psittirostra bailleui	In the past the Palila had a wide distribution. Now they are common from 7000' upwards to treeline. Only rarely are they found below 6500' and only in the Mamane forest which is their main food source on Mauna Kea.	Formerly in 1890 found at 4000'. At present, reported only high on Mauna Kea slopes in Mamane-Naio forest above 6000'.
DARK RUMPED PETREL Pterodroma phaeopygia sandwichensis	One reported at Kilauea Crater in 1948 and 5 dead birds found above 9000' on Mauna Loa from feral cats. Munro reports nests from 1500' to 5000'. The mongoose has caused its demise on Hawaii.	Endemic to main islands formerly from 1500' to 5000'. Now on Hawaii thought to be restricted to volcanic slopes above 7000'.
NEWELL'S SHEARWATER Puffinus newelli	(Threatened) Population reduced on Hawaii also by mongoose. Known to frequent island of Hawaii. Nesting colony on Kauai is located about 1500'. Munro reports nesting from 500' to 1000'.	Nests found in burrows near the sea from 500' to 1000' in forested areas.
HAWAIIAN HOARY BAT Lasiurus linereus semotus	Only endemic land mammal.	Observed this mammal at sea level, and at 9000' on Haleakala, Maui. Steven Sabo U.S. Fish and Wildlife Service (per. communication)

TABLE 2

Species	Actual # Sighted	Estimated Density Birds/ 100 Acres	Estimated Density Birds/ 341 Acres	95% Confidence Lev For Population Den In Total Area(341 . Lower	Upper
House Sparrow	23	4.90	16.71	10.57	24.2
N. American Cardinal	53	4.33	14.77	11.06	19.0
Japanese White Eye	232	67.01	228.51	200.05	258.8
Elepaio	40	12.89	43.94	31.38	58.6
Spotted Munia	13	4.03	13.73	7.28	22.21
Red-billed Leiothrix	7	.45	1.54	.61	2.89
House Finch	5	.66	2.24	.70	4.64
Melodious Laughing Thrush	2	.16	.55	.05	1.55
Kalij Pheasant	1	.03	.09	.000037	.36
Helmeted Guinea Fowl	2	5.73	19.53	1.84	55.98

TABLE 3

Species	Species Frequency	Species Incidence	Species Abundan
House Sparrow	8/100 = .08	23/8 = 2.875	23/232 = .099
N. American Cardinal	37/100 = .37	53/37 = 1.432	53/232 = .228
Japanese White Eye	89/100 = .89	232/89 = 2.607	232/232 = 1.00
Elepaio	32/100 = .32	40/32 = 1.25	40/232 = .172
Spotted Munia	5/100 = .05	13/5 = 2.60	13/232 = .056
Red-billed Leiothrix	5/100 = .05	7/5 = 1.40	7/232 = .030
House Finch	3/100 = .03	5/3 = 1.67	5/232 = .021
Melodious Laughing Thrush	2/100 = .02	2/2 = 1.00	2/232 = .009
Kalij Pheasant	1/100 = .01	1/1 = 1.00	1/232 = .004
Helmeted Buinea Fowl	1/100 = .01	2/1 = 2.00	2/232 = .009

Species Frequency - Number of count periods species is recorded divided by Total number of count periods.

Species Incidence - Number of a species recorded divided by Number of count periods species is recorded.

Species Abundance - Number of a species recorded divided by Number of most abundant species.

RECOMMENDATIONS

Considerations must be made for the adjacent areas to this 341 acres. The higher elevations of this area is approximately 500 ft. below the predominantly native forest where endemic birds are thought to occur. Effort must be taken to ensure that the degradation of adjacent areas by additional exotic vegetation does not occur. The native forest above, utilized by endemic bird species hopefully will not be affected by the clear cut logging of this 341 acres.

APPENDIX D: ARCHAEOLOGICAL SURVEY

Report Ms.34-060781

ARCHAEOLOGICAL RECONNAISSANCE SURVEY OF THE EUCALYPTUS BIOMASS FARM SITE PUUEO, SOUTH HILO, ISLAND OF HAWAII (TMK:3-2-6-18:Por.8)

by

Paul H. Rosendahl, Ph.D.
Principal Archaeologist

Prepared for

Juvik and Juvik
Environmental Consultants
223 Makani Circle
Hilo, Hawaii 96720

June 1981

PAUL H. ROSENDAHL, PH.D., INC.
Consulting Archaeologist
P.O. Box 504
Kurtistown, Hawaii 96760

Ms.34-060781

INTRODUCTION

BACKGROUND

At the request of Juvik and Juvik, Environmental Consultants, an archaeological reconnaissance survey was conducted at the site of the proposed Eucalyptus Biomass Farm in Puueo, South Hilo District, Island of Hawaii. This survey was carried out to provide necessary input for the preparation of an Environmental Impact Statement required by the State of Hawaii because of the location of the proposed farm site within Conservation District lands.

Survey field work was conducted on May 27-28, 1981 by a team consisting of Project Director Dr. Paul H. Rosendahl and Field Archaeologists Michael W. Kaschko, Ernest A. Kahana, and James Landrum. A preliminary oral report of survey findings and recommendations was made to Dr. James Juvik of Juvik and Juvik on May 30, 1981. The present report comprises the final report on the reconnaissance survey, and includes recommendation for full archaeological clearance for the site of the proposed Eucalyptus Biomass Farm.

SCOPE OF WORK AND DESCRIPTION OF PROJECT AREA

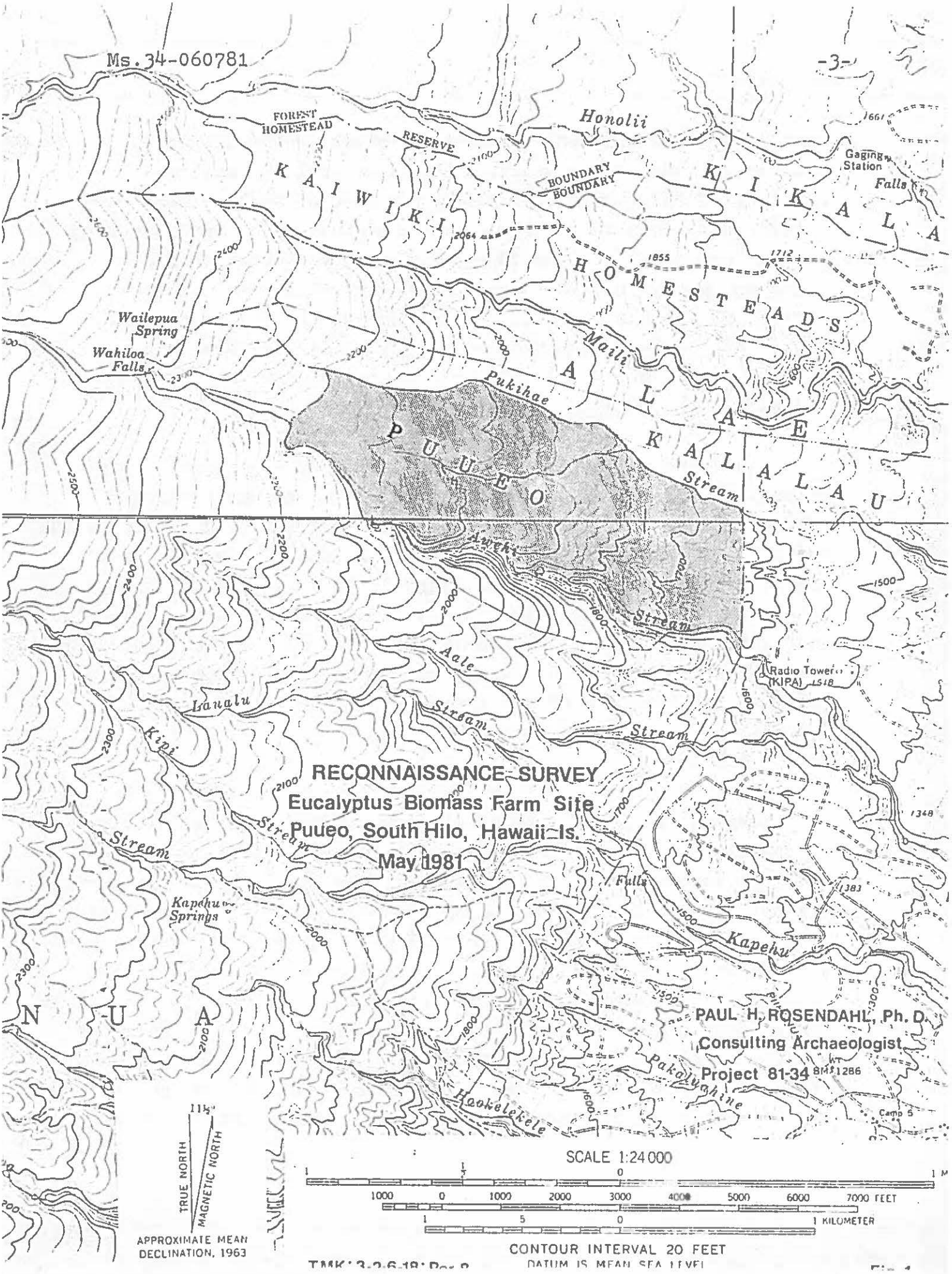
The basic purpose of the reconnaissance survey was to locate any sites of possible archaeological significance. A reconnaissance survey is simply a walk-through survey--extensive rather than intensive in scope--conducted to determine the presence or absence of archaeological resources within a specified project area. A reconnaissance survey (1) permits a preliminary evaluation of archaeological resources, and (2) facilitates formulation of realistic recommendations and estimates for any further archaeological work that might be necessary. Such additional work could include intensive survey--detailed recording of sites, and selected

test excavations; and possibly subsequent mitigation--salvage and/or research excavations, interpretive planning, and/or preservation of sites with significant research, interpretive, and/or preservation value.

The significance of archaeological resources can be defined in terms of potential research, interpretive, and/or preservation value. Research value refers to the potential of archaeological resources for producing information useful in the understanding of culture history, life-ways, and cultural processes at the local, regional, and inter-regional levels of organization. Interpretive value refers to the potential of archaeological resources for public education and recreation, and for promotion of ethnic identity. Preservation value refers to the need to conserve an adequate and representative sample of the archaeological resource base for future use.

To attempt evaluation of the significance of archaeological resources on the basis of a preliminary assessment such as a reconnaissance survey is generally premature. Occasionally it is possible at even a preliminary level of study, such as that of a reconnaissance survey, to evaluate the significance of specific sites when their research, interpretive, and/or preservation value is obvious; however, in most instances it is necessary to conduct more intensive survey, often including test excavations, to determine and document the significance of specific archaeological remains.

The proposed Eucalyptus Biomass Farm site consists of approximately 300 acres located in the inland portion of the land of Puueo, South Hilo District, Island of Hawaii (TMK:3-2-6-18:Por.8). The farm site project area is situated between Awehi Stream on the south and Pukihae Stream on the north, and extends inland from the edge of the presently cultivated cane land at c. 1620-foot elevation, to the 2200-foot elevation (Figure 1). For the most



RECONNAISSANCE SURVEY
Eucalyptus Biomass Farm Site
Puueo, South Hilo, Hawaii Is.
May 1981

PAUL H. ROSENDAHL, Ph. D.
Consulting Archaeologist
Project 81-34

SCALE 1:24 000

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET

DATUM IS MEAN SEA LEVEL

TRUE NORTH
MAGNETIC NORTH

APPROXIMATE MEAN DECLINATION, 1963

TMK: 3-2-6-19: Por. 8

Fig. 1

part, the terrain of the survey area rises gently in slope, with local areas of greater slope and several dry gullies. Portions of the survey area along the edge of Awehi Stream have a steep drop down to the stream bed. Virtually the entire survey area is covered with a dense vegetation cover of which guava (Psidium guajava L.) is the dominant, especially in the lower portion of the survey area. In the upper portion of the survey area, 'ohi'a-lehua (Metrosideros collina (Forst.) Gray subsp. polymorpha (Gaud.) Rock) becomes a co-dominant with guava, and the native koa (Acacia koa Gray) is commonly found.

The dense vegetation cover of the survey area makes it in general difficult to move through the area. Movement through the portion of the area nearer to Awehi Stream is made considerably easier by the presence of several hunter trails, the principal one of which extends along the course of a now-abandoned irrigation ditch. Movement through the portion of the survey area closer to Pukihae Stream is considerably more difficult because there are few hunter trails present, and passage through much of the area involves the breaking of new trails.

SURVEY METHOD

Despite the dense vegetation cover that made it difficult to traverse the survey area--often it was impossible to see more than ten meters ahead, the method utilized to carry out the survey was relatively simple. Beginning at the southeast corner of the area, near Awehi Stream, the initial inspection of the survey was made on May 27 by proceeding inland along the main hunter trail adjacent to the abandoned ditch. At irregular intervals, secondary hunter trails and feral pig runs that branched off were followed and the proximate land inspected. In this fashion, the portion of the survey area nearer Awehi Stream was explored to the approximate location of the 2200-foot elevation limit. At one point--

estimated to be about the 2000-foot elevation, the survey team dropped down to the stream bed of Awehi Stream and inspected the side of the stream area for several hundred meters.

For the most part it was virtually impossible to be certain of exact location within the survey area at any specific point. With the exception of the 1:24,000 scale U.S.G.S. 7.5 minute series quadrangle maps, there were no maps of the survey area available. Furthermore, the density of the vegetation and the absence of prominent points of high ground prevented establishment of specific position with reference to other known points.

Survey work on May 28 began by heading inland along the same main trail from the southeast corner of the survey area, but proceeded by bearing further to the north, cutting through the central portion of the survey area. The unnamed tributary of Pukihae Stream was crossed and a trail continued to be broken on into the northwest corner portion of the survey area. The survey team gradually turned and began heading seaward, in the area near Pukihae Stream. The absence of any trails and the presence of extremely dense vegetation made progress very slow. As it became late in the day, final exit from the survey area was made by cutting across through less dense forest to Maile Stream on the north, which was then followed down to c. 1600-foot elevation where the stream was intersected by a recently constructed dirt road that could be followed back to Pukihae Stream.

The total number of acres inspected during the reconnaissance cannot be estimated with any degree of accuracy, but it is felt that the two days spent traversing the survey area from the seaward to the approximate inland limits, and through both the southernly and northernly portions of the survey area, comprised a good sampling of the survey area. Any more formal sampling strategy would have required considerably greater expenditure of man-hours, and most likely would not have produced significantly different results.

SURVEY FINDINGS

No archaeological sites or features on any kind, nor any portable remains such as surface artifacts or midden, were found within the survey area of the proposed Eucalyptus Biomass Farm site. This negative finding is based on a sampling of the survey area, as discussed in the preceeding description of survey method.

CONCLUSION

No archaeological remains of any kind were found within the site of the proposed Eucalyptus Biomass Farm during the two days of reconnaissance survey field work. A check of records on file in the Hawaii County Planning Department in Hilo failed to reveal the presence of any previously recorded or known archaeological sites within or immediately adjacent to the survey area. Based on the completely negative results of the reconnaissance survey, it is concluded that no further archaeological work of any kind is necessary or justified, and it is recommended that full archaeological clearance be granted.

This conclusion and recommendation is given on the basis of the negative findings of the reconnaissance survey, and with the general qualification--given the scope of the survey as a surface, sampling inspection--that during any development activity involving the modification of the land surface there is always the possibility that previously unknown or unexpected sites or subsurface cultural features might be encountered. In such a situation, immediate archaeological consultation should be sought.

APPENDIX E: COUNTY PLANNING DEPARTMENT COMMENTS

CDUA

March 24, 1981

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
P. O. Box 621
Honolulu, HI 96809

Dear Mr. Ono:

Conservation District Use Application HA-3/3/81-1345
Eucalyptus Biomass Farm Development Use
at Puueo, South Hilo, Hawaii TMK: 2-6-18:8

Thank you for the opportunity to comment on the subject proposed project. We concur with your determination and notice of the preparation of an environmental impact statement (EIS) due to potential effects of the proposed actions on the environment.

In preparing the EIS, we feel that it should consider and discuss in detail the impacts on the following areas:

1. Grading of the area (especially if it is conducted during rainy season;

2. Erosion and sedimentary control/pollution in the streams alongside and within the parcel.

3. At present it does not appear that there is any vehicular access to the parcel. The EIS should discuss the location, creation, and concomitant impacts if any of a proposed access.

Please be informed that the project site area is not situated within the Special Management Area (SMA). Consequently, requirements established under Chapter 205-A, HRS, and Rule 9 of the County Planning Commission are not applicable.

We hope these comments will be of help and look forward to the drafting of an EIS for this project. We will withhold comments on the CDUA itself until the EIS has been completed.

MAR 25 1981

Should you have any questions, please feel free to contact us.

Sincerely,

SIDNEY FUKE
Planning Director

AK/VKG:wkm

cc: Glenn Taguchi
Roland Higashi

APPENDIX F: COMMENTS & RESPONSES ON EIS.

University of Hawaii at Hilo
COLLEGE OF ARTS AND SCIENCES
NATURAL SCIENCES DIVISION

9/15/81

September 17, 1981

Mr. Thomas B. Crabb
Bio Energy Development Corp.
P. O. Box 1801
Hilo, Hawaii 96720

Dear Mr. Crabb:

Thank you for allowing me to review the Environmental Impact Statement prepared for your Biomass Farm Development. I found the report to be most informative. And as far as I could determine within the scope of my own expertise, it is an accurate assessment of the possible environmental impact. I hope that the Board of Land and Natural Resources agrees favorably with the statement's assessment.

I hope to be able to attend the committee meeting set for October 1st at 9 a.m. It is a time that is usually open for me.

Sincerely,

John G. Chan

John G. Chan
Associate Professor of Biology

JGC:gi

1400 Kapiolani Street
HILO, HAWAII 96720 TEL: (808) 961-9383

United States Department of Agriculture
Soil Conservation Service
P. O. Box 1089
Kamuela, HI 96743

9/15/81

SUBJECT:

DATE: 9-14-81

TO: Mr. Thomas Crabb, Project Manager
Bioenergy Development Corporation
P. O. Box 1801
Hilo, Hawaii 96720

Mr. Crabb:

The environmental impact statement for the Puu'eo area TMK: 2-6-18:8 looks good from the soil and water conservation standpoint. The procedure outlined on page 53 of windrowing vegetative material across the slope is most admirable. This procedure has been used successfully in many parts of the state where conventional crop residue systems are not feasible in erosion control. The technique aids in gully as well as sheet and rill erosion abatement. Wind rows at 200 foot spacing or closer will give a dramatic reduction in soil loss during your critical "open" periods at planting-harvesting. Wider spacing will decrease erosion controlling ability and cause windrows to become so large as to be a nuisance to other field operations.

An area of concern which was not thoroughly covered but of which has been a problem in high rainfall areas, is access road erosion. The map in the E.I.S. indicates that roads will run up and down hill. These roads often become running water ways if not constructed to allow water an outlet into the vegetation-protected cropland. Heavy damage occurs each year on cane roads in your area due to improper construction. A simple, cost-effective measure is to construct slight swales and ridges periodically in the road to divert flows off the road and away. Properly constructed, these will not interfer with long wheel-based log trucks. The S.C.S. Field Office in Hilo is familiar with this technique and can assist in construction plans.

I wish you success in your enterprise and keep up the good conservation work.

Sincerely,

Jerry Williams

Jerry Williams, Conservationist
USDA, SCS
P. O. Box 1089
Kamuela, HI 96743

JUVIK & JUVIK environmental consultants

November 10, 1981

Mr. Jerry Williams, Conservationist
USDA, Soil Conservation Service
P. O. Box 1089
Kamuela, HI 96743

Dear Mr. Williams:

Thank you for reviewing and commenting on the Environmental Impact Statement for the proposed Eucalyptus Biomass Farm Development at Pu'u'eo, South Hilo, Hawaii. In answer to your specific comments:

1. We appreciate your comments on road construction techniques for mitigating erosion hazards in the high rainfall areas of Pu'u'eo. Your suggestion for periodic road swales to divert surface runoff from forest haul roads will be incorporated into road construction for the project. Subject to project approval, detailed road construction specifications will be submitted to your Hilo office for review.

Thank you for your interest in this project.

Sincerely,

James O. Juvik, Ph.D
JUVIK & JUVIK, Environmental Consultants
223 Makani Circle, Hilo, Hawaii 96720

COUNTY OF HAWAII

PLANNING DEPARTMENT

25 AUPUNI STREET • HILO, HAWAII 96720

HERBERT T. MATAYOSHI
Mayor

SIDNEY M. FUKE
Director

DUANE KANUHA
Deputy Director

September 24, 1981

Mr. Thomas Crabb
Bio Energy Development
P. O. Box 1801
Hilo, Hawaii 96720

Dear Mr. Crabb:

EIS/Puueo Mauka
Eucalyptus Biomass Farm Development

We have reviewed the subject first draft EIS for 341 acres of Conservation district lands to be utilized as a eucalyptus farm.

We suggest that, if known, the EIS also discuss proposed routes for the transportation of the logs. Will private cane haul roads be utilized or will the trucks be routed through Waianuenue Avenue?

Thank you for the opportunity to review the EIS.

Sincerely,

SIDNEY FUKE
Planning Director

VKG:lp

JUVIK & JUVIK environmental consultants

November 10, 1981

Mr. Sidney Fuke, Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Fuke:

Thank you for reviewing and commenting on the Environmental Impact Statement for the proposed Eucalyptus Biomass Farm Development at Pu'u'eo, South Hilo, Hawaii. In answer to your specific comment:

1. With respect to the transportation of cut logs/wood chips from the Pu'u'eo growing site to the Pepe'ekeo power plant, private cane haul roads and the belt highway will be utilized. Trucks will not be routed along Waianuenue Avenue.

Thank you for your interest in this project.

Sincerely,

James O. Juvik

James O. Juvik, Ph.D.
JUVIK & JUVIK, Environmental Consultants
223 Makani Circle, Hilo, Hawaii 96720

10/7/81
ltr
file

copies sent to Susan Quirk

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

DIVISIONS:
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FISH AND GAME
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

October 5, 1981

Mr. Thomas B. Crabb
BioEnergy Development Cooporation
P.O. Box 1801
Hilo, Hawaii 96720

Dear Tom:

Enclosed are some comments on the draft EIS for the Pu'u'eo project from several members of my staff.

It appears to be a good document. I hope you will find the comments helpful.

Very truly yours,

RONALD L. WALKER
Acting Administrator

Enclosures

Comments on Draft EIS for
Eucalyptus Biomass Farm Development
at Pu'u'eo, South Hilo, Hawaii

1. Pg. 50-51 - This discussion appears to be a correct analysis of the situation regarding the protective sub-zone. However, the statement that "Surface water sources in this area of the Hilo Forest Reserve are no longer utilized for domestic supply" should be documented by correspondence from the Hawaii County Department of Water. With that documentation, there would be two options (1) tree planting within a small section of P sub-zone, as now proposed or (2) sub-zone boundary change to make the area R instead of P.

2. Pg. 60 - The discussion of future potential "...large scale (thousands of acres) eucalyptus planting..." is essentially correct. It is correct that this present action should not be considered a precedent for "...large scale native forest conversion." However, the discussion could be modified on the basis of the following:

   a. HCPC purchases (1975 data) nearly 200,000 BBL oil per year, more than any other sugar plantation, so their needs for an alternate fuel is greatest.

   b. Total sugar industry uses approximately 600,000 BBL/year.

   c. If replacing one-half of this with wood is a reasonable expectation then some 15,000 acres of plantations would be needed.

   d. Some portion of this can be expected to be weedy native forest (as Pu'u'eo) but marginal ag zoned lands are likely to be the largest part.

   e. Since at least three islands are likely to be involved, the total impact of such an energy tree farm program will be slight.

   f. But this Pu'u'eo site is not a precedent because each site must be considered individually, etc.

3. Pg. 63 - The paragraph on economic growth is misleading. The EIS says "Because forest production is a labor intensive industry, it offers greater opportunities..."

   a. Forest production, especially that of the type envisioned for fuel production, is not labor intensive. It is land and capital intensive.

   b. There is no reference to the alternative land use with which forest production is being compared.

   c. Granted that there would be more jobs and more State revenues, an important but unmentioned impact is that wood fuel may help keep the sugar industry healthy.

4. The 25-foot buffer zone proposed between the biomass plantation and gullies may not be effective distances to present encroachment of exotics upon the gully ecosystems, particularly when comparing the presence today of weeds on the proposed site 1-2 miles inland from the lower conservation district boundary where Eucalyptus and sugarcane planting are land uses. Buffer zones of several distances (greater than 25 feet) should be tried and gully slopes monitored for increased weed frequencies.

5. A plant found on the proposed site is Metrosideros collina spp. polymorpha. Unfortunately Metrosideros needs to be defined to the varietal level since a rare variety, Newellii, is likely to occur on the site. This variety is proposed as a candidate endangered/threatened taxon (Federal Register, 15 December 1980) and is only known from above Hilo in the Wailuku watershed between 1,200 and 2,700 feet elevation. If it is on the site, the EIS needs to consider this taxon.

6. The native fauna occurring in Awaki and Pukihae Streams are not discussed, although the streams may be impacted by herbicide, silt, and additional runoff. These organisms, i.e., crustacians and fish, should be mentioned and protected whenever possible. Monitoring of water quality as a condition of land use should be considered.

7. The time of year the land will be cleared is not discussed, although the EIS states "...when (the soil) is allowed to dry it hardens irreversibly to fine gravel-size aggregatis" (page 24). Also there are 3 1/2 months between land clearing and eucalyptus planting, when herbicides will be applied to kill existing plants which allows potential soil drying to occur. These items need further explanation and mitigative actions.

8. On page 53 several legumes are mentioned as possible non-competive species to interplant with Eucalyptus for ground cover erosion control and nitrogen fixation. The species should be cleared with experts to make sure they will not become escapes that persist to invade other areas after the project. Conditions to enforce this may be necessary.

9. On page 68 it is stated that the project may be short term or longer depending on its success. Planting of any cleared land should occur even if the "total" project must be abandoned.

10. Questions involved in herbicide use have not been adequately addressed. Spray drift can have major effect on adjacent plants--particularly in downwind gulches.

Additional Comments Relating

to the Avian Assessment Survey

of the Pu'u'eo Area, South Hilo, Hawaii

1. The survey coverage appears to be good and with sufficient intensity to enable the detection of most resident forest bird species by a trained observer.

2. The assumption that any use of the area by other endangered forest birds is transient, if at all, is probably correct although no mention is made of what these species would be.

3. Although the species list for this area appears complete, it is not clear that audio or audio/visual observations were included in analysis as "sightings". This would significantly effect density/count figures. In addition, on six out of the ten species sighted, the observer appears to be under-estimating the resident populations as the actual number encountered (Actual Number Sighted) is greater than the upper confidence limit. Calculations used to derive density figures should also be included.

4. Although the Newell's Shearwater is mentioned as a possible resident, no effort appears to have been expended looking for burrows or other evidence of nesting and little effort (two evenings) in audio/visual location. In view of the fact that the gulch slopes in this area, may be attractive to 'Ao as nesting sites, more work should be done to clarify this point.

JUVIK & JUVIK environmental consultants

November 10, 1981

Mr. Ronald L. Walker
Acting Administrator
Division of Forestry and Wildlife, DLNR
1151 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Walker:

Thank you for reviewing and commenting on the Environmental Impact Statement for the proposed Eucalyptus Biomass Farm Development at Pu'u'eo, South Hilo, Hawaii. In answer to your specific comments:

1. See attached letter from Mr. H. William Sewake, Department of Water Supply, confirming that there are no plans to utilize surface water from either 'Awehi or Pukihae Streams for domestic use.

2. We are in complete agreement with your points raised under 2a-f.

3. The EIS (pages 63-64) has been modified to reflect points raised in your comments.

4. The 25-foot buffer zone width stated in the EIS represents merely a minimum figure, directed primarily at maintaining slope stability of the gulches. In many areas the buffer zone will necessarily exceed this minimum value as local conditions dictate. Subject to project approval and development a number of permanent vegetation plots will be established on the gulch slopes in areas with varying buffer width, in order to determine the influence of buffer zone width on the relative dominance of native and exotic plant species in the area.

5. The 'ohi'a variety Metrosideros collina polymorpha var. Newellii, is currently recognized as a candidate taxon for future federal endangered/threatened species consideration. Recently, St. John (Phytologica, 42: 215-218; 1979), following Dawson (Blumea, 18:441-445; 1970) has removed the Hawaiian Metrodiseros from widely distributed (South Pacific islands) collina, elevating polymorpha to species status. This revision does, however, retain Newellii as a valid variety of Metrosideros polymorpha even though the characters of Newellii appear intermediate between the more widely distributed varieties glaberrima and incana (See J. Rock, Haw. Bd. of Agri. & For. Bot. Bull, 4:58; 1917). Contrary to your comments the variety Newellii is not apparently restricted geographically to the area above Hilo. St. John, in his List of Flowering Plants of the Hawaiian Islands (1973) has recorded the form from Maui as well. There is also some evidence (G. Clarke, pers. Comm. 1981) that collections of Newellii have been obtained above South Point in the Ka'u District of Hawaii Island and at Lanaihale, Lanai. Thus, at present both the taxonomic relationships and geographic distribution of this variety appear poorly understood.

In order to clarify the status of this variety in the proposed project area at Pu'u'eo, a total of four person-days were spent in the field (October 29-31, 1981) by consulting botanists (G. Clarke and assistants). The following is a quote from his report filed on November 1, 1981.

"Positive evidence for the presence of Metrosideros polymorpha var. Newellii was not established, however the conjecture that the plant may exist within the parcel is still viable. The basic problem during this survey was that over 95% of the observed Metrosideros were sterile and fertile material not within reach. Positive identification of the plant warrants examination of the inflorescence. The majority of the Metrosideros within the study area are the variety glaberrima which consists of two forms common to most of the major islands. The form sericea, endemic to all major islands except Oahu, was identified from one collection of dried seed capsules."

Although this field work cannot rule out the possible presence of the 'ohi'a variety Newellii at the project site, it does confirm that the more common and widely distributed varieties glaberrima and sericea predominate in the area. Subject to project approval, a follow-up botanical survey of the project area Metrosideros will be conducted during more favorable

flowering periods in 1982. Protection will be undertaken for any individual trees or stands of Newellii subsequently discovered.

During the botanical survey of October 29-31, 1981, an additional 12 plant taxa were recorded from the project area, and these are listed below:

Checklist Additions

APOCYNACEAE		
Alyxia olivaeformis Gaud. var. olivaeformis	Maile	E
ASOIDIACEAE		
Athyrium microphyllum (Sm.) Alston	'Akolea	E
GESNERIACEAE		
Cyrtandra sp.		E
LOBELIACEAE		
Trematolobelia sp		E
MYRTACEAE		
Metrosideros polymorpha Gaud. var. glaberrima (Levl.) Rock f. serica Rock	'Ohi'a-lehua	E
ORCHIDACEAE		
Vanda sp		X
RUBIACEAE		
Gouldia aff. hillebrandii Fosb.	Manono	E
RUTACEAE		
Pelea clusiaefolia Gray	Alani, clusia-leav-ed pelea	E

Both Cyrtandra and Trematolobelia include candidate taxa under federal endangered/threatened species consideration.

With respect to the species encountered within the project area the Trematolobelia sp. does not resemble the candidate taxon T. wimmeri Deg. & Deg., and the sterile Cyrtandra was growing within Pukihae Gulch, where it would not be disturbed by the proposed project.

6. The native fauna of Pukihae and 'Awehi streams is limited to the shrimp 'Opae-kala-'ole (Atya bisulcata), and at lower elevations the freshwater nerite snale, Hihiwai (Nertina grinosa). Both forms are common and widely distributed throughout the archipelago. Introduced species include the Tahitian prawn (Macrobrachian lar), and the common crayfish (Procambarus clarkii). BioEnergy Development Corp. will take all feasible steps during project development to protect the quality of surface water sources through proper soil husbandry and judicious use of regulated herbicides.

7. The presence of surface litter and frequent rainfall should mitigate the possibility of irreversible soil drying. Current land clearing and eucalyptus planting in adjacent areas under similar soil and climatic conditions have not resulted in any significant problems of "irreversible hardening." The U.S. Soil Conservation Service appears generally satisfied with the clearing and erosion control methods proposed for the project (see attached letter in this section from Mr. Jerry Williams, USDA, Soil Conservation Service).

8. At present, on the basis of trials elsewhere, it does not appear that legumes will be interplanted with the eucalyptus in the project area. Should any such plantings be proposed in the future, BioEnergy Development Corp. will consult with relevant state agencies and botanical experts to insure that species with a high potential for invading native forest will not be introduced into the area.

9. In the event of future abandonment of the project area for commercial eucalyptus biomass farming, the areas will be left in a forested condition to protect watershed values of the site.

10. Details of herbicide application techniques are included in the attached letter from Mr. Thomas Crabb, BioEnergy Development Corp.

11. Questions relating to Avian Assessment:

    The Hawaiian Hawk is probably the major transient endangered species that could be expected to occasionally utilize the disturbed forest habitat of the project area.

    With respect to Table III (page 41) the upper confidence limits for population density exceeds total individuals sighted for some of the species with low total counts; this is because the sampling included the adjacent extra-project areas, for which the density figures have been corrected. Only visual sightings were recorded in the study.

Subject to project approval BioEnergy Development Corp. will retain an ornithological consultant to further survey potential 'Ao breeding sites during the 1982 Breeding season. Up to 100 nighttime hours will be spent seeking visual/audio confirmation of 'Ao occurence along major gulches of the project area. Should breeding areas be discovered, future eucalyptus biomass planting/harvesting activities can be modified to reduce disturbance of nesting birds (e.g. enlarged buffer zones, seasonal change in planting and harvesting schedules, etc.).

We hope we have been able to satisfactorily address your concerns on these matters. We have made every effort to assemble and present all of the environmental data relevant to the CDUA decision making process.

Sincerely,

James O. Juvik, Ph.D.
JUVIK & JUVIK, Environmental Consultants
223 Makani Circle, Hilo, Hawaii 96720

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII
25 AUPUNI STREET • HILO, HAWAII 96720

November 10, 1981

BioEnergy Development Corporation
P.O. Box 1801
Hilo, HI 96720

ATTENTION: MR. THOMAS B. CRABB
VICE PRESIDENT AND MANAGER

CONSERVATION DISTRICT USE APPLICATION FOR EUCALYPTUS
BIOMASS FARM DEVELOPMENT
PUUEO, SOUTH HILO, HAWAII
TAX MAP KEY 2-6-18:08

Thank you for informing us of the said project. Please be informed that the Department has no future plans to utilize the Pukihae and Awehi Streams for domestic use.

However, the Department has plans on utilizing Kapehu Stream as a source for the Piihonua area. Kapehu Stream is south of, but outside of, the proposed biomass farm area. The Department currently utilizes Hookelekele Stream, Wailuhi Stream, and Kahoama Stream as major sources of water for a portion of the City of Hilo. During dry spells, Kapehu Stream is utilized at approximately the 800-foot elevation for domestic use.

Should there be any questions, please do not hesitate to contact us at 935-1127.

William Sewake

H. William Sewake
Manager

CS

cc - Board of Land and Natural Resources

... Water brings progress...

BioEnergy Development Corp.
P.O. Box 1801 • Hilo, Hawaii 96720

TO: Jim Juvik

FROM: Thomas B. Crabb

SUBJECT: Comments on EIS by DLNR Staff
Item #10 page #3 - Herbicide Drift

DATE: October 23, 1981

In DLNR staff comments on preliminary draft of EIS it was mentioned in item #10 on page #3 we had not addressed the herbicide application adequately. "Spray drift can have major effect on adjacent plants -- particularly in downwind gulches".

May I expand on this and mention various approaches that are now being taken to prevent this problem and will be applied under similar circumstances in this area.

1. Wind velocity and direction is always ascertained prior to herbicide applications so as to eliminate any effect on adjacent plants. Operations are always curtailed under adverse conditions.

2. Nalcotrol (a gelatin like chemical) is added to the spray solution to create heavy and large droplets minimizing drift. (4 ounces P/100 gallons)

3. Pump pressures and nozzle sizes are adjusted or changed. Low pressure flood nozzles are used. Manual (back pack) operations can be injected into the operation so as to give the herbicide application closer personal control over mechanical means.

mst

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
550 HALEKAUWILA ST.
ROOM 301
HONOLULU, HAWAII 96813

George Yu
Director
TELEPHONE NO
548-6915

March 19, 1982

Juvik O. Juvik, Ph.D.
Juvik and Juvik
Environmental Consultants
223 Makani Circle
Hilo, Hawaii 96720

Dear Mr. Juvik:

Subject: Eucalyptus Biomass Farm Development Preparation Notice

We have reviewed your preparation notice and offer the following comments:

1. Due to the large area involved we anticipate tremendous erosion problems unless the project is properly planned and managed. We feel that the section on impact on soil and water resources should address the planting and harvesting process, disclosing the number of acres that will be exposed to erosion and the length of time of exposure.

2. In clearing the land and prior to planting, the herbicide "Roundup" will be applied. The effects of this herbicide on animals, the method of application, and the extent of application should be disclosed.

3. The fact that certain endangered species were not spotted during the avian assessment survey does not necessarily mean that they do not exist in the area. Being rare or endangered usually makes them difficult to come across because of their small numbers. Perhaps the safest way of handling this problem is to assume that those species that are suspected of existing in the area, do in fact live there.

4. The section on noise impact should address the effect of noise on endangered and threatened species living in areas adjacent to the project. Loud noise may disrupt the nesting and breeding habits of endangered species.

We trust that these comments are of assistance to you in preparing your draft environmental impact statement.

Yours truly,

George Yuen, Director
Office of Environmental Quality Control

cc: Mr. Thomas Crabb
BioEnergy Development Corporation
P.O. Box 1801
Hilo, Hawaii 96720

Juvik & Juvik
Environmental Consultants
223 Makani Circle
Hilo, Hawaii 96720

May 10, 1982

Mr. George Yuen, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Mr. Yuen:

Thank you for your comments on our EIS Preparation Notice for "Eucalyptus Biomass Farm Development at Pu'u'eo, South Hilo." We have taken your comments into consideration in preparation of the draft EIS, and take the opportunity here to offer specific responses to the points raised in your letter of March 19, 1982.

1. Erosion and Exposure

Although 341 acres are involved in the requested area approximately 300 acres would be the net area. Bio-Energy Development will not be clearing and planting the total area at once and adequate buffer zones would be left uncleared along all gulch, stream edges and extreme terrain conditions. U.S. Soil Conservation Service recommendations would be followed with clearing operations tailored to enhance this. Clearing is scheduled to be done incrementally with 30 acres planned for 1982 over a 3 month period (10 acres per month for 3 months) and 110 acres planned for 1983, (pending DOE funding) over a period of approximately 10-11 months. The balance of area will be cleared and planted in future years pending extension of the Research and Development program or commercialization.

Planting would commence immediately after clearing allowing for development of a canopy and root structure of approximately 1200-1700 trees per acre (depending on spacing) to inhibit serious erosion within 6 months. Intensive tree farming calls for close tree plantings of 5' x 5' spacings.

It should be reiteriated that eucalyptus planting has been proceeding for the past two years on agricultural zoned land immediately adjacent (makai) to the proposed project area where environmental conditions are similar. No serious erosion problems have developed in the 23 acre planting area either before or after canopy closure by the growing eucalyptus seedlings.

2. Herbicide Application

The herbicide "Roundup", applied at proscribed levels should have no adverse impact on animals in or adjacent to the project area, and will be applied only as weed establishment dictates.

Experience shows very little needs to be done if planting follows closely behind clearing as no weed seeds have spread into the area. A contact herbicide in combination with Simazine may only be required and mechanically applied. If Roundup is used it will be minimized for mechanical application on grasses prior to planting and spot work applied manually after planting with backpack knapsacks. The necessary precautions will be taken to remain away from running streams (the buffer zones will insure this) and herbicide application will be under low wind velocity conditions. Nalcatrol (a gelatin type substance) can be used to create larger and heavier droplets minimizing risks as well as pump pressure can be reduced minimizing drift.

It is anticipated that one mechanical herbicide application will be required before planting and one mannually (backpack knapsack) applied herbicide application required after planting.

3. Endangered Birds

The two endangered avian species "suspected" of potentially utilizing resources within the project area are the Hawaiian Hawk and Newell's Shearwater. The status and impacts related to these species are discussed in the Draft EIS (and earlier Environmental Assessment). The recent U.S. Fish & Wildlife Service Hawaiian Forest Bird Survey intensively sampled the Hilo Forest Reserve (Scott, et.al., 1980; Condor, 82:309-313). No endangered Hawaiian forest birds were found in the vicinity of the project area. Endangered Honeycreepers (drepanids)

were restricted to higher elevations above 3500-4000 ft. (lower limit), or a minimum of 4-5 miles mauka of the proposed eucalyptus biomass project area. (Personal communication: Dr. J.M. Scott, U.S. Fish & Wildlife Service, 1982.)

4. Noise Impact on Endangered Species

Although not yet confirmed as breeding in the immediate area of the project, the Newell's Shearwater is thought to be the only endangered species potentially impacted by noise from the eucalyptus project development. Mitigating measures are discussed on pages 61-62 in the Draft EIS. Current additional avian surveys of the project area continue in an effort to determine if nesting colonies of Shearwater's occur in gulches bordering the project area. As mentioned in the EIS should breeding colonies be discovered it will be relatively easy to adjust planting and havesting schedules so as to minimize disturbances and noise in areas immediately adjacent to such sites during the breeding season, particularly since planting and harvesting only occurs at 6-7 year intervals.

We hope that we have been able to adequately address your environmental concerns relative to the proposed project, and will look forward to any additional input you may wish to provide.

Sincerely,

James O. Juvik, Ph.D.
JUVIK & JUVIK, Environmental Consultants
223 Makani Circle
Hilo, Hawaii 96720

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

Office of the Director

April 7, 1982

PN:0018

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Preparation Notice
Environmental Impact Statement
Eucalyptus Biomass Farm Development
Pu'u'eo, South Hilo, Hawaii

The Environmental Center has made a brief review of the above cited document with the assistance of Sheila Conant, General Science; Charles Lamoureux, Botany; Paul Ekern, Agronomy and Soils; Jacquelin Miller and David Peterson, Environmental Center. With the intent of providing helpful input to the upcoming Draft EIS, we have prepared the following comments regarding the preparation notice.

General

If this project is to be an "experimental planting," the EIS should indicate what the experimental design is to be. What species of eucalyptus will be grown? What ground cover species or interplantings are proposed? These both will make a difference as far as amount of soil surface exposed during the growing cycle (when soil-erosion could be even more of a problem than during harvest/replanting at which times mitigating steps will be taken).

There are at least 400 different kinds of eucalyptus, variously adapted to alpine, tropical rainforest, mesic temperate, and semi-desert environments, among others. They cast different amounts of shade, and contain different chemicals which, upon leaching out of fallen leaves, inhibit various kinds of plants from growing beneath them. Thus, one must know which species of eucalyptus one is dealing with, and one cannot extrapolate either growth rates or environmental effects to other eucalyptus. The achievement of complete canopy closure in 9-12 months (page 53) really depends both on site and on species.

It is perhaps an overstatement (page 66) that failure to obtain permission to plant a specific parcel of land would "place in jeopardy" the eucalyptus biomass demonstration project (line 1) or "remove one important option" (line 6) from the alternative energy development quest. If this (or any other) specific site is so important to eucalyptus biomass development, then the whole project is on uncertain grounds.

Flora

There seems to be a problem in interpretation as to whether the current project site consists of a reasonably intact or a highly disturbed native forest. The preparation notice suggests it is highly disturbed but some quantitative information on the vegetation (i.e., percent cover of various species) would permit a more objective evaluation.

The identifications of Adiantum capillus-veneris and Blechnum orientale (page 28 and Appendix B, page 6) are questionable. Our reviewers are unaware of any reliable records of these species from the Big Island.

Avifauna

On page 40, the statement is made that "In general the project area was found too poor in resources for native birds, either for food, shelter or breeding, and the area does not resemble in any context what would be viewed as prime habitat for endemic or endangered bird species." On initial inspection, such a statement appears somewhat strong, without sufficient data to support this finding. An additional sentence, describing more explicitly what resources are in poor supply, is suggested.

The Avian Survey of Appendix C appears to be quite comprehensive, with well-designed censusing techniques and survey results that are thoroughly reported. With reference to page 2 of the survey, however, we would like to point out that, although native bird species and many of the endangered birds may "appear" to have little genetic resistance to the exotic diseases of malaria and fowl pox, the effect of these diseases on the birds is not thoroughly documented. We also would like to indicate (page 3, 2nd sentence of the Avian Survey) that the Hawaiian Hawk may be more properly classified under "forest birds" as opposed to "drepanids".

Our reviewers generally concur with the additional comments provided by Mr. Ronald Walker of the Hawaiian Division of Forestry and Wildlife (Appendix F) in a letter to Mr. Thomas Crubb of the BioEnergy Development Corporation. In particular, as Mr. Walker states under Item 3, the resident populations of several species seem to be under-estimated. Inclusion of calculations used to derive density figures is not necessary in the Draft EIS, but reference to a means of access to the computations should be provided.

The Center also suggests that the following two references may be useful in further assessments of the bird population, and should be appropriately included in the corresponding bibliography:

a) Conant, Sheila, ( ); "Recent Records of the 'Ua'u Dark-rumped Petrel and the 'A'o (Newell's Shearwater) in Hawai'i", Elepaio 41: 11-13.

b) Conant, Sheila, 1980; "Birds of the Kalapana Extension", Technical Report 36, CPSU-UH, Department of Botany, University of Hawaii.

The first of these documents reports on recent sighting of the seabirds mentioned in the title, while the second includes discussion of the relationship of disease to the elevation range of certain forest birds.

Soils

An extremely high rainfall erosion hazard appears to exist for many soils of Hawaii, and particularly for soils found in the region of the proposed biomass farm development. Consideration should be given to the use of the following three references in dealing with potential erosion problems:

a) Dangler, E.W., El-Swaify, Ahuja, L.R. and Burnett, A.P., 1976; "Erodibility of Selected Hawaii Soils by Rainfall Simulation", ARS W-35, Agricultural Research Service, U.S. Department of Agriculture in Cooperation with University of Hawaii Agricultural Experiment Station.

b) El-Swaify, S.A. and Cooley, K.R., 1980; "Sediment Losses From Small Agricutural Watersheds in Hawaii (1972-1977)," ARM-W-17, U.S. Department of Agriculture, Science and Education Administration, Agricultural Reviews and Manuals.

c) Lo, Andrew K.F., 1981; "Estimation of Rainfall Erosivity in Hawaii", PhD Dissertation in Progress, University of Hawaii.

Because of potential erosion hazards the proposed 25-foot wide buffer zone (page 52) seems inadequate at the edge of a steep gulch 100 feet or more deep.

The long-term effects of the biomass farming project on the physical and chemical nature of the underlying soils should also be addressed. Among the questions to be dealt with are:

1) What are the hydrologic and chemical effects of herbicide and fertilizer (nutrient) applications?

2) How will traffic due to harvesting equipment influence soil permeability, especially for thixotropic soils?

Additional references dealing with various aspects of these subjects are:

a) Fox, R.L. and Searle, P.G.E., 1978; "Phosphate Absorption by Soils of the Tropics", in "Diversity of Soils in the Tropics", ASA, SSSA, Chapter 7; pp. 97-119.

b) Sato, H.H., 1971; "Interpretation of the Index Properties of the Unified Classification System for Hawaiian Soils", Master of Science Thesis, University of Hawaii.

c) Tomaneng, A.A., 1966; "Comparative Effects of Forest and Pasture on Some Physical Properties of Latosolic Soils", Master of Science Thesis, University of Hawaii.

Yours truly,

Doak C. Cox

Doak C. Cox
Director

cc: Office of Environmental Quality Control
Sheila Conant
Charles Lamoureux
Paul Ekern
Jacquelin Miller
David Peterson

Juvik & Juvik
Environmental Consultants
223 Makani Circle
Hilo, Hawaii 96720

May 21, 1982

Dr. Doak Cox, Director
Environmental Center
University of Hawaii-Manoa
Crawford 317. 2550 Campus Road
Honolulu, Hawaii 96822

Dear Dr. Cox:

We are writing in response to your letter to Mr. Susumu Ono of April 7, 1982 dealing with Environmental Center comments on the EIS Preparation Notice for proposed Eucalyptus Biomass Farm Development at Pu'u'eo, South Hilo, Hawaii.

We offer the following responses to both general and specific comments raised in your letter.

GENERAL

The area here proposed for Eucalyptus biomass farm development involves land adjacent to existing biomass plantings in the Pu'u'eo area. The whole planting program is directed at answering an array of questions related to the feasibility of Biomass farm development for Hawaii. As such the experimental design utilized for existing and proposed planting areas is comprehensive and based on broad objectives. Through research and field trials the experimental design attempts to answer the following questions.

1) Site Preparation: What are the cheapest ways to clear land?

2) Species Selection: Which species produce the most fiber on a given site?

3) Provenance Trials: Which general region provide the best eucalyptus seeds to grow superior trees in Hawaii?

4) Spacing: How close should seedlings be planted when intensive culture is practiced?

5) Cutting cycles: How do cutting cycles and spacing influence yields?

6) Fertilizers: How much fertilizer do trees need? What is the optimum cost/benefit ratio for fertilization?

7) Tree Nitrogen: Does eucalyptus produce more wood fiber if interplanted with nitrogen-fixing species?

8) Analyses: How can leaf and soil analyses be used to maintain optimum growth?

9) Herbicides: What is the cost of adequate weed control? What are the most effective herbicides?

The subject area at Pu'u'eo is classified under one of the three categories which include marginal cane land, waste and pasture land and forested land.

The experimental design will be a randomized complete block design and plans are to install:

- Spacing and Rotation tests
- Fertilizer test
- Species test
- Provenance test
- Foliar analyses study
- Large field blocks for economic, harvesting and potential yield evaluation.

Various species will be planted and studied but E. saligna and E. grandis will predominate until other more promising species emerge.

No ground cover species or interplantings is being considered. However, in a 45 acre block in agricultural zoned land on the lower side of the proposed area which is from 6 - 20 months in age we have experienced no serious soil erosion problems. With the close tree spacing and intensive tree farming practices a protective canopy and root system is developed within the first 6 months. It is planned to clear and plant this area segmentally so as to have the minimum area exposed at any one time. U.S. Soil Conservation recommendations will be adhered to and clearing operations will be tailored to enhance this.

The initial clearing will be in the lower area nearest Pukihae Stream and extending upwards allowing for present vegetation to remain in place on the upper side of any clearing. It will be a continuation of previous clearing and plantings and an extension to recently installed access road.

Please find enclosed a copy of the BioEnergy Development Corp. 1981 Annual Report which details ongoing expermental research and field trials.

With respect to the importance of the specific Pu'u'eo parcel to the overall Biomass Program please see the comments offered by Mr. Thomas Crabb in Appendix G of the Draft EIS.

FLORA

Low altitude aerial reconnaissance of the subject parcel and analysis of air photographs has provided a rough estimate of percentage canopy cover by major arboreal species. The dominant canopy species are Ohi'a, Koa and Guava. Ohi'a and Koa frequently occur as scattered emergents within a dense guava thicket lower canopy. Aerial reconnaisance did not reveal any areas of the parcel supporting closed canopy native forest (Ohi'a/Koa). Cover estimates for the entire parcel by dominant species are listed below:

Species	Estimated Cover (range)	Comments
Ohi'a	25-35%	numerous large dead snags
Koa	15-25%	% cover increases with elevation
Guava	35-45%	% cover decreases with elevation
Other	10-20%	includes open grass areas, uluhe fern covered gulch slopes, and some tree canopy exotics such as Eucalyptus robusta (planted in the 1930's).

Regarding your remarks on the status of the two fern species Adiatum capillus-veneris and Blechnum orientale listed for the subject parcel, we offer the following comments. A check with botanists at the State Division of Forestry in Hilo established that Adiatum capillus-veneris has been recorded for the Island of Hawaii (e.g., Kohala). With respect to Blechnum orientale, this taxon should be referred to as Blechnum sp. until further determinations are completed.

AVIFAUNA

The page 40 statement on project area resources for native birds represents the subjective assessment of the avian consultant. We agree that the effect of exotic diseases on native bird decline has not been "thoroughly documented". The density estimates for bird species surveyed within the subject parcel were derived using the variable circular-plot technique (see Reynolds, et al., Condor, Vol 82:309-313; 1980). BioEnergy

Development Corp. will attempt to secure for its permament files (and make available to interested parties) the raw field data upon which density estimates were derived by the avian consultant. The consultants appreciate the additional references to recent publications by Dr. Sheila Conant. We are currently carrying out further nighttime surveys of the subject parcel in an effort to establish if the 'A'o (Newell's Shearwater) may be breeding in the project vicinity. Dr. Conant's summary of detection "hints" is most useful (Elepaio, Vol 41 11-13; 1980).

SOILS

Thank you for the additional references on physical/chemical properties of Hawaiian soils and erosion hazard. Professor Samir A. El-Swaify whose work you reference with respect to erosion hazard is currently involved in co-operative research with BioEnergy Development Corp. and has established erosion experiments in recently planted eucalyptus plantations on land adjacent to the proposed project area. Attached is a letter detailing this work and also providing estimates of soil erosion likely to occur if the project is developed at Pu'u'eo. As will be seen in the attached letter estimated soil loss rates during Eucalyptus rotation (2.0-3.8 tons/acre/year depending on soil husbandry techniques) are below tolerances set by the U.S. Soil Conservation Service for Akaka Soils (5 tons/acre/year). Dr. El-Swaify also provides comments on nutrient movement in the soil. The probable impacts of the project on physical properties of the soil (compaction, etc.) should be mitigated by the fact that, except for initial clearing phase, heavy equipment will not be used (except on access roads). Planting, maintance and harvesting are largely accomplished with hand operated equipment.

Enclosed please find a copy of the Draft Environmental Impact Statement for the Eucalyptus Biomass project. Your initial letter of comments has been included in Appendix F of the EIS.

Sincerely,

James O. Juvik

JAMES O. JUVIK, Ph.D.
Juvik & Juvik, Environmental Consultants

University of Hawaii at Manoa

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May 18, 1982

Mr. Thomas Crabb, Project Manager
BioEnergy Development Corporation
P.O. Box 1801
Hilo, HI 96820

Dear Mr. Crabb:

I appreciated receiving a copy of the EIS for the proposed Eucalyptus biomass farm at Pu'u'eo and the attached comments from the U.H. Environmental Center. Appropriately, the comments cite primarily our work on soil erosion potential and inventory. That work [a. Dangler, E.W., S.A. El-Swaify, L.R. Ahuja, and A.P. Barnett 1976, "Erodibility of Selected Hawaii Soils by Rainfall Simulation", ARS W-35, Agricultural Research Service, U.S. Department of Agriculture b. El-Swaify, S.A. and K.R. Cooley 1980, "Sediment Losses from Small Agricultural Watersheds in Hawaii (1972-1977)", ARM-W-17, U.S. Department of Agriculture, Science and Education Administration, and c. Lo, Andrew K.F. 1982, "Estimation of Rainfall Erosivity in Hawaii", Ph.D. Dissertation, University of Hawaii] and two recent USDA publications [a. Wischmeier, W.H. and D.D. Smith 1978, "Predicting Rainfall Erosion Losses", U.S.D.A. Agriculture Handbook 537 and b. U.S. Department of Agriculture, 1981, "Erosion and Sediment Control Guide for Hawaii", Soil Conservation Service, Honolulu, Hawaii] are the main sources of the comments provided below. In addition, we have attempted to draw upon the limited amount of data which so far have been collected from the runoff-erosion studies which are currently being carried out at Amauulu Mauka jointly with your corporation.

The maximum predicted soil loss for the development site was estimated by the universal soil loss equation using the best available estimates for soil erodibility (K = 0.08) and rainfall erosivity (1000 EI units) for bare fallow areas (with a cropping factor of 1.0) which are cultivated up and down slope and which conform to the "standard plot" specifications (9% slope gradient and 73 ft. slope length). The resulting estimate was 80 tons/acre/year. This figure far exceeds the value of 5 tons/acre/year assigned by SCS for tolerable soil loss from the Akaka soil. It is of interest to indicate here that our actually measured soil loss from the ongoing studies on bare standard runoff plots at nearby Amauulu Mauka did not exceed 0.1 ton/acre for the monitoring period 4/1/81 to 3/31/82. However, because signficantly less than average rainfall was received during that period (only 181 inches of sediment producing rain; the average for the area is nearly 275 inches), this figure is considered an underestimate. Therefore, as a margin of safety, the maximum predicted figure of 80 tons/acre/year is used as the basis for the ensuing estimates of soil loss during various stages of Eucalyptus growth.

Based on our observations of Eucalyptus saligna's performance in the field and on runoff plots at Amauulu Mauka, the various practices and growth stages were identified, the time period for each was estimated, and the corresponding value for the C factor was assigned as shown in table 1. The table indicates that the estimated average annual soil loss from planted fields for the seven (7) year planting cycle intended by BioEnergy is 3.8 tons/acre/year. This value meets the above stated tolerance limit for the Akaka soil. It is instructive to note from table 1 that nearly two-thirds of the predicted loss is due to crop stages 1a and 3. We acknowledge the SCS recommendations for reducing soil losses during these critical "open" periods (letter from J. Williams dated 9-14-81). In addition, the use of ground cover, grass strips, organic residue, and appropriate timing of weed control practices will significantly reduce the erosion hazard during the tree establishment stage. At harvest, the precautions listed on page 55 of the EIS will significantly reduce the C factor below the assumed value of 0.45. Further reductions in sediment movement may be achieved by the staggering of harvesting operations with space and time. If the indicated precautions during these two periods are observed, the average annual predicted soil loss from planted areas will remain below 2 tons/acre/year. Again, it is very likely that these figures represent overestimates since actual data so far do not bear out the assumed maximum erosion.

Erosional losses from field roads will depend on their percentage of the total area, their alignment with respect to prevailing slopes, and any drainage or protective surface treatments. Again, we endorse SCS's recommendations for diverting overland flow. We further recommend minimizing the area of roads aligned to run straight up and down hill.

Finally, as you are aware, occasional measurements have been made of fertilizer nutrient movements with runoff from the planted and unplanted experimental plots at Amauulu Mauka. So far, we have indications of no appreciable nitrate or phosphorus movement with runoff. This is expected since these soils have a high capacity for phosphorus fixation and Eucalyptus is known for its efficient extraction of soluble nutrients.

Please let me know if I can provide you with any additional information. Your direct participation in the ongoing erosion assessment studies at Amauulu Mauka attests to your genuine concern over important soil conservation issues.

We look forward to your continued cooperation.

Very truly yours,

Samir A. El-Swaify
Professor of Soil Science

SAE:ckh
cc: Susan Miyasaka
Andrew Lo
Attach.

Table 1. Soil loss estimates for a 7 year cropping cycle of *Eucalyptus saligna* trees at Amauulu Mauka.

Crop-stage	Crop-stage period	Crop-stage C value	Soil loss* (tons/acre)
(1) First Year:			
a. Disked, raked or bedded site preparation, with no mulch cover and live vegetation	0-2 months	0.72	9.5
b. Short brush with drop fall height of 20 in., 25 percent canopy cover and no ground cover	2-4 months	0.36	4.8
c. Average drop fall height of 6 1/2 ft. with 50% cover and 20% ground cover	4-6 months	0.16	2.1
d. Tree with average drop fall height of 13 ft. with 75% cover and 40% ground cover	6-9 months	0.09	1.8
e. Tree with average drop fall height of 13 ft. with above 75% cover and above 50% ground cover	9-12 months	0.01	0.2
Average C and total loss for the year		0.23	18.4
(2) Second to Seventh Years:			
Undisturbed forest land with 75-100 percent canopy cover	6 years	0.001	0.48
(3) Post-harvest:			
Idle land with no appreciable canopy and ground cover	3 months	0.45	9.0
Total soil loss for cropping cycle = 27.9 tons/acre			
Average annual soil loss for cropping cycle = 3.8 tons/acre			

*Soil losses computed using the universal soil loss equation, rainfall factor estimated at 1000 EI_{30} units, evenly distributed over the year and soil erodibility estimated at 0.08 with assumed L, S and P values of 1.

For the Protection of Hawaii's Native Wildlife

HAWAII AUDUBON SOCIETY

P. O. Box 5032
Honolulu, Hawaii 96814

P. O. Box 275
Volcano, Hawaii 96785

April 4, 1982

Mr. Thomas B. Crabb
Bio Energy Development Corp.
c/o Juvik & Juvik
Environmental Consultants
223 Makani Circle
Hilo, Hawaii 96720

Dear Mr. Crabb:

By this letter the Hawaii Audubon Society requests to be a consulted party in the preparation of the environmental impact statement for the Eucalyptus Biomass Farm Development on forested lands at Puueo, South Hilo, Island of Hawaii.

At the public hearing held in Hilo on March 24 on the Conservation District Use application for the project, on behalf of the Society I expressed serious reservations about converting 341 acres of native forest in the Conservation District into agricultural plantation use. A copy of that testimony is enclosed for your information.

Since there appears to be large acreages of developed farm lands that are presently unprofitable for cane production, as well as other under-utilized agricultural lands, it appears unnecessary to convert diversified forest to eucalyptus plantations. To bulldoze native forest (even though far from pristine) and put in a network of roads just to find out what the costs are is insufficient justification for the project -- in our view.

Would you kindly send a copy of the official draft EIS to me when it is released and to the president of the Society:

Dr. Charles H. Lamoureux
President, Hawaii Audubon Society
3426 Oahu Avenue
Honolulu, Hawaii 96822

Thank you for keeping me informed about the project.

Encl.

Sincerely yours,

Mae E. Mull

Mae E. Mull
Island of Hawaii Representative

BioEnergy Development Corp.
P.O. Box 1801 • Hilo, Hawaii 96720

May 11, 1982

Ms. Mae E. Mull
Island of Hawaii Representative
Hawaii Audubon Society
P. O. Box 275
Volcano, Hawaii 96785

Dear Ms. Mull:

In response to correspondence received from the Hawaii Audobon Society concerning preparation of the Environmental Impact Statement (EIS) for Eucalyptus Biomass Farm Development on forested lands at Puueo, South Hilo, Island of Hawaii may I offer the following statement to answer or clarify any concerns.

Although there is a feeling that there appears to be large acreages of farm lands that are unprofitable for cane production and unnecessary to convert diversified forest to eucalyptus plantations it is necessary and part of Bio-Energy Development Corporation's overall research and development objectives to obtain technical growing knowledge and an economic evaluation of various areas under varying climatic soils, rainfall and terrain conditions. Forested area is one of three categories. The other two being marginal cane and waste land.

Of the 535 acres planted to-date only 45 acres is in what could be considered this forested category. The remaining acreage is in marginal cane and waste land. Of the 900 acres to be cleared and planted over the 5 year period (pending DOE funding) approximately 250 acres are planned from forested area, 400 acres from marginal cane land with 250 acres from waste land.

This individual acreage in the three categories will give us the necessary area to insure reliability of our research and insure meeting our program objectives.

For future purposes the economic evaluation and related circumstances will determine direction.

Very truly yours,

Thomas B. Crabb
Vice President and Manager

For the Protection of Hawaii's Native Wildlife

HAWAII AUDUBON SOCIETY

P. O. Box 5032
Honolulu, Hawaii 96814
P. O. Box 275
Volcano, Hawaii 96785

Testimony for the Public Hearing held by the Board of Land and Natural Resources on March 24, 1982 in Hilo on conditional use within the Conservation District of the following: Conservation District Use Application No. HA-1/22/82-1449 by Bio Energy Development Corp. for Eucalyptus Biomass Farm Development on private property at Puueo, South Hilo, Hawaii.

The Hawaii Audubon Society applauds the use of developed agricultural lands for agricultural purposes. Growing eucalyptus for biomass is an agricultural enterprise. Bio Energy Corporation, a C. Brewer Comany subsidiary, is conducting an experimental, demonstration project, funded by the federal Department of Energy. We are acquainted with Thomas Crabb, the project manager, and his staff. They are doing careful planning and well-thought out experiments to determine the most feasible and inexpensive methods of growing eucalyptus. We have no problems with their operations thus far on the use of former cane lands and other lands in the Agricultural District.

However, we have serious reservations about this CDUA which is for the purpose of converting 341 acres of native forest in the Conservation District into agricultural plantation use.

Bio Energy is making their application to the wrong State agency. If the company is determined to destroy that forest for agricultural purposes, it should apply to the Land Use Commission for a boundary change from Conservation to Agricultural.

The 341 acres in question are still primarily a diversified native 'ohi'a forest with some koa present. Without question, there are exotics on the parcel, particularly strawberry guava -- a serious pest in the forest. But this land has not been cleared before.

It is in the Resource Subzone where growing and harvesting of forest products is a permitted use. But does that mean you can clear-cut the whole parcel in sections, entirely removing all vegetation and ground cover except for margins along stream banks? We do not believe this is the intent of the Resource Subzone -- to strip forest lands and plant agricultural crops.

We object to the proposal's intent, to bulldoze away a native forest for experimental purposes. Native forest, including a disturbed native forest such as this one, is habitat for a wide spectrum of endemic plants of many species. It is home for endemic spiders, insects and land snails. It is the habitat of native birds. It is a community of plant and animal life. This should not be destroyed for experimental purposes. If the project fails, the forest is still lost forever. Native forests cannot be reestablished once you have planted a eucalyptus crop on the ground.

We object to federal funds being used to bulldoze a native forest for experimental use.

There are other serious implications if this forest destruction project is approved.

We believe that permitting this use on Conservation District land will establish a dangerous precedent. Here are the reasons. A huge parcel of former Brewer-owned forest land, 30,000 acres or so, is mauka of these 341 acres. It was purchased by World Union, a Hong Kong company, several years ago. World Union representatives have been making inquiries and overtures on developing some parcels of that forest -- converting that high quality native 'ohi'a forest to eucalyptus plantations.

Some of that World Union land is Hilo watershed -- with very high rainfall and the hazards of rapid erosion when the forest cover is removed. If you permit Bio Energy to bulldoze this 341-acre forest, could you deny World Union's applications for eucalyptus plantations?

The Society recommends that this CDUA be denied and that Bio Energy Corporation consider applying to the Land Use Commission for a change in district boundary land use, or using other developed agricultural lands.

Thank you for your attention to this testimony. We would appreciate hearing by letter the Board's decision in this case.

Mae E. Mull

Mae E. Mull
Island of Hawaii Representative

R. 6.

GEORGE R. ARIYOSHI
GOVERNOR

1719

ARTHUR U. ISHIMOTO
BRIGADIER GENERAL
ADJUTANT GENERAL

82 MAR 31 P2:45

DANIEL K. C. AU
COLONEL
DEPUTY ADJUTANT GENERAL

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816

DEPT. OF LAND AND NATURAL RESOURCES
STATE OF HAWAII
29 MAR 1982

HIENG

Rec'd Plng. Ofc APR 1 1982
By
Gordon
Aki
Roger
Ian
Filing
Routing

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Eucalyptus Biomass Farm Development
at Pu'u'eo, South Hilo, Hawai'i

Thank you for providing us the opportunity to review the proposed project, Eucalyptus Biomass Farm Development Environmental Assessment.

We have completed our review and have no comments to offer at this time.

Yours truly,

Jerry M. Matsuda

JERRY M. MATSUDA
Captain, HANG
Contr & Engr Officer

APPENDIX G. TRANSCRIPT

BOARD OF LAND AND NATURAL RESOURCES PUBLIC HEARING

ON CONDITIONAL USE APPLICATION

BOARD OF LAND & NATURAL RESOURCES MEETING

---:---

Conference Room C
State Building
Hilo, Hawaii 96720
Wednesday, March 24, 1982

The aforementioned proceedings commenced at 5:00 p.m. pursuant to Notice.

BEFORE:

SUSAN S. HEASSLER, Notary Public
State of Hawaii

APPEARANCES:

For the Board of Land & Natural Resources Staff:	ROGER C. EVANS
For the Attorney General:	WILLIAM TAM
For the Applicant:	JAMES JUVIK
	HENRY ROSS
	MAE MULL
	WILLIAM MULL
	HENRY CARR
	RICK WARSHAUER
	THOMAS CRABB
Board Members:	J. DOUGLAS ING
	STANLEY W. HONG
	SUSUMU ONO, CHAIRMAN

ROLAND HIGASHI

TAKEO YAMAMOTO

P R O C E E D I N G S

CHAIRMAN ONO: We are going to move on to the next application. This is the Biomass Energy Development Corporation for Eucalyptus.

Mr. Evans.

MR. EVANS: Mr. Chairman, gentlemen. This particular application is for eucalyptus biomass farm development. It's an experimental project.

If I may, I would like to indicate to you the area. It's in South Hilo. It's within our resource and our protective subzones. The area lies mauka approximately five miles outside of Hilo.

As you can see, we have Hilo, it's centered here. These lands lead up to the project. The first mauka lands are zoned agriculture by the State Land Use Commission. Then we begin to go into our Conservation District. And our Conservation District here shows it lying within our resource subzone.

And we also have a parcel of protective subzone going into the area. Now the boundaries of the project itself are followed by this outline. And as you can see, a portion of the project does enter into the protective subzone, as stated in the proposal.

Now the current use of the area is primarily forest cover, dominated by strawberry guava, fern and ohia. The

proposed use is really a continuation of an earlier use, not in this area but in terms of the project itself.

In 1978 C. Brewer, who is the overall sponsoring firm for this development on an experimental basis, they submitted and did funding approval by the U.S. Department of Energy for this experimental project. It was a planned five-year, 900-acre project to determine basically the economic and technical feasibility of using eucalyptus tree biomass production in our state.

During the period 1978 to 1980 approximately 300 acres were planted. However, those acres were planted within our Agricultural District. We were not involved at that time. However, they planned to plant an additional 600 acres within our Conservation District at the proposed site, as has been demonstrated to you.

Now we have submitted this application to a number of agencies. We have received some comments from them. Importantly I would like to point out to the Board that we did receive comments from the U.S. Fish & Wildlife Service. They feel that the discussions that the environmental assessment contains relating to flora and fauna are adequate. However, they do suggest that insofar as the Department of Energy provided the funding source, that some formal consultations should take place between the U.S. Department of Energy and the Department of the Interic

which the Forest and Wildlife Services operates under.

Also, we have comments back from our Division of Acquatic Resources. They do have a concern that they have expressed relating to water quality. Now they also, in expressing their concern, do take note of three specific mitigating measures, which are proposed by the applicant, to ameliorate this difficulty.

Firstly, a vegetation buffer stretched along the slope of the existing stream gulches remain a 25-foot buffer, and the vegetation would be comprised of existing vegetation which is there today.

Secondly, they propose incremental clearing and planting of small plants over the three- to five-year period. And lastly, that incremental harvesting and replanting occur.

We have also received a response from our Division of Historic Sites. And they have provided their standard response through the Division of State Parks to us. Our Water and Land Development Division, they do point out that this area is a relatively high rainfall status -- somewhere up of 200 inches a year. And as a result they feel that erosion could be a concern, and that adequate steps should again be taken to minimize the possible erosion as a result of the project.

Our Division of Land Management and Department

of Health have expressed no objection to this project. Your staff has just recently received some input from Hawaii County Planning Department, and they do again note that the need for erosion control measures be implemented to minimize and mitigate the hazard. And they suggest that some of these minimization measures, should the Board approve eventually this project, that they be conditions of approval. And they do recommend at this time very conditional approval of the project on an experimental basis.

Our analysis to date, gentlemen, we have been able to determine so far that the proposed use is a conditional use of the resource subzone, that we are required to hold this public hearing. And on this particular application their staff has required an EIS to be completed prior to our final analysis, which would result in a formulation of a recommendation for your consideration.

The Environmental Impact Statement process is presently underway. We have consulted with the Environmental Quality Commission on this matter. The Environmental Quality Commission went so far as to give us a proposed timetable for the Environmental Impact Statement, and we have seen to it that the applicant did have a copy of that.

Gentlemen, the objective of our protective subzone

is a portion of that proposed for that use this evening. It is to protect valuable resources and such designated areas as restricted watersheds, wildlife preserves, designated historic and geological features, and other unique areas. The objective of our resource subzone is to develop with proper management areas to ensure the sustained use of those areas. We have attached a chronology of events that have led up to our being here this evening, from the first application, which did come in March of 1981. And subsequently because of the environmental requirements, it was withdrawn and we are proceeding on line at this time.

Gentlemen, I would like to at this time call your attention to the last page of your submittal. There should be a map there at the top right-hand corner. You will see Page 36. This indicates not only the Conservation District on that map there but also the resource and the protected subzone.

THE CHAIRMAN: Try that again, Roger?

MR. EVANS: The very last page of this submittal.

MR. HIGASHI: This map here.

MR. EVANS: That map there, yes, correct. On the top right-hand corner you will see Page 36. It does indicate our resource and the protective subzones. And I would like to bring to the Board's attention that your

staff has reviewed this particular map. We are not really in agreement with the term that the protected subzone is obsolete. That is the applicant's map. That is not your staff's map.

I did want to point that out in the application for you. That would be the extent of our analysis at this time, gentlemen.

MR. HIGASHI: Roger, on the application we have subzone, resource. Shouldn't that be subzone/protective?

MR. EVANS: The map that you have before you is, was taken from the applicant's application. On that application it was indicated in the resource only. You are correct.

In our review of it we have found it to be resource protective. And the application should be amended to that effect.

MR. HIGASHI: With the idea that he plans or intend to use the whole area, using the outer boundaries of the orange as the entire experimental project; right?

MR. EVANS: At the present time he's, his proposal is to use this area, the boundaries of which go into our protective subzone and incorporate both P and R.

Now as a part of your staff analysis we would have to analyze the objective of the protective subzone, the objective of the resource subzone to see if in fact

it would be compatible with these objectives or plans, or perhaps if some modification, if it weren't compatible with the protective subzone, in all likelihood we may recommend to the Board that should their recommendation be for approval, that only the resource subzone be used.

THE CHAIRMAN: No further questions?

(No response.)

Next would be Mr. James Juvik.

MR. JUVIK: Good evening. My name is James Juvik. I am a principal of Juvik & Juvik Environmental Consultants based here in Hilo. I was retained to prepare the Environmental Impact Assessment and Statement for this project.

I would like to attempt to clear up a couple of points. Your staff has presented basically the plan. There were a couple of errors in the presentation.

One is that only 300 acres of land are involved, not 600. As we can see here on the proposed project area, it is bounded by Awehi and Pukihae Streams. And does include, as is indicated here, a portion of the protected subzone. Now I would like to address this matter for just a moment, because there was some confusion regarding the purpose of this protected subzone, in other words why is that green little finger there to begin with. I had some difficulty determining from the DLNR exactly

why that area was in a protected subzone. Eventually it was indicated to me that it was in a protected subzone because at one time there were surface water sources used at mauka cane camps in the area that were being exploited and used for potable water, and that this protected subzon was created to insure the water quality for those potable water surface water sources.

However, as is attached to the current Environment Impact Statement, which is circulating now, and which is available to you through your staff, the reason for that protected subzone no longer exists. In other words, it was not set aside for rare and endangered plants, animals or archaeological sites. It was set aside to protect potable surface water. And the uses of those water resources no longer exists. The mauka cane camps are either on county water, well water or the camps have been disbanded.

So this is why the obsolete designation was indicated on our map. Also --

MR. ING: That does not take it out of the protective subzone, though?

MR. JUVIK: No. I simply meant obsolete in the sense of why it was, why it is in the protected subzone.

MR. ING: You understand that it is still in the protected subzone?

MR. JUVIK: I understand that, yes.

THE CHAIRMAN: The water source is still there though, yeah?

MR. JUVIK: The water is still coming down, that's right. It is not used for drinking water anymore.

And I have a correspondence from the State Department of Land and Natural Resources, dated October 5. This addresses this very issue, in which we argued that the protected subzone designation is obsolete for the purposes indicated, although it still exists, we acknowledge that.

And the Department of Land and Natural Resources did, under Ronald Walker for the Forestry and Wildlife, indicated, and I quote, "This discussion relative to the protected subzone appears to be correct." In other words, our discussion. "Analysis of the situation regarding the protected subzone -- however, the statement that, 'surface water resources in this area of Hilo Forest Reserve are no longer utilized for domestic water supply,' should be documented by correspondence from the Hawaii County Department of Water."

We have attached this documentation. A letter from William Sewake, Manager of the Department of Water Supply, County of Hawaii, indicates the fact that surface water resources are no longer used in that area. And that is our argument for why we feel that the protected

subzone designation is obsolete.

However, I would only add one more factor. Only about 10 acres of the proposed 341 acres, only about 10 are in this little area right here in the parcel, okay? So whether they are included or excluded in the proposed eucalyptus-growing activity, were it to be approved, is a relatively minor issue. Because we have also included these buffer zones, as you can see there, along the edges of the stream. So that takes up part of that small green area as well. It's only a relatively small area, about 10 acres.

If you refer to the last map there, the one with Page 36 on the top of it, you will see that only a very tiny area is in the protected subzone.

MR. HIGASHI: I have one question. What does the water -- in doing your research where did the water runoff end up after it leaves the protected subzone?

MR. JUVIK: Well, the water -- this is another reason that we were concerned about this protected subzone designation, is that we feel there is a cartographic error When this protected subzone was actually drawn by the DLNR the cartographic errors were incorporated because the protected subzone, which was supposed to protect the surface water resources, did not follow any of the stream courses. In other words, it cuts across from one stream

to another.

So it isn't protecting any kind of a consecutive watershed area. It just cuts across one ridge to another area. So it doesn't seem part of Maile Stream, and a small part of Pukihae Stream in this protected subzone.

But instead, one would normally think if they were trying to protect the quality of water, surface water resources of a specific stream, the protected subzone would follow that stream. In fact it cuts across.

And our discussions with DLNR indicate that there may have been cartographic errors involved in the construction of this small zone.

MR. HIGASHI: Besides the errors, I am asking you a question.

MR. JUVIK: Yes. It dumps into Pukihae Stream and into Maile Stream.

MR. HIGASHI: Below of that there's ag use?

MR. JUVIK: Yes.

MR. HIGASHI: Do you know for a fact that we don't have people using water from the stream for agriculture uses? You seem to be saying that there is no need for the protective subzone. But there may be a need of a downstream user using water. Therefore the protected subzone should be protected for its water resources.

I don't think you are entirely correct. It may be

not using domestic water anymore, but we have small dwonstream users that do use the water for agricultural purposes.

MR. JUVIK: I agree with you. In fact, the whole area, whether it's resource or whether it's protected, is a watershed. There is no question about that.

And I think that both the resource area and the protected subzone are or could be maybe used for agricultural water water supply. I have no argument with that.

However, the point is that the protected subzone has been designated specifically for drinking water.

MR. HIGASHI: Well, water is water. Water is valuable when a stream is dry.

MR. JUVIK: I agree.

MR. HIGASHI: And I think that is the intention of the protected subzone.

MR. JUVIK: Well, but that particular subzone --

MR. HIGASHI: I think you are trying to attack the integrity of the protected subzone, saying that it's obsolete.

MR. JUVIK: It's obsolete for the purposes for which it was proposed, which was drinking water for those mauka cane camps. I am not arguing that it is obsolete in the sense that the protected subzone does protect water. That's correct.

THE CHAIRMAN: You seem to be reading quite a bit into the conversations you have had with people and drawing on some conclusions. Is that it?

MR. JUVIK: Excuse me?

THE CHAIRMAN: You seem that you are reading quite a bit into pieces of information you pick up and saying, well, this is the way it should be or this was an error, so you should go out and correct it. And I am going to need plenty more evidence to substantiate, to come to your way of thinking. I just can't accept, based on what you are saying, that it is cartographic error and the subzone that's there now doesn't do what it's intended to do.

And these other conclusions that you are drawing, I can't buy that unless I have a little bit more.

MR. JUVIK: Well, I would encourage you to pursue that in the Environmental Impact Assessment, which we produced, and also through your own staff.

THE CHAIRMAN: I think that you as a representative of the applicant, that the burden is on you. You know, you are asking me to go do that.

MR. JUVIK: Well, I think we have presented the material in the Environmental Impact Assessment.

THE CHAIRMAN: Okay, if that is your position, fine.

A VOICE: Can we suggest something?

THE CHAIRMAN: Wait, wait.

A VOICE: That we require them to provide an ecological report of chemical analysis of the water as it affects all shrimp, Hawaiian shrimp and other things. Plants, too.

MR. ING: I have a question. I would like an explanation as to what this biomass operation will be.

MR. JUVIK: Okay. And I think perhaps, as I said, we bogged down a little bit on the protected subzone. It's a very small area of the proposed project area, less than 10 acres. It could easily be excluded without probabl detriment to the applicant.

The project involves, as I say, about 341 acres, which about 300 are being proposed be put into eucalyptus, planted eucalyptus forest, managed eucalyptus forest to be harvested on a six- to seven-year rotation for biomass that is chipped and fed into the power plant at Pepeekeo Sugar Mill, to be supplementing the bagasse that is used for electrical power generation.

As planned, the project will generate about 20 barrels of oil per acre per year, or around 6,000 barrels of oil per year from the project area at its full development. This will be used to supplement power generation at Pepeekeo Sugar Mill.

The area as proposed will be incrementally developed, 20 to 30 acres in the first year, subsequent years comparable amounts. So it will take a number of years to develop this area. At no time will it be completely open or uncovered by vegetation. And the rotation cycle will be about six to seven years.

MR. ING: Now with regard to development of a particular area, what is the nature of the development necessary, going into and grading it and planting seedlings, or you plant trees of a certain size? How big do they get before you harvest? What happens to the soil during the course of the six years?

A The plan envisions planting seedlings, small seedlings of six months of age, about 1,700 to the acre. These will be harvested after six to seven years when the trees are about a foot in diameter or perhaps 50 to 80 feet in height.

And approximately within a year the trees will develop closed canopy. In other words, they will be completely covering the ground. And a major erosion hazard -- and certainly this is a valid concern because of the high rainfall, as mentioned by the staff.

The applicant has undertaken this environmental assessment, and also is engineering plans for the area in conjunction with the Soil Conservation Service. The

Conservation Service's assessment is included in the environmental assessment, indicating certain procedures and so on which would have to be required, swaling the roads, cross-harrowing the -- windrowing the bulldozed vegetation material to reduce erosion hazard. These issues to mitigate erosion are addressed in the assessment.

Erosion and the possibility of stream runoff of erosional material into the stream is probably the most serious environmental concern for this project. It is a question of the integrity of the forest in terms of the composition of the forest, say the mixture of native and exotic species.

There were some elective lumbering activities, some grazing. And in the past, about 1900, a diversion ditch was built across the southern part of the area to feed bacteria getting in higher elevation, for fluming sugar cane. So the area is not undisturbed, by any means. In fact, vivee or strawberry guava is dominant in the area in terms of the numbers.

The area has been cleared incrementally, planted up in eucalyptus seedlings, which will cover the ground in about a year. So the next year would be the maximum area of erosion concern.

The applicant feels that he has instigated measure for erosion control, which are and include cross-windrowing

of the vegetation, swaling of the access road and so forth, and it will adequately address those issues.

MR. ING: What type of equipment will be used to grade the area initially then during the harvest? What type of equipment will be utilized for the harvesting?

MR. JUVIK: Clearing of the area will involve using a large-scale land clearer such as a D-9 with swamp tracks to accommodate the damp ground in some areas. The area will be cleared in that way. The areas will be planted by hand and other -- between clearing and harvesting most of the work will be done by hand like fertilizing and planting and so forth.

During the harvesting a number of techniques are proposed. Because this is a demonstration project involving Bio-Energy, a C. Brewer subsidiary, and the U.S. Department of Energy, and because this project has only been ongoing for three or four years and they haven't gotten to any of their harvesting stage on any of their land as yet, so they are looking at alternative harvesting methods. Some of those methods involve -- you may have seen some of these in parks where you actually put in wood into a grinding machine that spits out chips and haul the chips to a factory. Alternately hauling trucks will be used to haul the cut timbers to the chipping mill where there will be chipping on the mill site and they

will be fed into the Pepeekeo boilers.

I should add with regard to the use of these wood chip materials, Brewer does sell tar directly to HELCO for island use. And a part of the reason for desirin this parcel, it's nearness to the Pepeekeo site and the fact that these wood chips will help to enhance the quality of, the buring quality of their bagasse. And also during the times when the mill itself may be shut down and bagasse is not accumulating they can use this wood-chipped biomass to carry them through periods of bagasse scarcity.

MR. ING: What happens to the pieces that are not used, like the branches, things like that?

MR. JUVIK: These would be left on the ground to retard erosion.

THE CHAIRMAN: Anything else?

(No response.)

Thank you very much.

Henry Ross.

MR. ROSS: Mr. Chairman, members of the Board. My name is Henry Ross. I am from Kohala. I am active in the Kohala Community Association, although I am here speaking on my own behalf, because I did not have any contact with the Association prior to this meeting.

But from previous experience, I would like to bring the following things to your attention. In Kohala

Kohala we are very much interested in the project, in any project like this. Because we are looking for more diverse and alternative uses of land in order to create new jobs. As you may know, the sugar plantation in Kohala shut down about seven years ago. We are still looking for replacement employment.

So this could be an example for us as an alternative use of certain marginal lands maybe that we might follow. I would like therefore to make a few suggestions. In order not to make this process of approval be too long, which I think it must of necessity be, but maybe it can be shortened.

I would like to offer the following possibilities. As far as watershed is concerned, this has occurred to me. It's not only runoff water that we are looking at, but in Kohala we are looking at aquifers. I don't know if there are any. I don't know if there are any aquifers under this land or not. Anyway, for both reasons, use of water, whether agriculture or potable water, it is possible to, apart from the proposed buffer zones themselves, to make a conditional approval in the way of what herbicides and what fertilizers are going to be used. If the Commission sets a condition and says you cannot use certain herbicides and so on in order not to run the risk that the water becomes polluted, et cetera, then this would

be positive solutions.

Also, in this respect and as far as erosion of soil is concerned, erosion is a condition that could be made by the Commission, that applicant work together with the U.S. Soil Conservation Service who is active and very knowledgeable on this island. In other words, if soils have to be cut, as the previous speaker said and so on, grading has to be done, why not have the advice of the U.S. Soil Conservation Service there, which does not cost anything? They come voluntarily for any length of time, they give good advice and information as far as our experience goes.

I have one question that has not come up. And that is the following. What happens if this operation, if approved, would shut down? Is there anything going to be, is there a clause for reforestation to bring the area back more or less into its old condition or an acceptable condition? Or is it going to be left bare or open to erode? I would very much, we would be looking at that. I mean, I am looking at it, as I said, from the viewpoint of if we are going into a project like this in Kohala. We would like to have a good precedent and example for us to follow. And we would certainly be lookir for these things in Kohala.

If commercial ventures do this, usually at

elevations above where people live and so on, then you want to know what's coming from top to where people live. Because these people will be living there for a long time, hopefully. And as I said, I am a resident of this North Kohala, and looking for diversification of soil and so forth, different uses. I am very much in favor of this project, but I would like to be cautious in certain respects. Thank you.

THE CHAIRMAN: Any questions of this witness?

(No response.)

Thank you very much, sir.

Mrs. Mull?

MRS. MULL: My name is Mae Mull. I am the Island of Hawaii representative for the Hawaii Audubon Society. We applaud the use of the developing agricultural land for agricultural purposes. Growing eucalyptus for biomass is an agricultural enterprise. This is an experimental demonstration project funded by the Federal Department of Energy.

We are acquainted with Mr. Thomas Crabb, the project head and his staff. We have been talking to him about this project for several years. They are doing careful planning and well-thought-out experiments in all aspects of the project to determine the most feasible and inexpensive methods of growing eucalyptus. We have

no problem with their operations thus far on the use of former cane lands and other lands in the Agricultural District.

However, we have serious reservations about this CDUA, which is for converting native forests in the Conservation District to agricultural plantation use. Bio-Energy is making their application to the wrong state agency. If Bio-Energy is determined to destroy that forest for agricultural purposes, the company should be applying to the Land Use Commission for a boundary change from conservation to agriculture. The 341 acres in question are still primarily a diversified native ohia forest with koa present. Without question there are exotics present, particularly strawberry guava, a serious pest in the forest But this land has not been cleared before.

It is in the resource subzone of the Conservation District where growing and harvesting of forest products is a permitted use. But does that mean that you can clear-cut the whole parcel in sections entirely removing all vegetation and ground cover except for a margin along the stream beds? We do not believe this is the intent of the resource subzone, to stip the land completely and plant agricultural products. We object to the proposal's intent to bulldoze away the native forest for experimental purposes.

Native forest is habitat for a wide spectrum of endemic plants and many species, and it is a diversified forest. Their planting list will show you that. A large number of native species are located in that forest.

It is the home for endemic insects, spiders and snails, and this is habitat for native birds, it is a community of plants and animal life. This should not be destroyed for experimental purposes.

If the project fails the forest is still lost forever. Native forests cannot be reestablished once you have planted a eucalyptus crop on the ground. We object to federal tax funds being used to bulldoze a native forest for experimental use.

MR. ING: Do you consider vivee a native plant?

MRS. MULL: No, strawberry guava is an exotic. That's what I said. It is present and it is a serious pest.

There are other serious implications if this forest destruction project is approved. We believe that permitting this use on Conservation District lands will establish a dangerous precedent. A huge parcel of former Brewer-owned forest land is mauka of these 341 acres. It was purchased by World Union, a Hong Kong company, several years ago. World Union representatives have been making inquiry and overtures on developing some part of

that native forest.

Converting that high-quality native ohia forest to eucalyptus plantations, some of that World Union land is in Hilo Watershed. And it has a very high rainfall and carries the hazards of erosion when it is cleared. If you permit Bio-Energy to bulldoze this 341-acre forest, could you deny World Union's application for eucalyptus plantations?

The Hawaii Audubon Society recommends that CDUA be denied and that Bio-Energy apply to the Land Use Commission for a change in boundary of land use.

MR. HIGASHI: I have a question. If the application was approved be the Land Use Commission for a boundary amendment, then you would not be opposed to it?

MRS. MULL: I think at that time we would point out its qualities as a native forest. I would like, Mr. Higashi, to tell you though that Bio-Energy has bulldozed some of that native forest that is in the agricultura subzone. We made no protest on that. It was in the agricultural zone, which is for the growing of agricultural products.

I don't make any pretense that this is high-quality forest. It is a degraded with strawberry guava, but I do maintain that it is essentially native forest. And as long as it's in the Conservation District it should

not be bulldozed. It should, if they want to apply for it, to a rezoning by the Land Use Commission, I don't see any serious objections why that permit would not be given. They have given similar land that is also in the agricultural zone.

MR. HIGASHI: And you would support the change of boundary amendment?

MRS. MULL: I wouldn't say that I would support it, but I don't think that there would be any serious objections to it.

MR. HIGASHI: In your opinion.

MRS. MULL: In my opinion, yes.

MR. HIGASHI: But the end use of the land would be the same?

MRS. MULL: Yes, but it's for agriculture. This is setting a precedent within the Conservation District. This is what we are objecting to, the precedent for this kind of use of Conservation District lands.

MR. HIGASHI: But in your presentation you recognize that it is a permitted use?

MRS. MULL: I question it.

MR. HIGASHI: I think it was your statement in the earlier part of your testimony that you stated it was a permitted use, however.

MRS. MULL: Yeah, growing and harvesting of forest

products. But I question whether that means bulldozing this parcel and planting eucalyptus. Is that the same, is that equivalent to growing and harvesting harvest products? That's what we question.

MR. HIGASHI: I understand your line of thinking.

THE CHAIRMAN: I am not clear. If you go to the Land Use Commission asking that the Land Use Commissior redefine the boundary and put the 341 acres into agricultur wouldn't that also be accepting a precedent for other landowners like the Hong Kong owners, you know, the same argument that you used against this particular application may be applicable before the Land Use Commission.

MRS. MULL: Well, it's the way we look at the quality of the land. This is, you know, degraded. It is not the habitat, as far as I know, of an endangered bird, this particular parcel. But the World Union parcel is very important habitat for several species of native birds. And I think this Land Use Commission would not change it to agriculture because it is such a high-quality forest.

MR. HIGASHI: I think we are not talking about the same, you know, not everything being equal. When you referred to the other parcel, that hasn't even been applied for. I think the quality of those lands may be entirely different than the applicant's property right now.

MRS. MULL: Yes.

MR. HIGASHI: I agree, but maybe we really don't know.

MR. ING: I think your concern is not to establish a precedent but I think the Land Board will take into consideration factors such as what is the quality of the presently existing forest on the land, whether or not that should be preserved. There are many other factors that go into our decision as to whether or not to, for example, allow a biomass operation in conservation lands.

So in terms of whether or not it establishes a precedent, I don't know if that is particularly valid. Although you do have a good point.

MRS. MULL: Well, that is our primary concern. Thank you.

THE CHAIRMAN: Yes, thank you very much.

MR. MULL: Paul had to leave and asked me if I would read his testimony, which is in his handwriting. So please bear with me if I stumble a little.

THE CHAIRMAN: Would you state your name?

MR. MULL: My name is William Mull, M-u-l-l. I am member of the Conservation Council for the Island of Hawaii Chapter. But Paul, as you know, is the secretary of that organization. And as an officer he should be submitting this testimony. It will be submitted in formal,

typed copy later.

This is testimony on behalf of the Conservation Council for Hawaii, the Big Island Chapter. We at the Conservation Council for Hawaii are glad to see that Bio-Energy Development Corporation is researching and developing eucalyptus uses as an alternative source of energy to lessen Hawaii's dependence on fosil fuels. We are also pleased that the 900 acres proposed for this conservation project, that of these 900 acres proposed for this demonstration project, that of these 900 acres, 300 acres will be planted in marginal agricultural lands and abandoned cane lands.

We are not against the development of these resources in Hawaii in producing its energy needs, or against creating new employment opportunities for the people of Hawaii. But on the other hand, we feel that by granting Bio-Energy Development Corporation's request to clear and plant the proposed conservation-zoned land with eucalyptus may set a precedent for future clearing and biomass development of other forested lands, whether or not they are intact native forests or mixed native and exotic forests.

At this time I would like to see the research and development of biomass as an energy source be carried out on highly altered lands, pastures, idle cane lands,

rather than undeveloped native forests. Other concerns of the Conservation Council of Hawaii are, one, with respect to this parcel, high erosion rate due to the heavy rainfall in the area. And two, runoff into streams and eventually the ocean.

That's the end of his testimony.

THE CHAIRMAN: Thank you very much.

MR. MULL: Thank you.

THE CHAIRMAN: Mr. Mull, you are next on the agenda, so why don't you just stay there and proceed with your testimony.

MR. MULL: Okay. My personal comments would be as a person doing long-range biological research in native eco systems, planned eco systems of the Big Island. As such I am interested in native forests as the cnly, as the primary resource with which I am dealing as a biologist and in my other work with biologists in Hawaii.

And my general feeling is that native forest land is, has been so depleted in area that we should, that the Board I would think as my representative in this thing, should look very carefully at any proposals to destroy that native forest, especially that under the state land. But also that which is zoned conservation is covered by state law for conservation purposes. Even though this parcel has been judged, declared altered for

not pristine, there are nevertheless over 15 native species of plants, for example, as listed in the Environmental Impact Statement.

There are undoubtedly more plants than there are or were for that couple of weeks of study that was done altogether by a couple of people. 340 acres of land can't be adequately surveyed with any degree of certainty that you have covered all of the species in that period of time.

So as a person doing biological research, I hate to see other native forests destroyed any more than would seem to be absolutely necessary. And that gets to another point.

This is Brewer land. Brewer has all kinds of cane land that is rapidly becoming cost inefficient. What is going to happen to those cane lands in the next few years? They are not going to be raising cane on it, in all probability, the way things are going. There is going to be plenty of land to grow eucalyptus or other biomass products. Why destroy native forests with the prospect of vast amounts of land becoming available on the Big Island for just such purposes as biomass development. It seems to me that waiting on this a while and see what happens to the cane would be more feasible.

It is a shame to see government money going into

destruction of more native Hawaiian forests when it could go into, for example, marginal cane land or cane lands that have lost apparently their cost efficiency.

MR. ING: Mr. Mull, did you review the EIS?

MR. MULL: Yes, I did. I have gone over it somewhat.

MR. ING: Weren't alternative native lands addressed in it?

MR. MULL: Not that I recall. As I say, I scanned part of it. I did not really thoroughly read it. Dr. Juvik could comment on that, perhaps.

But it seems to me that there's a lot of Brewer land available in cane that may be used for just this. But Mr. --

MR. HIGASHI: Mr. Mull, if the bagasse is the main ingredient and eucalyptus is the supplement, if cane is no longer harvested I am sure that I am not going to use eucalyptus because there is no main ingredient to burn. So I would have reservations about forcing them to use cane land. If they cease harvesting cane they are out of business. So --

MR. MULL: If they ceased harvesting cane, what is 300 acres of eucalyptus, what good is that going to do them? None whatsoever. So I --

MR. HIGASHI: But if you take out the sugar they

close up the sugar mills.

MR. MULL: If they take 300 acres out of cane in comparison to all the Brewer land that's invested in cane now I don't know how much there is, but my general impression that there are many thousands of acres. And that would be a drop in the bucket. It is a Brewer project

The only reason this is being done, I should imagine, is because there's federal money in it. It would be cost efficient to go the cost of clearing that forest to do this kind of research. I would suggest, I think it's misdirected use of federal money, personally, in this particular instance and with this particular piece of ground involved.

I am sorry, I didn't mean to be so wordy. Thank you for allowing me to do it.

THE CHAIRMAN: Any questions of Mr. Mull?

(No response.)

Thank you very much, Mr. Mull.

Mr. Carr, you had some other comments?

MR. CARR: Four million acres of land in the territory, 1,400,000 being other lands that were deeded to the Hawaiian people. Prince Kuhio in 1926 deeded the homestead lands to the plantations, providing they raised cane, agriculture and the best lands were cane lands. And the worst lands were given to the Hawaiians, which

were on the beach and up in the mountains and among the rocks and everything. So the Hawaiians got 30,000 acres out of a million four hundred thousand acres.

9,000 Hawaiians applied for 30,000 acres out of 150,000 Hawaiians at that time. So that the balance of that land that was given to the plantations, actually I hold it to be homestead lands. They were actually homestead lands for the Hawaiians and they should revert back when the cane goes out to the people. And then we have use for it.

But to go into exotic plants, to kill native plants and endemic species, I can't see that. I am just like any other biologist because I drove on it and it was pointed out to me that this is a rare plant, this is a rare plant. And these plants are rare. Snails on Hawaii are found only on Hawaii, tree snails, I mean. And that's peculiar feature that belongs to us alone.

Then there's a number of plants. And I feel that we should make use of what is thrown out of cultivation and not use any land that was originally zoned not for cane but reserved for the people. And that belongs to the people, I think. The Hawaiian people, because it came from their portion of king and chiefs' lands.

I might tell you at this time that employees of the State working for the Federal Government stayed

Pohakuloa, I understand, they are just on the premises to put out fires started by those soldiers when they want to play around and set fire to the mamani trees, which kills, which when dead will encourage the palila bird to be leaving. And that I think is another case of man's destruction of nature's gift to us.

THE CHAIRMAN: Okay. Anybody else wishing to testify on the eucalyptus question?

MR. WARSHAUER: My name is Rick Warshauer. I am testifying for the Sierra Club. Like the previous two conservation organizations I am, I applaud the use of eucalyptus for energy production, as long as it is on agricultural land. When you take forested land out of forest and put it into agricultural use, which is quite frequently, there are some problems that arise that are going to be, to lead to long-term negative effect. Let me use sugar cane production as an example.

The sugar cane which is grown just makai of the area results in a net loss of nutrients from the systems. There is erosion associated with the periods of bare soil with each cropping, and there's also nutrients taken out with the crops on each cycle. The same thing will happen with eucalyptus production.

In the use of cane lands, most of the nutrients has been deleted and everything that comes out of there

goes in as fertilizers. The same thing may happen to the lands above it, the forested land, once the top soil is eroded away and the nutrients are cropped out or eroded with the soil loss. What happens then is that fertilizers will be needed to retain production, and if this didn't happen, then it's likely to be uneconomical. Then if the area is uneconomical to grow eucalyptus we may lose the area for that purpose and it would be abandoned and grow back as a weed patch.

The point brought out by Mrs. Mull that this is, can be viewed as a pilot project for a much larger-scale operation by World Union land makes me worry that on a large scale we can lose a lot of watershed forest to a weed patch. If the nutrients are lost in the system from erosion and from cropping and not put in, the whole thing is abandoned, I think it's much more feasible that they grow the eucalyptus on abandoned cane land where they really can test the economics in a realistic situation with soil that has been depleted already by cropping and erosion.

As pointed out earlier, there's a lot of cane land coming up for grabs these days. And there's likely to be a lot more as plantations are giving signs that they are going to go out of business one after another. I really feel that the Board ought to consider denying

the application and suggesting as an alternative sugar cane lands. If it can't come up with cane right away, then on C. Brewer land perhaps they should look for other land to utilize such as land that has gone out of productic either in Kohala or Puna. That is all.

THE CHAIRMAN: Any questions of this witness?

(No response.)

Thank you very much.

Anyone else on this particular application?

MR. CRABB: My name is Thomas Crabb. I am present managing the Bio-Energy Development Corporation, a project that is being funded by the Department of Energy. Listenir to the conversations or the testimony, I would like to maybe elaborate on some points or possibly clarify some points for you.

As a matter of background, we now have 535 acres planted to date. All of this is in abandoned cane land and marginal cane lands areas. Except for 45 acres in an agricultural-zoned forest area. I do not want to leave the impression here that Bio-Energy is not looking at abandoned cane lands or marginal cane lands.

We have broken the study down into three categorie and that not only includes the marginal and abandoned cane lands but wastelands, also reforested lands. The information we gather in all of this could be applicable

to the whole area, and we are, we have to find out or we would prefer finding out what it takes and what it costs to get into forested areas. Because there could be some available that could be made to good use.

So it's all part of the total project, not only learning the technical feasibility of growing the trees but also getting the economics on it. The economics will dictate what C. Brewer will do. There is not much question on that. There is no question abandoned cane lands at the moment appear to be the cheapest, simply because of the land being cleared for harvesting of cane and access roads already available to the area.

The wasteland costs a little more, simply because roads have to be built into it and clearing costs a little more. Now the forested area, there is no question it will be the most expensive because of the higher clearing costs and the road building, the access roads. But we have to find out all this, and this is part of the total objective of the project.

So this is why we are requesting that we get into this 341 acres, to help us, you know, to reach this goal of finding out just what it entails to grow the trees in the area, and what it would cost. And this is the bottom line figure, what it would show.

I just kind of wanted to clarify that. I agree

with the other speakers that it would be nice to stay in abandoned cane lands and marginal cane lands. And it's easy to say Brewer should just take land out of cane. But I think most of us really realize right now that just recently Maunakea, through the president of C. Brewer, Dr. Byers, has already spoken of a reduction in acreage of cane and putting in macadamia nuts. We have an ongoing study on eucalyptus, and there's no question that this looks like it's economically feasible or viable project or a way to go. I am sure Brewer is looking at it very seriously right now.

But we are not in a position to do that. We are still trying to obtain the cost and benefit figures and the knowledge of these areas so that we can come to that type of a decision. That is all I have. Thank you.

MR. HIGASHI: I have one question, Mr. Crabb. If the project is not feasible on that piece of property and after it is cleared, would Brewer, if the condition were imposed that this area be reforested to the satisfaction of the Forestry Division, would you work with that?

MR. CRABB: I think to alleviate the fears I believe Ross brought that up, but to alleviate the fears of those that we get in there and then leave the acreage open, this is not the intent. We will only clear and plant what we have agreed to on an annual basis. This

area, we are scheduled to hopefully get 30 acres in up there. This would be the first part of getting into that area. We have funding for it from the Federal Government. We have bids out and awards already, bid awards being made to people to get in there and do the work.

It is not the idea of getting in there and not completing it. We get in and we clear it, we will plant. We will go ahead and continue operation of getting it back in the ground or getting it back into forested area.

THE CHAIRMAN: Mr. Crabb, what if the application is denied, what happens to your project?

MR. CRABB: It would eliminate the knowledge which we are hoping to gain up there. We would have to look for some alternative source. We are committed to, we were committed to 900 acres up until the beginning of this year. That will be revised slightly, simply because we have approval to sizedown the project due to the lack of funding.

We are supposed to put in 200 acres this year. It will be sized down, so 120 acres or so depending on what the funding is going to be next year it may be sized down again.

So we would have to be looking at some alternative site. But we would like information that we hope to gain in this area. That is one of our goals or objectives

of our agreement.

MR. ING: How much acreage do you plan to plant on an annual basis?

MR. CRABB: Right now?

MR. ING: If this CDUA were allowed.

MR. CRABB: Do you mean on a commercial basis, Mr. Ing?

MR. ING: No, on an annual basis. You said you were going to plant X number of acres per year.

MR. CRABB: We are into the fourth year of a five-year agreement. And this fourth year we had scheduled 30 acres of this 341 acres. Next year we had scheduled 120 acres depending on funding, pending approval. So that at that point it's 30 acres this year and scheduled for 102 acres, I am sorry, next year, out of the 341, leaving a balance of somewhere around 230 acres. That would depend on what direction we go after this agreement is either terminated or extended by the Department of Energy.

MR. ING: What is the life of the agreement?

MR. CRABB: The life of the agreement is five years. It expires at the end of 1983, next year. And it's on an annually funded basis. It's not a five-year blanket. It's not a five-year guaranteed program. It is verbally agreed-on money set aside, but we have to

come in annually and request funding that is available to us only on completion of our milestone objectives, what we had said we would accomplish in our research program.

It's not a blank check. We have to gain, or we have to reach these objectives or goals that we set in our research program.

MR. ING: I think one of the factors that we should consider in light of the public comments is whether we should allow, should we decide to go that way, the entire 341 acres. If your plan over the next two years is only to cultivate and plant what would amount to 132 acres over the next two-year span of the agreement that expires in 1983, maybe we ought to consider something less than the entire 341 acres.

What do you say to that? And then if necessary you can come back in and by this time we will know whether or not the project is going to be feasible economically and some of these other questions would be answered. Yet it would limit the area that you proposed to use in this Conservation District to half of what you are now seeking.

MR. CRABB: Well, as I said, to the end of the agreement of next year we are scheduled to plant somewhere around 132 acres. And that would be required to fulfill our agreement. What you are suggesting is a possible

alternative, although it's kind of half a pie, so to speak. And it would not be what I would want. But it would be acceptable.

THE CHAIRMAN: Any other questions?

(No response.)

Anybody else on the biomass energy development project?

MR. HIGASHI: I would like to --

MR. HONG: Roger, I don't see any comments from our Forestry Division. I would really like to see what their comments are.

MR. EVANS: We have not received any comments as of this evening on it. We have as a matter of course contacted our Forestry Division and Forestry will be responding with specific comments. They will be placed in the submittal when it does finally come to the Board. Those comments will be considered in terms of the staff analysis. You will have an opportunity to view for yoursel the comments from the Forestry Division.

MR. HONG: Thank you.

MR. HIGASHI: I would just like to say one thing, Mr. Chairman. I have heard a lot of testimony and interesting things brought out. I would like to request that the testimony tonight be included in the EIS to answer some of the questions that were brought up tonight, some

of the concerns. The EIS is still being circulated and I think to give them some time still to respond to some of the questions in their final submittal.

MR. EVANS: Staff can see that that is taken care of, Mr. Higashi.

THE CHAIRMAN: Thank you.

I will call a recess at this time.

(Whereupon the meeting was adjourned.)

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STATE OF HAWAII)
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CITY AND COUNTY OF HONOLULU)

I, SUSAN S. HEASSLER, Notary Public in and for the State of Hawaii, do hereby certify:

That on Wednesday, March 24, 1982, the foregoing proceedings were reported by me in machine shorthand at the time and place stated herein; and were thereafter reduced to typewriting under my supervison; that the foregoing is a true and correct transcript of the proceedings.

I further certify that I am not attorney for any of the parties hereto nor in any way interested in the outcome of the pending cause.

Dated this _____ day of April, 1982, at Honolulu Hawaii.

SUSAN S. HEASSLER
Notary Public, State of Hawaii
My commission expires January 1, 19