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DIVISION OF FORESTRY AND WILDLIFE
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August 27, 1997
OFFICE OF ENVIRONMENTAL
QUALITY CONTROL

Mr. Gary Gill, Director
Office of Environmental Quality Control
236 South Beretania Street Suite 702
Honolulu, HI 96813

Dear Mr. Gill:

Subject: Negative Declaration for Kalalau Rim Endangered Plant Exclosure and
Outplanting Site TMK 1-4-01 Waimea, Kauai

The State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife has reviewed the comments received during the 30 day public comment period which began on OEQC Bulletin Publication date June 23, 1997. The agency has determined that this project will not have significant environmental effect and has issued a negative declaration. Please publish this notice in the September 23, 1997 OEQC Bulletin.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the final EA.

Please contact Mr. Thomas C. Telfer at (808) 274-3433 if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael G. Buck".

for Michael G. Buck
Administrator

enc.

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1997-09-23- KA- FEA- Kalalau Rim
Endangered Plant Exclosure & Outplanting Site
FINAL ENVIRONMENTAL ASSESSMENT

SEP 23 1997
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KALALAU RIM ENDANGERED PLANT EXCLOSURE & OUTPLANTING SITE
WAIMEA, KAUAI

Submitted in Accordance with
Requirements for Chapter 343, HRS

Department of Land and Natural Resources
Division of Forestry and Wildlife
Kauai District

September, 1997

FINAL ENVIRONMENTAL ASSESSMENT

Proposed Action : Kalalau Rim Endangered Plant Exclosure and Outplanting Site
Applicant : Department of Land and Natural Resources
Division of Forestry and Wildlife, Kauai District
Location : Waimea, Kauai
TMK: 1-4-01 (M.O.U. with Division of State Parks)
Determination : EIS REQUIRED _____ NOT REQUIRED X
Approving Agency : Board of Land and Natural Resources

Agencies and Organizations Consulted or Contacted
in Preparing this Assessment

Federal : Department of the Interior, U.S. Fish and Wildlife Service
State : Department of Land and Natural Resources
Division of State Parks
Division of Forestry and Wildlife
Kauai Aquatic Life and Wildlife Advisory Committee
Division of Historic Sites
Division of Conservation and Resources Enforcement
Organizations: National Tropical Botanical Gardens
: Koke'e Natural History Museum
: Kauai Hunting Association

SECTION 1

DESCRIPTION OF THE PROPOSED ACTION

A. Technical Characteristics:

The Kauai District of the Division of Forestry and Wildlife has a wide range of natural resource management responsibilities, including the protection of watersheds, development and maintenance of recreational trails and wildland use facilities, protection and enhancement of threatened and endangered wildlife and plants, natural areas, and administration of public hunting programs. One of the most challenging responsibilities is the protection of an ever growing list of plants that have become threatened or endangered as a result of a variety of factors including: noxious weed overgrowth, new insect and disease pests, ungulate browsing and trampling, loss of native insect pollinators, human development and natural disasters, such as hurricanes and fires.

Many survivors of rare native plants are found in the moist, mid-elevation habitat typical of Kalalau Rim and the upper Koke'e forested areas of Kauai at about 4,000 feet elevation. These plants have remained naturally in very small numbers, and are located in sites that are extremely vulnerable to a multitude of threats. They are difficult to protect physically with fences because of precipitous cliff habitat in which they exist. There is severe overgrowth of some fast spreading non-native weed plants, and there is damage caused by the browsing and trampling of ungulates including: Feral pigs, feral goats and black-tailed deer. The remnants of several rare plant species are dispersed over a wide area of degraded habitat making it impossible to physically protect each individual plant or plant colony because of the steep nature of the terrain and the multitude of problems confronting them.

One of the strategies that the Division of Forestry and Wildlife has adopted for rare plant preservation, is to develop fenced out-planting sites. Within these fenced areas, ungulate damage can be most effectively and economically controlled. Non-native weed overgrowth can be more effectively and economically controlled where manpower has easy and regular access. If insect and disease control are found to be necessary, it will be much easier to apply remedial care, if the plants were located where they can be regularly monitored and treated.

The Division of Forestry and Wildlife, D.L.N.R. proposes to construct a 11.5 acre seven foot high fenced enclosure within Koke'e State Park to protect native and rare plant specimens from destruction by a variety of inimical factors. The site will be incrementally cleared of non-native weeds, and used for an outplanting site for several rare plant species that will be propagated and "hardened" at the nearby Koke'e Mid-elevation Plant Nursery. The site will act as a sanctuary where the well being of these plants can easily be monitored and cared for by DOFAW and DOSP staff and supervised volunteer groups. It will have long term potential for interpretive use by the public, because it is readily accessible from the highway within Koke'e State Park.

The enclosure fence itself will be constructed of treated wood fence posts every 100 feet with appropriate corner or line braces every 200 feet. Between each wooden post, there will be nine hot-dipped galvanized metal "T" fence posts located on ten foot centers. The fencing will be seven feet high, and constructed of two 48 inch rolls of galvanized hog wire (overlapped one foot), with a double strand of barbed wire fastened at ground level to exclude feral pigs. The seven foot high fence is necessary to effectively exclude black-tailed deer that are known to easily clear shorter fences.

The vegetation along the fenceline will be cleared in a six to eight foot wide strip to accommodate fence construction. Depending upon the type of vegetation requiring removal, a very small tractor may be necessary to clear a route for proper fence building. In some cases, where a large amount of hurricane debris, and weed overgrowth must be removed, a tractor mounted chipper and brush mulcher may be used to eliminate vegetative material along the fence line. The weed overgrowth is too voluminous in some areas to effectively clear by hand.

Once the 11.5 acre enclosure is completed, the area within will be incrementally cleared of non-native vegetation, leaving significant native plants intact. Native rare and endangered plants, typical of this habitat will be produced at the Koke'e Mid-elevation Nursery, now under construction within one mile of the Kalalau Rim endangered plant enclosure and outplanting site. It is intended as a propagation and "hardening" facility for rare native plants that will be transplanted into the enclosure. Many rare plants to be grown there have specific rainfall, temperature and soil requirements similar to the proposed enclosure site.

Aggressive weed regrowth is anticipated, and will be a serious concern. A portion of the enclosure may be set aside for the composting of weed materials cleared from the forest. Volunteer groups with adequate supervision will be assigned specific areas within the enclosure to regularly weed, in order to encourage vegetation to return to as pure native conditions as possible. It will not be possible for the entire enclosure area to be immediately cleared of all exotic plants and re-planted with native species. It will be a long term process and may take considerable time to accomplish even a small area of forest restoration. Many important non-endangered native plant species typical of the area will also be protected within the fence.

The location of the Kalalau Rim Rare Plant Enclosure and Outplanting Site has another potential benefit. Because of its location between the Kalalau Valley, and Puu O Kila visitor lookouts, there is good potential for future guided nature walks, or other interpretive uses of the area. This locality is easily accessed by the public, and would provide an excellent opportunity for people to see and enjoy the unique diversity and unusual rare plants that they otherwise would never have the opportunity to see. It could assist in developing public support for the costly job of maintaining these plants for perpetuity. Volunteer groups involved in an "adopt a plot" program within the enclosure, could develop a sense of public "ownership" in the native plant protection program.

B. Socio-economic Cost:

The cost of fence construction is estimated at \$25,000; the materials and labor of which will be purchased through local vendors. Funding for the project will come from Federal sources including a grant provided from a U.S. Forest Service Hurricane Recovery Grant, and from special Federal and State funding set aside for the protection of threatened and endangered species. No negative economic impacts are expected as a result of the project. The construction project is expected to provide approximately 80 - 100 person days of labor to Kauai residents. The long term benefits of the project would benefit the community socially and economically, by providing a resource that could be used for educational and interpretive display of native rare plants.

C. Environmental Characteristics

The project site is an approximate equilateral triangle (1,000 feet on a side) located on 12 acres of relatively flat land that projects out from the rim of Kalalau Valley. The elevation is 4,100 feet. The topography is gentle, but includes some small hillocks and ravines. Soils are classified within the "Koke'e" Series, and are described as "non-stony, deep (over 30 inches), moderately fine in texture, well-drained, and very dark brown to dark brown" (Land Study Bureau, U. of H., 1967). Rainfall averages 60 to 70 inches annually (with fog).

The project site falls within vegetation zone C₂ (after Ripperton and Hosaka, 1942) and consists of native ohia montane wet forest, with an understory predominated by false staghorn fern, and a variety of other native and introduced plants. A botanical survey was conducted under a contract by the Hawaii Division of Forestry and Wildlife, D.L.N.R. to The Hawaii Natural Heritage Program, The Nature Conservancy. A copy of the Biological Database & Botanical Field Survey of Kalalau Rim, Island of Kauai is appended to this document.

Severe disruption of the forest overstory resulted from Hurricane Iniki which occurred in September 1992. The subsequent opening of the overstory has enabled the spread and overgrowth of several noxious weed plants including: Daisy fleabane (*Erigeron karvinskianus*), blackberry (*Rubus penetrans*), and firebush (*Myrica faya*), among many others. Although several endangered plants were identified in the T.N.C. Botanical Field Survey on the steep cliffs outside of the proposed outplanting enclosure, no listed plants were located within the area of the proposed enclosure. The fence is not intended to protect those listed plants growing in situ on the adjacent cliffs, but will serve as a refuge for outplanting these same species where they can be more easily protected from herbivores, weeds, and other limiting factors.

The fauna found within the area includes a variety of introduced mammals including the feral pig (*Sus scrofa*), feral goat (*Capra hircus*), black-tailed deer (*Odocoileus hemionus columbianus*), black rat (*Rattus rattus*), Polynesian rat (*Rattus exulans*), Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), feral cat (*Felis*

catus) and occasionally feral dogs (*Canis domesticus*). Only one native mammal exists within the area, the endangered Hawaiian bat (*Lasiurus cinereus semotus*). A list of introduced, endemic, and indigenous birds found in the area is appended to this report. During the past twenty years, no confirmed observations of endangered birds have been made within the immediate project vicinity; however, there was an unconfirmed sighting of the Nukupuu (*Hemignathus lucidus*) at Kalalau Lookout in the late 1970's (one half km to the west), and more recently, on 18 January 1995, a visiting "novice to intermediate birder" reported seeing a Nukupuu about 3 kilometers to the east of the project site on the Alakai Swamp Trail. Puaiohi (*Myadestes palmeri*) too have been sighted in the last decade on the Alakai Swamp Trail on a few occasions. The presence of listed forest birds is a possibility within the project site, but these birds have become so critically rare in recent years, that the likelihood of them being found at the project site is very low, owing to the forest degradation that has taken place as a result of weed infestation and overstory damage that occurred as a result of Hurricane Iniki.

SECTION II

DESCRIPTION OF THE AFFECTED ENVIRONMENT

A. Use:

The land area is located near the terminal end of the highway within Koke'e State Park, Kauai, between the Kalalau and Puu O' Kila visitor Lookouts. The area is primarily an aesthetic element of the park, but is not intensively managed. The adjacent cliff area has been designated by the Division of Forestry and Wildlife as a portion of Hunting Unit "K", which is limited to archery only for the taking of feral goats and pigs. The steepness of the terrain however, provides very little safe hunting opportunity. Firearm hunting is prohibited because of safety concerns for other users in the park. The proposed exclosure site itself is inhabited by feral pigs and black-tailed deer, but hunting is not permitted because of its proximity to the public highway and visitor viewpoints. There are dozens of "Kokee" plum trees that were planted along the roadside many years ago, which produce an abundant fruit crop enjoyed by the public. Permits are issued by the State Parks Division for plum picking during the summer months, but this use is limited to those areas just off the highway.

B. Utilities:

There are no utilities. It is wildland portion of Koke'e State Park.

C. Access:

The project site lies immediately north of and adjacent to about 1,000 feet of the Puu O Kila Road. There are several short but unmaintained foot trails by which residents gain access to the plum trees that parallel the highway. There are no other

maintained access routes at the site. Access for fence building and maintenance will need to be developed by a path directly off the highway, but no permanent vehicular access is planned. In the event that future public interpretive use is made of the plant enclosure, there is sufficient road shoulder along the highway for development of parking space, as well as a larger roadside clearing on the southern side of the highway that could eventually be developed for public parking. At this time however, no public use or parking is planned, because the main objective of this project is to provide a secure outplanting site for several mid-elevation native endangered plant species. Such public use facilities, if deemed desirable in the future, would need to be planned and implemented by the Division of State Parks, which manages public uses within the park.

D. Vegetation:

See Appendix "D": "Biological Database & Botanical Field Survey of Kalalau Rim, Island of Kauai" by Hawaii Natural Heritage Program, The Nature Conservancy of Hawaii, January 1995).

E. Topography:

The project site consists of about 12 acres of mostly flat ground interspersed with some small hillocks and ravines. The elevation is 4,100 feet above sea level. Soils are classified within the "Kokee" Series, and are described as "non-stony, deep (over 30 inches), moderately fine in texture, well-drained, and very dark brown to dark brown" (Land Study Bureau, U. of H. 1967).

F. Historic or Archaeological Site Plans:

See Appendix "E": "Archaeological Reconnaissance Survey of a Portion of Kahuama'a Flat, Koke'e State Park, Hanalei District, Island of Kauai" by Alan Carpenter and Martha Yent, D.L.N.R. Div. of State Parks, February 1994).

G. Fauna:

See Appendix "C": "Faunal Survey of the Proposed Kalalau Rim Endangered Plant Enclosure and Outplanting Site" by Tom Telfer, DLNR, November 1996).

SECTION III

IMPACTS AND ALTERNATIVES TO THE PROPOSED ACTION

Identification and summary of major impacts and alternatives: There are three impacts that may be considered significant: (A) Disruption from fence building, weeding and the unavoidable removal of some native plants, (B) disposal of the weedy vegetation

removed, and (C) aesthetic considerations within Kokee State Park.

A. Short Term Impact: Disruption of wildlife and removal of some native plants.

"The Biological Database & Botanical Field Survey of Kalalau Rim" prepared by the Hawaii Natural Heritage Program, The Nature Conservancy, identified a large list of native plant species as well as many non-native species. No listed endangered plants were identified within the portion of Kahuama'a Flats that will be used for enclosure construction; however, because the area is overgrown with a large variety of native plants and weeds, care will be needed when clearing fencelines, and weeding the site after the fence is constructed. Botanists and foresters familiar with these plants will need to monitor and oversee the work done. Removal and disruption of some native plant species will be unavoidable while building the fenceline, but will be kept to a minimum. The disruption of wildlife would be very localized, and temporary in nature.

a. Alternative: The only alternative would be not to construct the enclosure fence, not to weed the invasive non-native plant species within the enclosure, and not to out-plant native and rare endangered plant species propagated from wildlings and nursery stock. This alternative is unacceptable in our opinion, because such an out-planting enclosure is the only feasible way to preserve some endangered plant species. No other practical means is available to protect these plants from ungulate damage. Ungulates are and will continue to be controlled within the area of endangered plants known to exist outside the proposed enclosure on Kalalau Rim by public archery and staff control.

B. Short Term Impact: Disposal of the weedy vegetation removed.

The proposed enclosure is filled with a large variety of non-native invasive weeds including: New Zealand laurel (*Corynocarpus laevigatus*), daisy fleabane (*Erigeron karvinskianus*), white ginger (*Hedychium coronarium*), yellow ginger (*Hedychium favesces*), kahili ginger (*Hedychium gardnerianum*), Japanese honeysuckle (*Loneria japonica*), firetree (*Myrica faya*), banana poka (*Passiflora mollissima*), strawberry guava (*Psidium cattleianum*), firethorn (*Pyracantha angustifolia*), prickly Florida blackberry (*Rubus argutus*), glory bush (*Tibouchinia urvilleana*), airplant (*Kalanchoe pinnata*) wild strawberry (*Fragaria vesca*), and others. Following completion of fence construction, large amounts of weedy-vegetation will need to be removed by hand, some mechanically (chain saws and a chipper/mulcher). This will be done incrementally as needed, to encourage the protection of existing native plant species from weed overgrowth, as well as to provide space for outplanting of endangered plants reared in the Koke'e Mid-elevation Nursery. Limited use of herbicides may be necessary to control some particularly aggressive weeds, such as daisy fleabane, or injections of stumps to systemically kill some persistent alien tree species such as firetree. A brush chipper/mulcher will be used to reduce the volume of material for composting. Several small ravines within the enclosure area that are overgrown with blackberry could be used for composting of this material, and would additionally restore the soil that was once lost due to past erosion.

a. Alternative: The only alternative is to remove all weed material cleared from the site and haul it to a sanitary landfill or other composting site. This alternative however would be extremely expensive and disruptive, because it would require heavy equipment to enter the area for loading and hauling.

C. Long Term Impact: Negative aesthetic impacts on Kokee State Park.

The construction of the 11.5 acre enclosure fence may have a negative long term impact on Kokee State Park, in that some portions of the seven foot high fence may be visible from the highway or lookouts. However, it is planned for there to be a minimum set-back of 50 feet from the road shoulder, so that the fencing would be screened as much as possible from the highway view by the existing vegetation. The fencing materials to be used should weather significantly, and not be very noticeable to the casual observer. If necessary they could be painted to blend into the surroundings. The fifty foot setback would also allow the public to enjoy and utilize the fruit of the Kokee plum trees that grow parallel to the highway, and yet not allow them into the enclosure where the native forest restoration is the major aim. The benefits of constructing the enclosure and restoring native forest will far outweigh the negative impact of visual degradation, and in the long term could enhance the aesthetics of the park as an interpretive area.

a. Alternative: One alternative is to plant native tree species along the roadside outside the enclosure fence to reduce the visibility of the fence from the highway. This alternative would involve clearing non-native vegetation closer to the road, so that native trees could be planted and maintained, probably creating a greater aesthetic disturbance. It would require the expenditure of additional manpower that is already in short supply, and would take many years to produce the desired results because of the slow growth of the native trees that could grow there.

b. Alternative: A second alternative is not to build the enclosure fence. This alternative would result in not being able to fulfill the objectives of preserving and outplanting threatened and endangered plant species adapted to this type of habitat.

c. Alternative: A third alternative is to construct the outplanting enclosure at a different site. Another location would in most cases require utilization of State Parks land, because this particular habitat type is not readily accessible in other areas. One of the advantages of the proposed site is that it is easily accessed by staff and volunteers who will be needed to maintain, weed and monitor the plants within the enclosure. Furthermore, the proposed site has the advantage of being less in conflict with other uses, such as public hunting, because hunting is not an appropriate use of the area. Also, the potential for future public interpretational uses of the enclosure may not be available at another site.

SECTION IV

PROPOSED MITIGATION MEASURES:

A. Mitigation for the disruption of wildlife and removal of some native plants.

Although this negative factor is unavoidable during fence construction, the numbers of native plants removed in comparison to the whole benefit of the enclosure for native plant protection would be minimal. Staff botanists and foresters will designate the fenceline, and monitor its clearing to ensure that threatened or endangered plants are not removed. If feasible, the less common native plants that require removal will be transplanted within the enclosure. No mitigation is possible for disruption of wildlife in the area, but the human activities involved will be short term and insignificant.

B. Mitigation for the disposal of weedy vegetation removed.

The large volume of weedy material removed from within the enclosure will be reduced in volume by chipping, mulching and composting within the enclosure. The compost will be deposited where soil has been lost due to past erosion and where no standing native forest exists. Eventually, these areas may be re-claimed for out planting and native forest restoration. If herbicides are used, they will be applied only under the supervision of a trained personnel, within the label restrictions, and only where they will not endanger existing native plant species.

C. Mitigation for the aesthetic value lost by construction of the enclosure fence.

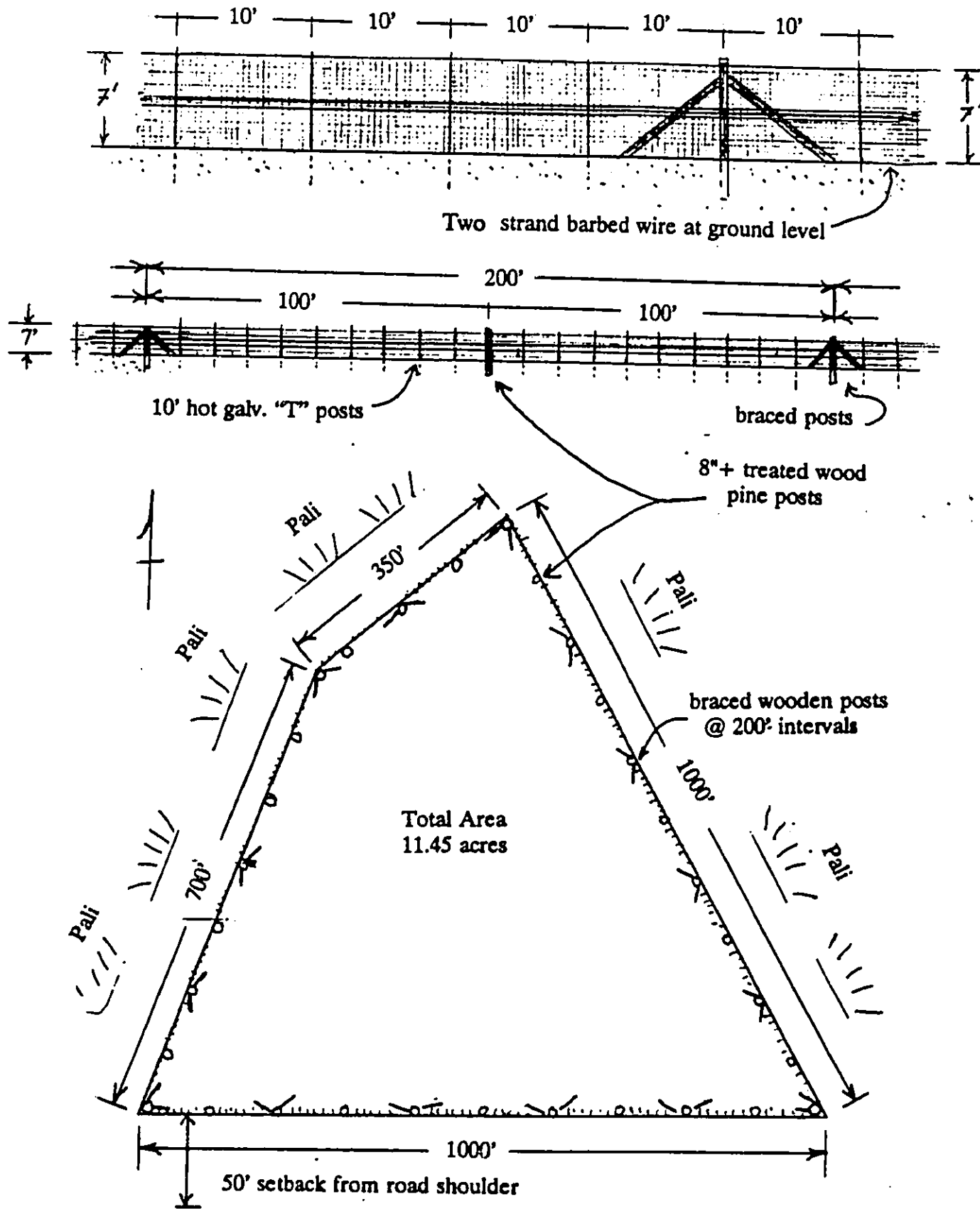
The enclosure will be set back a minimum of 50 feet from the highway. Existing vegetation will be left intact between the roadside and the enclosure to screen it from view. Visible fencing will be painted to blend into the environment if necessary. The access route from the Puu O Kila Road into the enclosure site will be designed with a "dog leg" so as to hide the fenced area from roadside view. The fencing will be far enough back from the roadside so as not to exclude the public from using the existing plum trees along the highway.

D. Additional Precautions:

In addition to the aforementioned impacts, there is a small potential for the discovery of unknown archaeological or human remains. If such remains are discovered during the construction of the enclosure or clearing of non-native weed plants, work in the area will cease and the Division of State Parks archaeological staff, and/or Burials Program of the State Historic Preservation Division will be immediately notified as recommended in Appendix "E".

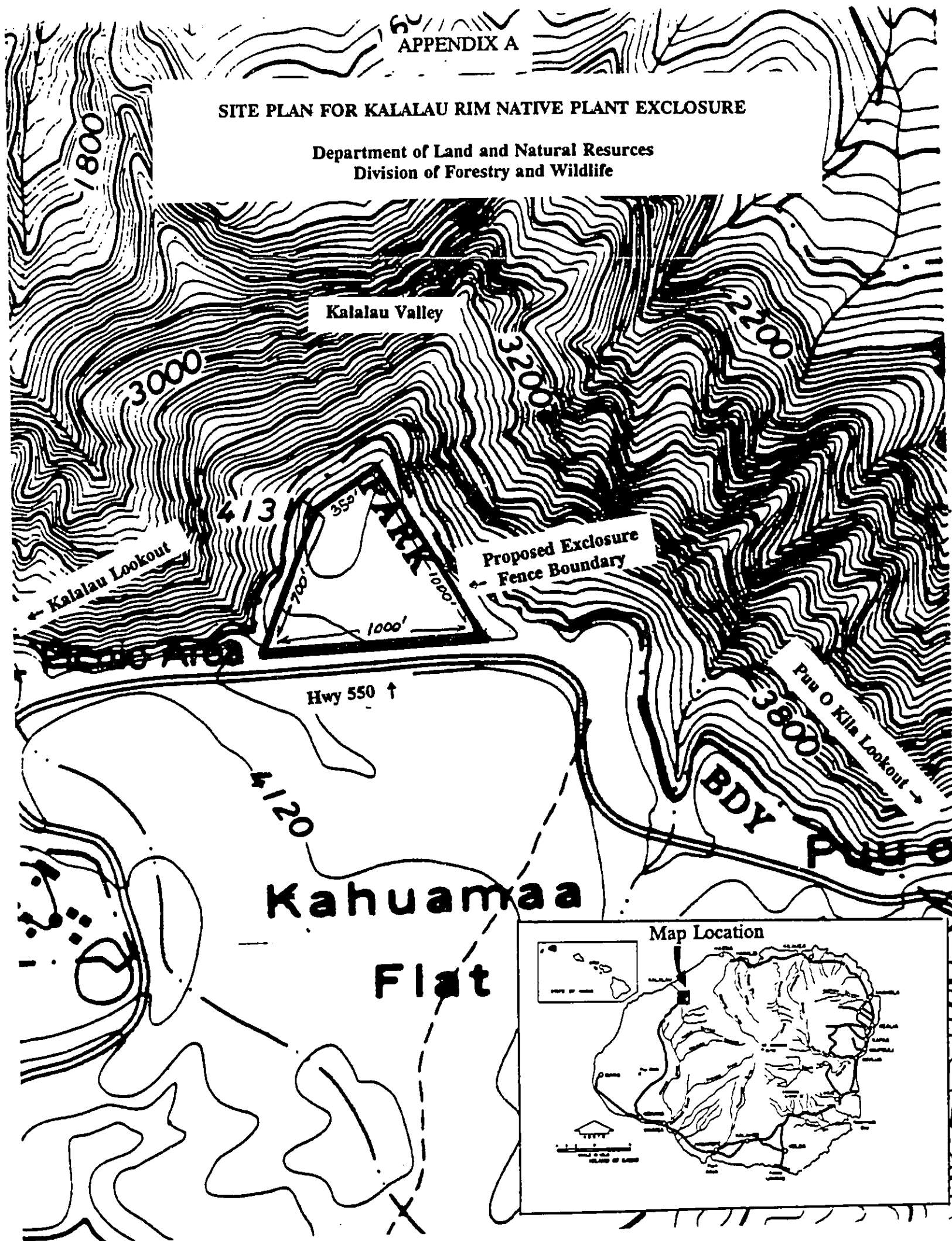
APPENDIX B

KALALAU RIM NATIVE PLANT EXCLOSURE DESIGN
Department of Land and Natural Resources
Division of Forestry and Wildlife



SITE PLAN FOR KALALAU RIM NATIVE PLANT ENCLOSURE

Department of Land and Natural Resources
Division of Forestry and Wildlife



APPENDIX C

Faunal Survey of the Kalalau Rim Endangered Plant Exclosure and Out-planting Site Koke'e State Park, Kauai

Thomas C. Telfer
District Wildlife Biologist
November, 1996

The proposed Kalalau Rim Endangered Plant Exclosure and Out-planting Site is located at 4,100 feet elevation near the terminal end of highway 550 within Koke'e State Park. The topography is generally flat with a few small hillocks and ravines. Vegetation is remnant native Ohia (*Metrosideros polymorpha*) wet forest that has become degraded as a result of encroachment by a large number of non-native weed plants. Damage to the forest overstory was moderate to severe as a result of hurricane Iniki that occurred in September, 1992. Much of the understory is covered with false staghorn fern (*Dicranopteris linearis*), but a considerable variety of native tree, shrub and understory plants still exist within the area. Several listed threatened and endangered plants occur on the steep cliffs on the rim and cliffs of Kalalau Valley, but none have been located on the proposed exclosure site. Feral pigs (*Sus scrofa*), black-tailed deer (*Odocoileus hemionus columbianus*), and feral goats (*Capra hircus*) inhabit the area, and are one of several negative impacts upon the native forest resources in the area.

Faunal surveys were conducted in the vicinity during the forest bird "calibration camp" on the upper Awaawapuhi Trail and Kaluapuhi trails nearby on February 22-23, 1994, and the general area is frequented by many bird-watching enthusiasts, because of its easy access. Native forest birds recorded in this locality include: 'Apapane (*Himatione sanguinea*), 'Amakihi (*Hemignathus virens*), 'Anianiau (*Hemignathus parvus*), 'Akepa (*Loxops coccineus*), 'Iiwi, (*Vestiaria coccinea*), 'Elepaio (*Chasiaempis sandwichensis*), and although not seen during the survey, the Kaua'i Creeper (*Oreomystis bairdi*) likely occurs in this forest on occasion. No endangered forest birds have been recorded in the immediate project vicinity in recent years, but in the late 1970's there was an unconfirmed sighting of the Nukupuu (*Hemignathus lucidus*) at the Kalalau Lookout one half km. to the west of the project site, and more recently, on 18 January 1995 a Nukupuu was reportedly seen by a "novice to intermediate" birder about three km. to the east of the project site on the Alakai Swamp Trail. Puaiohi (*Phaeornis palmeri*) have been recently seen in the upper Kawaikoi Stream drainage four to five kilometers to the east of the project site.

The locality of the proposed Kalalau Rim Endangered Plant Exclosure and Outplanting Site is on the margin of good native forest bird habitat, but degradation from hurricane damage, and heavy non-native weed infestation has reduced its utility to native birds. Furthermore, being on the edge of Kalalau valley, birds at this site are prone to the potential infection with avian malaria, and avian pox, transmitted by mosquitos that exist up to 4,000 feet. Birds using this area may inadvertently fly down

into the mosquito range or infected mosquitos are blown up with the prevailing winds from Kalalau Valley.

Other native fauna found in the vicinity include: the Pacific Golden Plover (*Pluvialis dominica*), Hawaiian short-eared owl (*Asio flammeus*), and birds of a recent transplant of the Hawaiian goose (*Nesochen sandvicensis*) have taken up residence in the area. The Hawaiian Bat (*Lasiurus cinereus semotus*) is known to occur one kilometer to the southwest of the project site at the Hawaii Air National Guard Radar Station, and likely resides in the forest surroundings.

Non-native birds known to use the area include: The H'wamei (*Garrulax canorus*), White-rumped Shama (*Copsychus malabaricus*), Red Junglefowl (*Gallus gallus*), Ring-necked Pheasant (*Phasianus colchicus*), Erckel's Francolin (*Francolinus erckeli*), Spotted Dove (*Streptopelia chinensis*), Japanese White-eye (*Zosterops japonicus*) Common Mynah (*Acridotheres tristis*), Northern Cardinal (*Cardinalis cardinalis*), House Sparrow (*Passer domesticus*), House Finch (*Carpodacus mexicanus*), Nutmeg Mannikin (*Lonchura punctulata*) and Barn Owl (*Tyto alba*).

Other than the aforementioned game mammals, non-native mammals in the area may include: Feral cats (*Felis catus*), Black rat (*Rattus rattus*), Norway Rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans*), and the house mouse (*Mus musculus*).

Reptiles and amphibians were not surveyed, but the Metallic Skink (*Leiopisma metallicum*), likely inhabits the area, and the Wrinkles frog (*Rana rugosa*) may inhabit the small drainages within the area.

Appendix D
Biological Database & Botanical Field Survey
of Kalalau Rim
Island of Kauai

DRAFT

Prepared for:

State of Hawaii
Division of Forestry and Wildlife
Department of Land and Natural Resources
Honolulu, Hawaii

Prepared by:

Hawaii Natural Heritage Program
The Nature Conservancy of Hawaii
Honolulu, Hawaii

January 1995

EXECUTIVE SUMMARY

In 1994, the Hawaii Division of Forestry and Wildlife (DOFAW) contracted with The Nature Conservancy's Hawaii Natural Heritage Program (HINHP) to provide botanical information for an area along the Kalalau rim on Kauai. The information provided is meant to assist with DOFAW land use planning and management of rare and natural resources in the project area. The area will eventually be fenced, and portions used for outplanting appropriate threatened or endangered plant taxa. On November 2-4, 1994 Hawaii Natural Heritage Program staff, accompanied by staff from the National Tropical Botanical Garden (NTBG), conducted a botanical field survey of the prescribed area. The primary objective of the botanical survey was to identify plant taxa within the project area and particularly note and document the presence of rare, threatened, or endangered taxa.

The Kalalau Rim survey area includes many native botanical resources. The HINHP database and survey of the area revealed 30 rare plant taxa. The area is largely occupied by montane wet forest.

Natural Communities: One native natural community, 'Ohi'a (*Metrosideros polymorpha*) Montane Wet Forest, was observed in the Kalalau Rim survey area. This community type is not considered rare. Two subtypes of 'Ohi'a Montane Wet Forest were observed: 'ohi'a/mixed shrub forest occupied the flat to gentle slopes along the Kalalau rim, while 'ohi'a/uluhe (*Dicranopteris linearis*) forest occupied the moderate to steep slopes at the head of the valley and along gulches.

Rare Plants: Thirty rare plant taxa have been reported from the Kalalau Rim survey area. Eleven of these are federally listed as endangered or threatened, and 11 are candidates or recommended candidates for listing as endangered or threatened. Thirteen of the previously documented taxa were observed in the study area during the HINHP survey. The rare plants occur throughout the survey area.

Management Concerns: The primary threats to the significant botanical resources of the Kalalau Rim survey area include non-native plants, and feral pigs and goats. The most important management needs are discussed.

Acknowledgements

Several organizations and individuals contributed information, guidance, and references for the botanical survey of the Kalalau Rim survey area. The Natural Heritage staff deeply appreciates their cooperation and support. In particular, we would like to thank Steven Perlman and Kenneth Wood who accompanied us during the field survey. We would also like to acknowledge the following organizations for access to their herbarium collections: Bishop Museum, National Tropical Botanical Garden, and the University of Hawaii's Botany Department and Harold H. Lyon Arboretum.

We are indebted to the many biologists, past and present, who have explored and documented the rich flora and fauna of the Hawaiian Islands. There are far too many to name, but their dedication to Hawaiian biology is deeply appreciated. Without their efforts, this report would not be possible.

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INTRODUCTION

In 1994, the Hawaii Division of Forestry and Wildlife (DOFAW) contracted with The Nature Conservancy's Hawaii Natural Heritage Program (HINHP) to conduct a botanical survey of the Kalalau rim area (referred to herein as the *Kalalau Rim survey area*) between Kalalau Lookout and Puu o Kila Lookout. Located in northwestern Kauai, the Kalalau Rim survey area (Figure 1) is approximately 113 acres. The purpose of the study is to: 1) identify all native and non-native plants present in the survey area, with emphasis on documenting rare, threatened or endangered plants; 2) identify natural communities; 3) describe and map any rare plant taxa, and rare natural communities expected or observed in the project area; and 4) list management concerns, including recommendations for any threatened or endangered plant taxa encountered. This report summarizes the methods used and the results of the field survey.

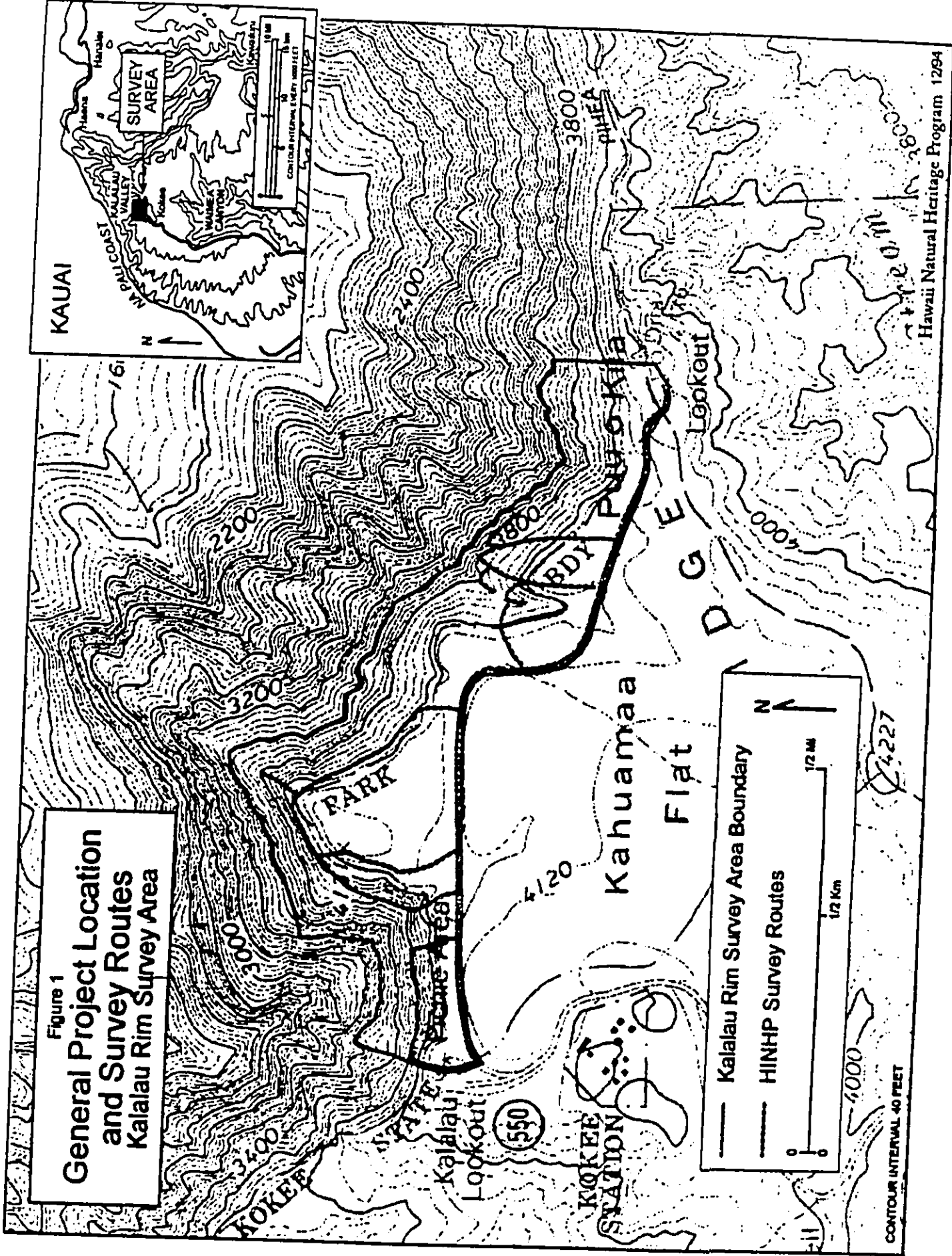
Data presented in this report are based upon an extensive body of available information derived from publications, documents, museum collections, reports and personal observations from knowledgeable individuals. The HINHP staff supplemented this information with a field survey of the Kalalau Rim survey area. From these data, HINHP updated the Natural Diversity Database on the location and condition of natural resources in the Kalalau survey area.

The Nature Conservancy's HINHP Natural Diversity Database is dependent on the research of many scientists and individuals. In most cases, this information is not the result of comprehensive site-specific field surveys, and has not been confirmed by HINHP staff. Many areas in Hawaii have never been thoroughly surveyed, and new plants and animals are still being discovered. Database information should never be regarded as final statements or substituted for on-site surveys required for environmental assessments. Data provided by the HINHP do not represent a position taken by The Nature Conservancy of Hawaii. If information from this report is distributed in any way, the above statement must accompany that information.

FOR MORE INFORMATION

The following documents can be consulted for additional information:

How to Read Heritage Database Reports (HINHP 1991). This booklet explains the methods used by Natural Heritage Program staff to document plant and natural community locations and other pertinent information in the database.



Biological Database for the Department of Land and Natural Resources, Division of Forestry and Wildlife, Kalalau Rim Survey Area (HINHP 1994a). These data summarize, in the form of Element Occurrence Records (EORs), the available information for each location where a rare plant has been reported from the Kalalau Rim survey area. This includes a list of all information sources consulted for these records.

This report contains the most recent information on rare botanical resources of the Kalalau Rim survey area as of December 1994. If additional or updated information is needed at any time, the HINHP staff and database are available for consultation.

NOTE ON TERMINOLOGY AND HAWAIIAN DIACRITICAL MARKS

We have made a sincere effort throughout this report to minimize the use of technical terms and HINHP jargon; however, the use of a small number of unfamiliar biological terms is unavoidable. For example, most people are familiar with "rare species" but this term is often inappropriate. While rare plants and animals are sometimes rare species, they may also be rare subspecies or rare varieties of more common species. The term "rare taxa" is used to refer to species, subspecies, and varieties in this report. A glossary of technical terms is included at the end of the report to clarify terminology. If definitions are lacking for any unfamiliar terms or concepts contained in this report, please contact the HINHP staff for clarification.

This report uses the glottal stop in Hawaiian names of plants, animals, and geological features. The macron indicating long vowels is not used due to text processing limitations. While HINHP recognizes the importance of Hawaiian diacritical marks in place names as well, it has adopted a policy of excluding all marks from place names because U.S. Geological Survey (USGS) topographic maps do not include diacritical marks.

METHODS

Heritage Database: Prior to the survey, the HINHP Natural Diversity Database was consulted for records of rare plants and natural communities in the survey area. Any information on rare plant taxa or communities reported from the Kalalau Rim survey area was extracted and compiled. A review of aerial photographs of the survey area was used to evaluate the known and potential native natural communities there.

Botanical Field Survey: The primary objectives of the field survey were: 1) document all native natural communities, 2) search for previously unreported populations of rare plants, and 3) document damage by non-native animals and the presence of non-native invasive plants. The field survey was conducted on three consecutive days (Nov. 2-4, 1994) by an HINHP botanist and ecologist, assisted by two staff from the National Tropical Botanical Garden (NTBG) (Appendix B). Observations of natural communities and native and non-native plants were made, and a plant species list was prepared as the survey routes (Figure 1) were walked. Plant specimens were taken whenever confirmation of identification was needed. Information on damage by non-native animals and presence of non-native invasive plants was recorded along the survey routes, and other threats were noted where recognized.

A survey of the entire Kalalau area, and slopes greater than 60%, were not within the scope of this study. Our survey routes were chosen to search suitable habitat for unrecorded populations of rare plant taxa.

Limitations: As in most field surveys, the plant taxa recorded reflect the seasonal and environmental conditions extant during the survey. Certain taxa may not have been detectable during the survey period. The terrain was often steep, and sometimes difficult to traverse.

NATURAL COMMUNITIES OF KALALAU RIM SURVEY AREA

One native natural community was observed in the Kalalau Rim survey area, 'Ohi'a (*Metrosideros polymorpha*) Montane Wet Forest. This community type is not considered rare, but certain examples are known to include rare plants, birds, and invertebrates.

'Ohi'a Montane Wet Forest
Metrosideros polymorpha Montane Wet Forest
Heritage global rank: G3 (HINHP 1994c)

'Ohi'a-dominated forests above 905 meters (3,000 feet) elevation without canopy codominants and with understory dominated by a mix of fern and shrub species or uluhe mat ferns are known from the islands of Kauai, Oahu, Molokai, Lanai, Maui and Hawaii. It is one of the most widespread wet forest communities in the Hawaiian Islands. Three common subtypes of this community are recognized: 'Ohi'a/Mixed Shrub Lowland Wet Forest, 'Ohi'a/'Olapa (and/or Lapalapa) Lowland Wet Forest, and 'Ohi'a/Uluhe Lowland Wet Forest. Often these subtypes form complex mosaics on the landscape, with 'ohi'a/mixed shrub and 'ohi'a/'olapa forest more common on ridge tops and gentler slopes, and 'ohi'a/uluhe forest on moderate to steep slopes, and on slopes approaching lowland elevations.

Dominance of 'ohi'a is the consistent factor in the subtypes. 'Ohi'a trees are the most abundant, but other trees frequently seen are manono (*Hedyotis terminalis*), mehame (*Antidesma platyphyllum*), kolea (*Myrsine lessertiana*), and 'ohi'a ha (*Syzygium sandwicensis*). Hapu'u (*Cibotium* spp.), mamaki (*Pipturus* spp.), naupaka kuahiwi (*Scaevola* spp.), and na'ena'e (*Dubautia* spp.) may also be found here. In the 'ohi'a/mixed shrub subtype, a rich shrub and fern layer including such species as pu'ahanui (*Broussaisia arguta*), kamaakahala (*Labordia* spp.), manono (*Hedyotis* spp.), pilo (*Coprosma* spp.), and alani (*Melicope* spp.) is present. This subtype often includes rare understory species. In the 'ohi'a/'olapa (or lapalapa) subtype, species of *Cheirodendron* (generally 'olapa, *C. trigynum* or lapalapa, *C. platyphyllum*, among others) are co-dominant with 'ohi'a in the canopy. 'Ohi'a/uluhe forest is the simplest of the three subtypes, with uluhe (*Dicranopteris linearis*), and in some places uluhe lau nui (*Diplopterygium pinnatum*), forming a dense ground cover under the 'ohi'a canopy, generally 0.5 to 1.5 meters deep. Native trees and shrubs are scattered throughout this layer of matted ferns.

In the Kalalau Rim survey area, two subtypes of 'ohi'a montane wet forest were observed: 'ohi'a/mixed shrub forest and 'ohi'a/uluhe forest. 'Ohi'a/mixed shrub forest was observed on the plateau and valley walls. In the lower elevations of the survey area it has been degraded by goat activity, resulting in a rather open understory. The 'ohi'a/uluhe forest subtype was seen on the plateau and extending over the rim. The 'ohi'a canopy in both forest subtypes was closed to open, ranging from 5 to over 10 meters in height. Other common trees observed included 'olapa and lapalapa (*Cheirodendron* spp.), kawa'u (*Ilex anomala*), and 'ohi'a ha (*Syzygium sandwicensis*). The native shrub and fern layer was rich, including shrubs and small trees of pukiaawe (*Stryphella tameiameia*), 'ohelo

(*Vaccinium calycinum*), 'a'ali'i (*Dodonaea viscosa*), kalia (*Elaeocarpus bifidus*), pilo (*Coprosma* spp.), olomea (*Perrottetia* spp.), na'ena'e (*Dubautia* spp.), alani and mokihana (*Melicope* spp.), 'ohe (*Tetraplasandra waimeae*), 'akia (*Wikstroemia oahuensis*), pu'ahanui (*Broussaisia arguta*), kamakahala (*Labordia waialealae*), and naupaka (*Scaevola* spp.). The fern layer was also relatively rich, including other *Elaphoglossum* spp., *Dryopteris* spp., wahine noho mauna (*Adenophorus* spp.), 'akolea (*Athyrium microphyllum*) and ho'i'o (*Diplazium sandwichianum*), moa (*Psilotum complanatum*), and *Asplenium* spp. Where uluhe mat ferns (*Dicranopteris linearis*, *Sticherus owhyensis*, and *Diplopterygium pinnatum*) were dominant, they made up over 75% of the understory. Native herbs, vines, and sedges were also observed, including 'ala'alawainui (*Peperomia* spp.), pa'iniu (*Astelia argyrocoma*), hulurnoa (*Korthalsella cylindrica*), *Carex wahuensis*, ma'ohi'ohi (*Stenogyne purpurea*), maile (*Alyxia oliviformis*), and hoi kuahiwi (*Smilax melastomifolia*).

RARE PLANTS OF THE KALALAU RIM SURVEY AREA

Hawaii is known for the high level of endemism of its native flora. The native flowering plant flora of Hawaii consists of 1,094 taxa, 91% of which occur only in Hawaii (Wagner *et al.* 1990). Seventy-five percent of the 158 Hawaiian native fern and fern ally taxa are restricted to Hawaii (Wagner and Wagner 1992).

Thirty rare plant taxa are reported from the Kalalau Rim survey area (Table 1), all of which are endemic to the Hawaiian Islands. More than half of the rare plant taxa are endemic to Kauai. Appendix A lists all the vascular plants recorded from within or near the Kalalau Rim survey area.

FEDERAL STATUS

Eleven of the 30 rare plant taxa of the Kalalau Rim survey area are federally listed as endangered or threatened (USFWS 1994a,b). All federally listed plants (threatened and endangered) on all lands within the state are also protected by Hawaii State Law (H.R.S. 195-D). Eleven other rare plant taxa are candidates or recommended candidates for listing as endangered or threatened (USFWS 1994b; M. Brueggmann, pers. comm., 1994).

HERITAGE GLOBAL RANKS

According to HINHP's global ranking system (Table 1), 23 of the 30 rare taxa are critically imperilled (currently known from five or fewer occurrences in the world; ranked G1 or T1). The remaining seven rare taxa are more widespread and abundant but are still considered imperilled with global extinction; these are ranked G2 (HINHP 1994c).

DISTRIBUTION

The rare plants occur throughout the survey area. Of the 30 rare plants known to occur in the survey area (Figure 2), 13 were observed during this survey, and 15 others have been observed in the survey area within the last five years. Detailed accounts for each are presented below.

Table 1. Rare Plants* of the Kalalau Rim Survey Area.

SCIENTIFIC NAME ¹	TAXONOMIC CATEGORY ²	COMMON NAME	FEDERAL STATUS ³	HERITAGE GLOBAL RANK ⁴
<i>Asplenium hobdyi</i> W.H. Wagner	F, Aspleniaceae		None	G1
<i>Chamaesyce remyi</i> (A. Gray ex Boiss.) Croizat and Degener var. <i>remyi</i>	D, Euphorbiaceae	'Akoko, kokn, kokomalei	C2	G2T1
<i>Cyanea recta</i> (Wawra) Hillebr.	D, Campanulaceae	'Oha, haha, 'ohawai	recommend. C1	G1
<i>Dubautia laevigata</i> A. Gray	D, Asteraceae	Na'ena'e	None	G1
<i>Dubautia microcephala</i> Skotts.	D, Asteraceae	Na'ena'e	C2	G1
<i>Eurya sandwicensis</i> A. Gray	D, Theaceae	Anini, wanini	C2	G2
<i>Exocarpos luteolus</i> C. Forbes	D, Santalaceae	Heau	LE	G1
<i>Hedyotis tryblium</i> Herbst & W.L. Wagner	D, Rubiaceae		C2	G1
<i>Lepidium serra</i> H. Mann	D, Brassicaceae	'Anaunau, naunan, kunana	C2	G1
<i>Lobelia niihauensis</i> St. John	D, Campanulaceae	'Oha, haha, 'ohawai	LE	G2
<i>Lobelia yuccoides</i> Hillebr.	D, Campanulaceae	'Oha, haha, 'ohawai	None	G2
<i>Lysimachia kalalauensis</i> Skotts.	D, Primulaceae		C2	G1
<i>Melicope pallida</i> (Hillebr.) T. Hartley & B. Stone	D, Rutaceae	Alani	LE	G1
<i>Melicope puberula</i> (St. John) T. Hartley & B. Stone	D, Rutaceae	Alani	C2	G1
<i>Myrsine linearifolia</i> Hosaka	D, Myrsinaceae	Kolea	recommend. C1	G1
<i>Neraudia melastomifolia</i> Gaud.	D, Urticaceae	Ma'aloa, ma'oloa, 'oloa	None	G2
<i>Nothoecstrum pelatum</i> Skotts.	D, Solanaceae	'Aiea	LE	G1
<i>Nototrichium</i> sp. 1	D, Amaranthaceae		None	G2
<i>Panicum beecheyi</i> Hook. & Arnott	M, Poaceae		None	G1
<i>Peucedanum sandwicense</i> Hillebr.	D, Apiaceae	Makou	LT	G2
<i>Plantago princeps</i> Cham. & Schlechtend. var. <i>anomala</i> Rock	D, Plantaginaceae	Aie	LE	G2T1
<i>Poa mannii</i> Munro ex Hillebr.	M, Poaceae		LE	G1
<i>Poa siphonoglossa</i> Hack.	M, Poaceae		LE	G1
<i>Psychotria grandiflora</i> H. Mann	D, Rubiaceae	Kopiko, 'opiko	None	G1
<i>Ranunculus mauiensis</i> A. Gray	D, Ranunculaceae	Makou	C2	G2

SCIENTIFIC NAME ¹	TAXONOMIC CATEGORY ²	COMMON NAME	FEDERAL STATUS ³	HERITAGE GLOBAL RANK ⁴
<i>Remya kauaiensis</i> Hillebr.	D, Asteraceae		LE	G1
<i>Remya montgomeryi</i> W.L. Wagner & Herbst	D, Asteraceae		LE	G1
<i>Schiedea membranacea</i> St. John	D, Caryophyllaceae		recommend. C1	G1
<i>Stenogyne campanulata</i> Weller & Sakai	D, Lamiaceae		LE	G1
<i>Stenogyne kealiae</i> Wawra	D, Lamiaceae		None	G1

¹ Scientific names of flowering plants are according to Wagner *et al.* (1990). Scientific name of fern is according to Wagner and Wagner (1992).

² F = Fern or fern ally
D = Dicot
M = Monocot

³ Key to Federal Status (USFWS 1994a,b,c):

LE = Taxa formally listed as endangered.

LT = Taxa formally listed as threatened.

C1 = Taxa for which the USFWS has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.

C2 = Taxa for which information now in the possession of the USFWS indicates that proposing to list as endangered or threatened is possibly appropriate, but for which sufficient data on biological vulnerability and threat are not currently available to support proposed rules.

* = Recommended candidate by the Pacific Islands Office of the USFWS, December 15, 1994.

⁴ Key to HINHP global ranks:

G1 = Species critically imperilled globally (typically 1-5 current occurrences).

G2 = Species imperilled globally (typically 6-20 current occurrences).

T1 = Subspecies or variety critically imperilled globally (typically 1-5 current occurrences).

* = These rare plants have been observed in the survey area within the last five years, with the exception of *Cyanea recta* and *Psychotria grandiflora* which have not been observed here for more than 30 years.

Figure 2

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Figure 2. Distribution of Rare Plants
Kalalau Rim Survey Area (cont'd from previous page)

*The following taxa are widespread in the survey area and are not shown on this figure.
Their ranges within the survey area are described in the rare plant taxon accounts:

Chamaesyce remyi var. *remyi*
Dubautia laevigata
Dubautia microcephala
Lepidium serra
Lobelia yuccoides
Lysimachia kalalauensis
Melicope puberula
Myrsine linearifolia
Nototrichium sp. 1

RARE TAXON ACCOUNTS

Federally Listed Taxa

Exocarpos luteolus C. Forbes

Common name: Heau

Family: Sandlewood family (Santalaceae)

Federal status: Listed endangered (USFWS 1994a,b)

Heritage global rank: G1 (HINHP 1994c)

Exocarpos luteolus is a shrub ranging from 0.5 to 2 meters tall with green stems. There are two leaf types: some leaves are expanded, and others are small and scale-like. The expanded leaves are elliptic, oblanceolate, or broadly obovate, 36 to 87 millimeters long and 18 to 36 millimeters wide. The flowers are green. The 11 to 16 millimeter long drupes are pale yellow at maturity, cylindrical, and embedded in a golden yellow, fleshy receptacle (Wagner *et al.* 1990).

E. luteolus is endemic to the island of Kauai. It has been recorded near bogs in wet forest or in mesic forest from 515 to 1,219 meters (1,690 to 4,000 feet) in elevation (HINHP 1994c).

E. luteolus is found in several areas in the central portion of the survey area, on the valley rim and upper walls. A total of about two dozen plants are in these areas (K. Wood, pers. comm., 1994).

Lobelia niihauensis St. John

Common name: 'Oha, haha, 'oha wai

Family: Bellflower family (Campanulaceae)

Federal status: Listed endangered (USFWS 1994a,b)

Heritage global rank: G2 (HINHP 1994c)

Lobelia niihauensis is a branched prostrate plant with woody stems 20 to 40 centimeters long. Each branch bears an apical rosette of narrowly elliptical or oblanceolate leaves. The leaves are 7 to 15 centimeters long and 0.7 to 1.8 centimeters wide. The unbranched inflorescences 12 to 15 centimeters long bear magenta flowers. The fruits are ovoid capsules 6 to 8 millimeters long (Lammers 1990).

L. niihauensis is endemic to Niihau, Kauai, and the Waianae Mountains of Oahu. It is typically found growing on cliffs in dry and mesic habitats, from 150 to 730 meters (500 to 2,400 feet) in elevation (HINHP 1994c).

Three plants of *L. niihauensis* were seen on the HINHP survey. They were on a steep slope on the upper walls of Kalalau Valley, about one third of the distance below the valley rim. There are no other records of this species from the survey area.

Melicope pallida (Hillebr.) T. Hartley & B. Stone
Common name: Alani
Family: Rue family (Rutaceae)
Federal status: Listed endangered (USFWS 1994a,b)
Heritage global rank: G1 (HINHP 1994c)

Melicope pallida is a tree 6 to 10 meters tall with a stout trunk and black resinous new growth. The leaves are 6 to 21 centimeters long and 2.5 to 8 centimeters wide, and narrowly elliptic to ovate or oblong to ovate, leathery and brittle, usually crowded towards the ends of the branches and arranged in threes. The leaves are often folded in a broad V-shape. The inflorescences are composed of 15 to 35 flowers arranged in minutely white cymes arising from the leaf axils. The flower petals are pale yellowish and 3.5 to 5.0 millimeters long. The fruits are 17 to 21 millimeters wide with four distinct follicles that each contain two seeds about 3.5 millimeters long (Stone *et al.* 1990).

M. pallida is endemic to Kauai and the Waianae Mountains of Oahu. It grows in mesic forests from 490 to 1,035 meters (1,600 to 3,400 feet) in elevation. (HINHP 1994c).

Several trees of this species are known from the survey area below the valley rim. A few plants have been seen below the Kalalau Lookout, and a few have been observed about midway between the two lookouts (K. Wood, pers. comm., 1994). Another tree was seen on the HINHP survey northwest of Puu o Kila.

Nothocestrum peltatum Skottsbo.
Common name: Aiea
Family: Nightshade family (Solanaceae)
Federal status: Listed endangered (USFWS 1994a,b)
Heritage global rank: G1 (HINHP 1994c)

Nothocestrum peltatum is a small tree up to 5 meters tall with bright ash-brown smooth bark. Flowering stems are 6 to 7 millimeters in diameter and covered with matted wooly hairs. Leaves are ovate to ovate-elliptic or oblong in shape, and 6 to 23 centimeters long and 3.5 to 7.5 centimeters wide. Some leaves are attached to the stem by their lower surface usually near the center, while many other leaves are attached at the base. Greenish yellow, densely hairy flowers are borne in clusters of up to 10. The orange berries are ellipsoid in shape and 1.3 to 1.4 centimeters long (Symon 1990).

N. peltatum is endemic to Kauai and is found in mesic to wet forest on the western side between 915 to 1,220 meters (3,000 to 4,000 feet) in elevation (HINHP 1994c).

Five trees of this species are currently known in the survey area. Four were found on the HINHP survey just below the Kalalau rim, 0.5 to 0.8 kilometers (0.3 to 0.5 miles) west of Puu o Kila. A fifth tree was seen in 1990 below the valley rim and about midway between the two lookouts (HINHP 1994c). The only other record of this species in the survey area is a specimen collected in 1961 at the Kalalau Lookout (Stern and Carlquist 44,811, BISH).

Peucedanum sandwicense Hillebr.

Common name: Makou

Family: Parsley family (Apiaceae)

Federal status: Listed Threatened (USFWS 1994a,b)

Heritage global rank: G2 (HINHP 1994c)

Peucedanum sandwicense is an erect or sprawling, parsley-scented perennial herb, typically 50 to 100 centimeters tall. Leaves are pinnately compound, ovate to triangular-ovate, and 7 to 13 centimeters long and 2.5 to 7 centimeters wide. The white flowers are arranged into 10 to 20-flowered umbels, and the fruits are broadly winged (Constance and Affolter 1990).

P. sandwicense is endemic to Kauai, the Waianae Mountains of Oahu, Molokai, and Maui from sea level to 790 meters (sea level to 2,600 feet) in elevation (HINHP 1994c, Constance and Affolter 1990).

At least a dozen or so plants of *P. sandwicensis* have been seen in recent years below the Kalalau Lookout (K. Wood, pers. comm., 1994). This species has not been observed elsewhere within the survey area.

Plantago princeps Cham. & Schlechtend. var. *anomala* Rock

Common name: Ale

Family: Plantain family (Plantaginaceae)

Federal status: Listed endangered (USFWS 1994b,c)

Global heritage rank: G2T1 (HINHP 1994c)

Plantago princeps var. *anomala* is a small shrub with hollow stems. The leaves, 15 to 30 centimeters long and 1.5 to 5 centimeters wide, are narrowly elliptic to sometimes elliptic, thick, leathery, sessile, and bunched near the tips of the stems. The flowers are borne on spikes 11 to 28 centimeters long. The fruit are narrowly ovoid-ellipsoid capsules with black seeds (Wagner *et al.* 1990).

P. princeps var. *anomala* is endemic to Kauai. It typically grows on steep slopes in mesic and wet forests from 915 to 1,220 meters (3,000 to 4,000 feet) in elevation (HINHP 1994c).

A population of about 20 plants of *P. princeps* var. *anomala* is approximately midway between the two lookouts, and another four plants are growing near Puu o Kila. Both of these populations were seen during the HINHP survey.

Poa mannii Munro ex Hillebr.

Common name: No common name

Family: Grass family (Poaceae)

Federal status: Listed endangered (USFWS 1994a,b)

Global heritage rank: G1 (HINHP 1994c)

Poa mannii is a perennial grass with short rhizomes that extend in a single direction. The culms, 50 to 75 centimeters tall, are tufted and strongly compressed. The blades are flat and loosely packed, and up to 15 centimeters long and 2 to 4 millimeters wide. The inflorescences are panicles of spikelets. The reddish brown fruit is an ellipsoid to spindle-shaped caryopsis (O'Connor 1990).

P. mannii is endemic to Kauai. It has been recorded in mesic forest and shrubland from 490 to 1,220 meters (1,600 to 4,000 feet) in elevation (HINHP 1994c).

During the HINHP survey, a group of about 10 plants of *P. mannii* on the western side of the large eastern drainage was observed. This species has also been seen in recent years below the Kalalau Lookout, and about midway between the two lookouts. At least a dozen plants have been observed at each of the two locations (K. Wood, pers. comm., 1994).

Poa siphonoglossa Hack.

Common name: No common name

Family: Grass family (Poaceae)

Federal status: Listed endangered (USFWS 1994a,b)

Global heritage rank: G1 (HINHP 1994c)

Poa siphonoglossa is a perennial grass with tufted aerial stems that are often extensive and cascade from banks in long masses up to 4 meters long. The blades are flat and loose, usually less than 10 cm long and 2 to 3 millimeters wide. The spikelets are 2 to 5-flowered, and relatively few per inflorescence panicle. The reddish brown fruits are ovoid caryopsis (O'Connor 1990).

P. siphonoglossa is endemic to Kauai. It typically grows on wet shady banks and along ridges between 890 and 1,300 meters (2,920 and 4,265 feet) in elevation (HINHP 1994c, O'Connor 1990).

Two plants of *P. siphonoglossa* are known on the Kalalau Valley rim about midway between the two lookouts. These plants were seen during the HINHP survey. No other plants of this species have been recorded from the survey area.

Remya kauaiensis Hillebr.

Common name: No common name

Family: Sunflower family (Asteraceae)

Federal status: Listed endangered (USFWS 1994a,b)

Heritage global rank: G1 (HINHP 1994c)

Remya kauaiensis is a weakly erect to climbing shrub 1 to 4 meters tall with stems that are leafy at the ends. The leaves, 4.5 to 17 centimeters long and 2.2 to 7 centimeters wide, are lanceolate to elliptic-lanceolate or broadly ovate. The leaf margins are sharply serrate-dentate to dentate. The upper leaf surface is sparsely covered with long, soft, tangled, cobweb like hairs when young, and smooth at maturity. The undersides are densely covered with tangled woolly hairs. The flower heads have cream colored ray florets. The fruit, 1.5 millimeters long, are achenes covered with short, fine hairs (Wagner *et al.* 1990).

R. kauaiensis is endemic to Kauai. It has been recorded in mesic forests from 850 to 1,220 meters (2,800 to 4,000 feet) in elevation (HINHP 1994c).

Only a single plant of *R. kauaiensis* has been recorded from the survey area, approximately midway between the two lookouts (K. Wood, pers. comm., 1994).

Remya montgomeryi W.L. Wagner & Herbst

Common name: No common name

Family: Sunflower family (Asteraceae)

Federal status: Listed endangered (USFWS 1994a,b)

Heritage global rank: G1 (HINHP 1994c)

Remya montgomeryi is a weakly erect shrub up to about 1 meter tall with stems leafy toward the apex. The leaves, 13 to 15 centimeters long and 2 to 3.2 centimeters wide, are narrowly elliptic, thin, and closely spaced with serrate to irregularly doubly serrate margins. The flowers occur in purplish brown heads which are borne in panicles up to 24 centimeters long. The fruit, 1.6 to 1.8 millimeters long, are 3 to 4-angled achenes (Wagner *et al.* 1990).

R. montgomeryi is endemic to Kalalau Valley, Kauai. It has been recorded in mesic to wet forest on steep cliffs from 1,035 to 1,110 meters (3,400 to 3,630 feet) in elevation (HINHP 1994a).

This species is known from several locations in the survey area: perhaps 90 plants 0.5 to 0.6 kilometers (0.3 to 0.4 miles) northwest of Puu o Kila; about a dozen plants 0.8 kilometers (0.5 miles) northwest of Puu o Kila; and three plants below the Kalalau Lookout (K. Wood, pers. comm., 1994).

Stenogyne campanulata Weller & Sakai

Common name: No common name

Family: Mint family (Lamiaceae)

Federal status: Listed endangered (USFWS 1994a,b)

Heritage global rank: G1 (HINHP 1994a)

Stenogyne campanulata is a densely hairy vine with quadrangular stems. The leaves, 5 to 6.3 centimeters long and 2.6 to 3.6 centimeters wide, are broadly ovate, thin, flexible, and densely hairy. About six flowers are borne at a node. The corolla tube is white with purple lips, and densely hairy on the outside. The fruit are unknown (Weller and Sakai 1990).

S. campanulata is endemic to Kalalau Valley, Kauai. It has been recorded from mesic forest between 950 and 1130 meters (3120 and 3,700 feet) in elevation (HINHP 1994c).

S. campanulata has been seen in two locations in the survey area: about six plants 0.5 to 0.6 kilometers (0.3 to 0.4 miles) northwest of Puu o Kila; and three or four plants 0.5 miles northwest of Puu o Kila (K. Wood, pers. comm., 1994).

Recommended Category 1 Candidate Taxa

Cyanea recta (Wawra) Hillebr.

Common name: `Oha, haha, `ohawai

Family: Bellflower family (Campanulaceae)

Federal status: Recommended Category 1 candidate (USFWS 1994b)

Heritage global rank: G1 (HINHP 1994c)

Cyanea recta is an unbranched shrub 1 to 1.5 meters tall. The leaves are elliptical, 12 to 28 centimeters long and 1.2 to 5 centimeters wide. The inflorescences are 5 to 7-flowered. The flower petals are purple or white with purple stripes, and very hairy. The fruits are obovoid purple berries (Lammers 1990).

C. recta is endemic to Kauai. This species is found in mesic forest of northeastern Kauai from 450 to 1,400 meters (1,490 to 4,600 feet) in elevation (HINHP 1994c, Lammers 1990).

In the survey area, *C. recta* was collected in 1938 on the Kalalau cliffs at "Kilohana Lookout" (Skottsberg 1944). This lookout is the present day Kalalau Lookout. There are no other records of this species from the survey area.

Myrsine linearifolia Hosaka

Common name: Kolea

Family: Myrsine family (Myrsinaceae)

Federal status: Recommended Category 1 candidate (USFWS 1994b)

Heritage global rank: G1 (HINHP 1994c)

Myrsine linearifolia is a shrub 2.5 to 8 meters tall with green to reddish brown branches. The leaves are slightly fleshy, linear with a prominent midrib, and 5 to 9 centimeters long and 0.25 to 0.4 centimeters wide. The flower petals are greenish with bracts below. The fruit is a black ellipsoid drupe about 6 millimeters long (Wagner *et al.* 1990).

M. linearifolia is endemic to Kauai. This species is found in mesic to wet forests from 580 to 1,280 meters (1,900 to 4,200 feet) in elevation (Wagner *et al.* 1990).

M. linearifolia is scattered in the eastern third of the study area on the plateau, valley rim, and valley walls. There are about 100 plants in this area (K. Wood, pers. comm., 1994). Some of these plants were observed during the HINHP survey.

Schiedea membranacea St. John

Common name: No common name

Family: Pink family (Caryophyllaceae)

Federal status: Recommended Category 1 candidate (USFWS 1994b)

Heritage global rank: G1 (HINHP 1994c)

Schiedea membranacea is a perennial herb which dies back to a woody stem below ground during the dry season. The leaves are broadly elliptic to broadly elliptic-ovate, 13 to 20 centimeters long and 5 to 8 centimeters wide, and somewhat hairy. The inflorescence is about 25 to 27 centimeters long, with numerous flowers. The flowers have green bracts and purple sepals, and the seeds are dark brown and compressed (Wagner *et al.* 1990).

S. membranacea is endemic to Kauai. This species occurs in mesic and wet forests from 560 to 1,160 meters (1,840 to 3,800 feet) in elevation (HINHP 1994c).

S. membranacea is known from three locations in the survey area. About 15 to 20 plants are known [we saw a few of the plants on our survey] in the large drainage 0.5 to 0.8 kilometers (0.3 to 0.5 miles) northwest of Puu o Kila (K. Wood, pers. comm., 1994). Another dozen plants are known at a site just below the valley rim and 0.3 kilometers (0.2 miles) east of Kalalau Lookout (S. Perlman, pers. comm.). One plant has been observed below the Kalalau Lookout (K. Wood, pers. comm., 1994).

Category 2 Candidate Taxa

Chamaesyce remyi (A. Gray ex Boiss.) Croizat & Degener var. *remyi*

Common name: 'Akoko

Family: Spurge family (Euphorbiaceae)

Federal status: Category 2 candidate (USFWS 1994b).

Heritage global rank: G2T1 (HINHP 1994c)

Chamaesyce remyi var. *remyi* is an erect to climbing shrub with branches 0.3 to 2 meters long. The leaves are elliptical to oblong or broadly lance-shaped, 35 to 165 millimeters long and 15 to 75 millimeters wide. The cyathia (a compact inflorescence with small individual flowers, the whole simulating a single flower) are solitary in the leaf axils. The fruit is a smooth capsule that extends beyond the top of the cyathia (Koutnik 1990).

Chamaesyce remyi var. *remyi* is endemic to Kauai. This variety is found in mesic and wet forests from 430 to 1,240 meters (1,400 to 4,080 feet) in elevation (HINHP 1994c).

In the survey area, *C. remyi* var. *remyi* plants are scattered between the two lookouts, particularly along the rim and a little way down the valley sides (K. Wood, pers. comm., 1994).

Dubautia microcephala Skottsbo.

Common name: Na'ena'e

Family: Sunflower (Asteraceae)

Federal status: Category 2 candidate (USFWS 1994b)

Heritage global rank: G1 (HINHP 1994c)

Dubautia microcephala is a shrub or small tree up to 4 meters tall with relatively few spreading branches. Stems are either smooth or have a few long hairs. Leaves are opposite, linear-lanceolate to linear-oblong, 10 to 24 centimeters long and 9 to 25 millimeters wide. The flower heads are numerous in panicle inflorescences up to 35 centimeters long and 30 centimeters wide. The flower heads contain 4 to 7 florets. Flower petals are yellow, and the bracts at the base of the flower heads are dark purple to black with small white hairs (Carr 1990).

D. microcephala is endemic to Kauai and found in mesic to wet forest from 670 to 1,275 meters (2,200 to 4,000 feet) in elevation (HINHP 1994c).

This species is locally common and distributed along the entire length of the survey area, particularly along the valley rim and walls (K. Wood, pers. comm., 1994).

Eurya sandwicensis A. Gray
Common name: Anini, wanini
Family: Tea family (Theaceae)
Federal status: Category 2 candidate (USFWS 1994b)
Heritage global rank: G2 (HINHP 1994c)

Eurya sandwicensis is a small tree or shrub 2 to 6 meters tall, with branchlets covered with hairs. The leaves are closely spaced, leathery, oblong, elliptic, or narrowly obovate, typically 3.5 to 9.0 centimeters long and 1.5 to 4.0 centimeters wide with reddish veins. The veins on the lower surface of the leaf form a conspicuous network pattern. The leaf margins are finely serrated. One to two unisexual flowers are borne in the leaf axils. The petals are pale-yellow to cream colored and somewhat fleshy. The fruit is a round, dark bluish-black berry, 7 to 10 millimeters in diameter (Wagner *et al.* 1990).

E. sandwicensis has been recorded from the islands of Kauai, Oahu, Molokai, Maui, and Hawaii. It occurs in wet forests and shrublands, often on ridges, from 450 to 1,720 meters (1,500 to 5,640 feet) in elevation (HINHP 1994c).

About six plants of *E. sandwicensis* have been seen in the survey area about 0.3 miles northwest of Puu o Kila, on and just below the valley rim (K. Wood, pers. comm., 1994). Some of these plants were seen during the HINHP survey.

Hedyotis tryblium Herbst & W.L. Wagner
Common name: No common name
Family: Coffee family (Rubiaceae)
Federal status: Category 2 candidate (USFWS 1994b)
Heritage global rank: G1 (HINHP 1994c)

Hedyotis tryblium is a climbing shrub up to 5 meters long with stems that root with ground contact. The upper surface of the leaves is green and the lower surface is pale green and marked with purple or brownish purple areas. The leaves are leathery, oblong-elliptic to elliptic, and 13 to 22 centimeters long and 3 to 7.5 centimeters wide. Flowers are densely aggregated and are yellowish green and reddish purple tinged. The fruit is a dry drupe 4 to 5 millimeters in diameter (Wagner *et al.* 1990).

H. tryblium is endemic to Kauai. This species is found in wet forests from 650 to 1,350 meters (2,130 to 4,420 feet) in elevation (HINHP 1994c, Wagner *et al.* 1990).

H. tryblium is known from two locations in the survey area. During the HINHP survey, four or five plants were seen below the Kalalau Valley rim and east of the Kalalau Lookout (S. Perlman, pers. comm., 1994). Another three plants were seen below the valley rim and northwest of Puu o Kila.

Lepidium serra H. Mann

Common name: 'Anaunau, naunau, kunana

Family: Mustard Family (Brassicaceae)

Federal status: Category 2 candidate (USFWS 1994b)

Heritage global rank: G1 (HINHP 1994c)

Lepidium serra is a small shrub typically 60 to 120 centimeters tall with many branches. The leaves, crowded at the end of the branches, are thin, usually elliptic, occasionally lanceolate or oblanceolate, 6 to 17 centimeters long and 0.6 to 4 centimeters wide. The flowers are found in minutely hairy bunches. The fruits are silicles (elongate capsules), and 2.5 to 3.1 millimeters long and 4 to 4.5 millimeters wide (Wagner *et al.* 1990).

L. serra is endemic to Kauai and is found in mesic forest between 180 to 1,160 meters (600 to 3,400 feet) in elevation (HINHP 1994c).

L. serra plants are scattered on the valley wall portions of the survey area, particularly on the steeper, open cliff faces (K. Wood, pers. comm., 1994).

Lysimachia kalalauensis Skottsbo.

Common name: No common name

Family name: Primrose family (Primulaceae)

Federal status: Category 2 candidate (USFWS 1994b)

Heritage global rank: G1 (HINHP 1994c)

Lysimachia kalalauensis is a sprawling or climbing shrub with stems 2 to 3 meters long, and with reddish brown bark marked with fine parallel lines. The leaves are alternate, thin and leathery, elliptic, and 48 to 95 millimeters long and 16 to 34 millimeters wide. The lower leaf surface is covered with long soft brown hairs when young, becoming smooth with age. The flowers are solitary in the leaf axils, and the petals are green with purplish red bases and purple veins. The fruit is a capsule, broadly egg-shaped to almost spherical, and 9 to 10 millimeters long (Wagner *et al.* 1990).

L. kalalauensis is endemic to Kauai. This species is known from mesic forest from the Kokee area between Kalalau and Makaha valleys, 915 to 1,055 meters (3,000 to 3,400 feet) in elevation (HINHP 1994c, Wagner *et al.* 1990).

This species is fairly common through the entire length of the survey area, primarily on the valley rim and on the valley walls below the rim (K. Wood, pers. comm., 1994).

Melicope puberula (St. John) T. Hartley & B. Stone

Common name: Alani

Family name: Rue family (Rutaceae)

Federal status: Category 2 candidate (USFWS 1994b)

Heritage global rank: G1 (HINHP 1994c)

Melicope puberula is a shrub or small tree, 3 to 10 meters in height. The newest growth is characterized by a layer of matted yellowish brown hairs on the stems and older growth is characterized by smooth stems. The leaves are opposite, leathery in texture, narrowly elliptic to elliptic or elliptic-obovate, and 6 to 17 centimeter long and 3 to 6 centimeters wide. The upper leaf surface is smooth and the lower leaf surface is sparsely to moderately hairy. About five flowers are borne on hairy flowering stalks, arising from the leaf axil. The fruits are dark red capsules 14 to 20 millimeters wide. The seeds are about 5 to 6 millimeters long (Stone *et al.* 1990).

M. puberula is endemic to Kauai. This species is found in mesic to wet forest and between 1,070 and 1,220 meters (3,510 and 4,000 feet) in elevation (HINHP 1994c).

This species is scattered throughout the eastern third of the study area, primarily on the plateau and the valley rim (K. Wood, pers. comm., 1994).

Ranunculus mauiensis A. Gray

Common name: Makou

Family: Buttercup family (Ranunculaceae)

Federal status: Category 2 candidate (USFWS 1994b)

Heritage global rank: G2 (HINHP 1994c)

Ranunculus mauiensis is a perennial herb 50 to 200 centimeters tall with sparsely to densely pubescent stems and fibrous roots. The flowers are in loose cymes with yellow, glossy petals. The fruits are achenes, about 2 millimeters long and smooth (Duncan 1990).

R. mauiensis is recorded from Kauai, Molokai, Maui, and Hawaii, and Mount Kaala on Oahu. This species occurs in open sites in mesic to wet forest and along streams from 1,060 to 1,920 meters (3,500 to 6,300 feet) in elevation (Duncan 1990, HINHP 1994c).

R. mauiensis has been found in several locations in the eastern half of the survey area. About six to eight plants have been seen below the valley rim, about 0.8 kilometers (0.5 miles) northwest of Puu o Kila. Another dozen or so plants have been seen 0.3 to 0.5 kilometers (0.2 to 0.3 miles) northwest of Puu o Kila. A solitary plant used to be on the valley rim about one kilometer (0.6 miles) northwest of Puu o Kila, but it appears to have died (K. Wood, pers. comm., 1994).

Taxa With No Federal Status

Asplenium hobyi W.H. Wagner

Common name:

Family: Spleenwort family (Aspleniaceae)

Federal status: None

Heritage global rank: G1 (HINHP 1994c)

Asplenium hobyi is a tufted fern with leathery texture. The fertile fronds are once pinnately compound, 10 to 40 centimeters long and 0.5 to 2 centimeters wide. The pinnae are oblong, 0.5 to 1.2 centimeters long and 0.4 to 0.6 centimeters wide. The veins of the pinnae are conspicuous with six on the anterior side and 1 or 2 on the basal side. The indusium is leathery and conspicuous (Wagner 1993).

A. hobyi is found in dark damp forests of Kauai, Molokai, Maui, and Hawaii from 1,190 to 1,970 meters (3,900 to 6,460 feet) in elevation (HINHP 1994c, Wagner 1993).

One large patch of plants of this species has been seen on the plateau about 0.5 kilometers (0.3 miles) west of Puu o Kila (K. Wood, pers. comm., 1994).

Dubautia laevigata A. Gray

Common name: No common name

Family: Sunflower family (Asteraceae)

Federal status: None

Heritage global rank: G1 (HINHP 1994c)

Dubautia laevigata is a shrub, often narrow and up to 2.5 meters tall. Stems are smooth and erect, occasionally lower stems will sprawl along the ground before turning upwards. The leaves are opposite, oblong-lanceolate, 7 to 24 centimeters long and 1 to 3.5 centimeters wide. The inflorescences are 3 to 40 centimeters long and 5 to 20 centimeters wide. Flower heads are found in clusters of 2 to 5 with 8 to 18 yellow florets per head. There are 8 to 18 bracts per head and each bract is associated with a floret (Carr 1990).

D. laevigata is endemic to Kauai and found in mesic and wet forests from 575 to 1,250 meters (2,000 to 4,035 feet) in elevation (HINHP 1994c).

In the survey area, *D. laevigata* is scattered along the rim and upper valley walls of Kalalau Valley (K. Wood, pers. comm., 1994).

Lobelia yuccoides Hillebr.

Common name: Panaunau

Family: Bellflower family (Campanulaceae)

Federal status: None

Heritage global rank: G2 (HINHP 1994b)

Lobelia yuccoides has erect stems 1.5 to 2.0 meters long, with a dense apical rosette of leaves. The leaves are linear, 24 to 35 centimeters long and 0.5 to 1.5 centimeters wide. The leaf undersides are covered with matted white hairs. The terminal inflorescence is unbranched, and 60 to 100 centimeters long. The flower petals are blue to lilac, 36 to 40 millimeters long and 3 to 5 millimeters wide (Lammers 1990).

L. yuccoides is endemic to Kauai and the Waianae Mountains of Oahu. It has been found from 700 to 1,230 meters (2,300 to 4,040 feet) in elevation in mesic forests and shrublands (HINHP 1994c).

L. yuccoides is widespread and locally common on the steep slopes of the western three-fourths of the survey area (K. Wood, pers. comm., 1994).

Neraudia melastomifolia Gaud.

Common name: Ma`aloa, ma`oloa, `oloa

Family: Nettle family (Urticaceae)

Federal status: None

Heritage global rank: G2 (HINHP 1994c)

Neraudia melastomifolia is a shrub or small tree usually up to 4 meters tall. Its leaves are thin to thick and leathery, elliptic, elliptic-ovate to ovate, or lanceolate, and 5 to 24 centimeters long and 1.5 to 7.0 centimeters wide. The plants are unisexual, bearing either female or male flowers. The flowers and fruits are small, and tightly clustered in the leaf axils (Wagner *et al.* 1990).

This species is endemic to Kauai, Oahu, Molokai, and West Maui. It has been recorded from 275 to 1,220 meters (900 to 4,000 feet) in elevation from mesic and sometimes wet forests (HINHP 1994c).

Two individuals of *N. melastomifolia* were seen just below the Kalalau Valley rim northeast of the Kalalau Lookout. There are no other records of this species in the survey area.

Nototrichium sp. 1
Common name: Kului
Family: Amaranth family (Amaranthaceae)
Federal status: None
Heritage global rank: G2 (HINHP 1994c)

This undescribed species of *Nototrichium* is endemic to northwestern Kauai. It typically grows on cliffs in mesic habitats (K. Wood, pers. comm., 1994).

Nototrichium sp. 1 is distributed along the entire length of the survey area, primarily on the steeper cliffs below 1,160 meters (3,800 feet) in elevation (K. Wood, pers. comm., 1994).

Panicum beecheyi Hook. & Arnott
Common name: No common name
Family: Grass family (Poaceae)
Federal status: None
Heritage global rank: G1 (HINHP 1994c)

Panicum beecheyi is a perennial bunchgrass 30 to 60 centimeters tall. The leaf blades are 10 to 18 centimeters long and 0.2 to 0.5 centimeters wide. The inflorescence is a panicle 10 to 18 centimeters long (Davidse 1990).

P. beecheyi is endemic to Niihau, Kauai, the Waianae Mountains of Oahu, and West Maui. It is primarily found in dry or mesic habitats, often on cliffs with shrubs and grasses, from 425 to 1,065 meters (1,400 to 3,500 feet) in elevation (HINHP 1994c).

P. beecheyi was found for the first time in the survey area during the HINHP survey. A group of about three plants was seen on the valley rim, about midway between the two lookouts.

Psychotria grandiflora H. Mann
Common name: Kopiko, `opiko
Family: Coffee family (Rubiaceae)
Federal status: None
Heritage global rank: G1 (HINHP 1994c)

Psychotria grandiflora is a small tree or shrub up to 5 meters tall. The leaves are usually tinged red, leathery, obovate or occasionally elliptic, 4 to 14.1 centimeters long and 1.6 to 6.3 centimeters wide, with the margins rolled under. The flowers are functionally unisexual, pendent and waxy, and the flower petals are white. The inflorescences have one main axis and whorled branching. The fruit is pear shaped and 10 to 15 millimeters long at maturity (Wagner *et al.* 1990)

P. grandiflora is endemic to Kauai. This species is found in mesic to sometimes wet forest in the Kokee area and Alakai Swamp, from 1,040 to 1,230 meters (3,410 to 4,030 feet) in elevation (HINHP 1994c, Wagner *et al.* 1990).

A specimen of *P. grandiflora* was collected at the Kalalau Lookout in 1947 (St. John *et al.*, 22,898, BISH). Although the species has not been reported there since, it is known to occur just outside the survey area south of the lookout (across the road from the lookout) (K. Wood, pers. comm., 1994).

Stenogyne kealiae Wawra

Common name: No common name

Family: Mint family (Lamiaceae)

Federal status: None

Heritage global rank: G1 (HINHP 1994c)

Stenogyne kealiae is a trailing vine with four angled stems. The leathery leaves are lanceolate to elliptically lanceolate, 8 to 15 centimeters long and 2.5 to 4.5 centimeters wide. The flowers are deep pinkish purple with whitish bases and are in groups of 4 to 5. In addition, the sepals are toothed and lanceolate (Wagner and Weller 1991).

S. kealiae is found in wet forests on Kauai from 1,090 to 1,250 meters (3,580 to 4,100 feet) in elevation (Wagner and Weller 1991).

Twenty to 25 plants of this species were seen during the HINHP survey. They are below the valley rim, about 0.3 to 0.6 kilometers (0.2 to 0.4 miles) northeast of the Kalalau Lookout. No other plants of this species are known in the survey area.

BIOLOGICAL SIGNIFICANCE

Although the 'Ohi'a Montane Wet Forest community observed in the Kalalau Rim survey area is not considered rare, it is significant because it provides habitat for endangered, threatened, candidate, and other plants of concern. The opportunity to preserve this ecosystem is important because of the ongoing degradation and destruction of native natural communities in Hawaii.

Rare plants have been reported from throughout the survey area. Twenty-two of the 30 rare plants of the survey area are federally listed endangered, threatened or, candidates or recommended candidates for listing as endangered or threatened (USFWS 1994, HINHP 1994c). While only 13 rare plant taxa were observed during this survey, 28 of the rare plant taxa have been seen in the survey area during the past five years (HINHP 1994c; J. Lau and K. Wood, pers. comms., 1994).

MANAGEMENT CONCERNS

The HINHP survey identified several threats to the biological resources of the Kalalau Rim survey area. The major threats are alien species, primarily invasive, non-native plants, feral goats (*Capra hircus hircus*) and pigs (*Sus scrofa scrofa*). These threats and possible methods of control are discussed below.

Invasive Non-Native Plants

Several habitat-modifying non-native plant taxa have invaded the natural areas of the Kalalau Rim survey area. Some of these are already widespread; others are just getting established. The most serious habitat-modifying non-native plant taxa are firetree (*Myrica faya*), banana poka (*Passiflora mollissima*), and strawberry guava (*Psidium cattleianum*). White and yellow ginger (*Hedychium coronarium* and *H. flavescens*), Japanese honeysuckle (*Lonicera japonica*), firethorn (*Pyracantha angustifolia*), and glory bush (*Tibouchinia urvilleana* var. *urvilleana*) should be eradicated as soon as possible, while their populations are still localized. The other weed taxa, which are more widespread and difficult and not likely to be completely eradicated, might be subject to methods of control in areas identified for active management.

Prevention is the preferred method of non-native plant (weed) control. Steps can be taken to minimize the chances that a new weed species will be introduced and become established in a given area. For example, staff and visitors can be required to inspect their shoes, clothing, and gear, removing all soil, plant matter, and pests such as ants before entering a biologically sensitive area. Another way to help prevent the establishment of non-native plant species is to regularly monitor areas near trails and roads for new weed populations. It is extremely important to eradicate all such populations as early as possible. Because ungulates are considered important in the spread and establishment of many alien plants (see below), controlling ungulates is also an important way to control weeds.

Various ways of removing weeds include chemical (treating a target species with a herbicide), manual (cutting down, pulling out, or digging up weed plants), and biological (the use of one or more organisms, usually predators or pathogens, to control a weed species). In natural areas, weed control methods often vary for each species that is managed, and different methods may be used depending upon the specific setting.

New Zealand laurel, karakanut (*Corynocarpus laevigatus*)

New Zealand laurel is an evergreen tree which can grow up to 15 meters tall. This invasive, alien tree forms dense shade, thus inhibiting the reproduction of both common and rare subcanopy plants. In 1929, it was spread by aerial broadcast seeding over the interior of Kauai and is now widely naturalized there. It is also naturalized on Oahu, Molokai, and Hawaii in mesic habitats between 700 and 1,500 meters (2,300 and 4,920

feet) in elevation (Smith 1985, Wagner *et al.* 1990). The fruit, which is very poisonous to man, is dispersed by non-native, fruit-eating birds. This tree occurs as scattered individuals and groups of plants in the plateau portion of the survey area.

Smith (1985) reported that New Zealand laurel had not been evaluated for biocontrol. On Kamakou Preserve, one of The Nature Conservancy's preserves on Molokai, chemical control (with ROUNDUP applied on cut stumps or frilled trunks) of mature trees and pulling of seedlings and saplings have nearly eliminated this localized weed (Holt 1992).

Daisy fleabane (*Erigeron karvinskianus*)

Daisy fleabane is a sprawling perennial herb which usually forms dense clumps, thus preventing the establishment of seedlings of native plants. It is naturalized and sometimes locally common in moderately wet areas, from about 300 to 1,300 meters (980 to 4,260 feet) in elevation on Kauai, Oahu, Maui, and Hawaii (Wagner *et al.* 1990). Daisy fleabane has infested many of the steeper slopes on the Kalalau Valley walls. It is, perhaps, the most serious weed on many of the cliff faces in the survey area.

We found no published information on controlling this weed in Hawaii. Either control methods have not been developed for this species, or they are not widely known.

White ginger, `awapuhi ke `ok`o (*Hedychium coronarium*)

White ginger is a fragrant-flowered herb that grows rapidly by stolons, displacing all other plants. It is widely distributed in wet and mesic habitats on all of the major Hawaiian Islands except Niihau and Kahoolawe (Cuddihy and Stone 1990, Nagata 1990, Smith 1985, Wester 1992). White ginger is not a heavy producer of conspicuous fruit or seed, so vegetative reproduction predominates. Man is the primary long-distance dispersal agent (Smith 1985). White ginger is still fairly restricted in distribution in the survey area. It was seen in a couple of spots near the Kalalau Lookout.

Yellow ginger, `awapuhi melemele (*Hedychium flavescens*)

Yellow ginger is a fragrant-flowered herb that grows rapidly by stolons, displacing all other plants. It is widely distributed in wet and mesic habitats on all of the major Hawaiian Islands except Niihau and Kahoolawe (Cuddihy and Stone 1990, Nagata 1990, Smith 1985, Wester 1992). Yellow ginger is not a heavy producer of conspicuous fruit or seed, so vegetative reproduction predominates (Smith 1985). Yellow ginger is restricted to the area around the Kalalau Lookout.

Kahili ginger (*Hedychium gardnerianum*)

Kahili ginger is a showy, aggressive perennial herb that grows rapidly by stolons and displaces all other plants. In native rain forest it can form very dense stands even under the heavy shade of intact canopies of native trees and tree ferns (Cuddihy and Stone 1990). The conspicuous, fleshy, red seeds are dispersed by fruit-eating birds, as well as by man. This species grows in wet habitats on all islands between sea level and 1,700 meters (sea level and 5,580 feet) in elevation (Loope *et al.* 1992, Smith 1985). Kahili ginger is scattered in the survey area, particularly on the plateau.

The potential for biocontrol of gingers is poor because of opposition from horticulturists and commercial ginger producers (Cuddihy and Stone 1990, Gardner and Davis 1982, Smith 1985). Chemical control methods have been investigated but are not completely effective (Cuddihy and Stone 1990, Santos *et al.* 1992). On The Nature Conservancy's Kamakou Preserve on Molokai, control methods for white and yellow ginger include cutting back the vegetative parts of the plants, digging up the rhizomes, and herbicide application (J. Yoshioka, pers. comm., 1994).

Japanese honeysuckle (*Lonicera japonica*)

Japanese honeysuckle is a perennial sprawling and twining vine. It is widely cultivated, often escapes and has become a serious weed in areas such as eastern North America (Wagner *et al.* 1990). It is generally associated with disturbance, and can invade undisturbed forest whenever natural openings occur (ie. hurricanes) (Sather unpub.). On the continental U.S., the seeds are dispersed by birds into light gaps of otherwise closed forest. Japanese honeysuckle can also propagate by runners. In Hawaii, it is naturalized in mesic to wet areas on Kauai and Hawaii (Wagner *et al.* 1990). Japanese honeysuckle is still localized in the survey area. It was observed only at the Kalalan Lookout.

We found no published information on controlling this weed in Hawaii. Either control methods have not been developed for this species, or they are not widely known. Japanese honeysuckle is of concern to managers of eastern (U.S.) deciduous forests, and methods for its control there include mowing, grazing, burning, and the use of herbicides (Loope 1992, Sather unpub.).

Firetree (*Myrica faya*)

This rapidly growing noxious evergreen tree forms dense single-species stands that completely shade out other vegetation. The leaves are suspected of some allelopathic activity; this may also explain why there are no understory plants in dense stands (Cuddihy and Stone 1990, Smith 1985, Whiteaker and Gardner 1992). The fruit of firetree is dispersed primarily by birds. Feral pigs (*Sus scrofa scrofa*) have also been identified as possible dispersal agents for seeds of firetree (Cuddihy and Stone 1990, Smith 1985).

Whiteaker and Gardner 1992). Firetree is found in dry scrub to mesic and wet habitats from 425 to 1,940 meters (1,400 to 6,400 feet) in elevation on Kauai, Oahu, Lanai, Maui, and Hawaii. Firetree is currently concentrated on the Puu o Kila side of the survey area, where it is found scattered on the plateau and the upper walls of the valley.

Herbicides are the primary agents used for control of firetree. Bulldozing of infested pasturelands with follow-up herbicide treatment of stumps, and other mechanical methods have also been tried (P. Bily and J. Crummer, The Nature Conservancy of Hawaii, pers. comms., 1994; Gardner and Kageler 1982, Santos *et al.* 1989, Walters and Null 1970, Whiteaker and Gardner 1992). There are no native or otherwise valued members of the Myricaceae family in Hawaii, making firetree a good candidate for biocontrol. Potential biological control agents have been investigated, off and on, over the past 40 years (many authors *in* Whiteaker and Gardner 1992). However, previous attempts to introduce biocontrol agents have been ineffective (Cuddihy and Stone 1990).

Banana poka (*Passiflora mollissima*)

Banana poka was introduced to the Kokee region of Kauai in 1923 as an ornamental. This fast growing, perennial vine invades newly opened or disturbed areas and smothers the forest canopy. Feral pigs are principal short-distance dispersal agents while birds, as well as man, act as long distance dispersal agents (La Rosa 1992, Smith 1985). Banana poka has invaded many of the major upland wet and mesic forests on Kauai and Hawaii, and to a lesser extent on Maui, from 850 to 2,225 meters (2,800 to 7,300 feet) in elevation (Escobar 1990, Jacobi and Warshauer 1992, Wester 1992). Banana poka is scattered throughout the survey area, on both the plateau and the valley walls.

Management recommendations for this invasive weed are discussed in La Rosa (1992), Mack (1992), Markin and Yoshioka (1992), Markin *et al.* (1992), Tunison and Stone (1992).

Strawberry guava, waiawi (*Psidium cattleianum*)

Strawberry guava, called the "worst pest in Hawaii's rain forests" (Smith 1985), is a small shrub or tree which readily displaces native plants and eventually forms dense, single species thickets. It is naturalized in disturbed mesic and wet forests between 15 and 1,500 meters (50 and 4,900 feet) in elevation on all of the main islands except Niihau and Kahoolawe (Wagner *et al.* 1990, Wester 1992). It is readily spread by birds that feed on the fleshy fruits, and feral pigs (Smith 1985, Wagner *et al.* 1990). Scattered infestations of strawberry guava are found mostly on the plateau portions of the survey area.

Manual and chemical control methods can be effective in controlling small infestations (P. Bily and L. Perry, pers. comms., 1994; Hawaii Natural Heritage Program 1994). Other management recommendations for this invasive weed are discussed in Cuddihy and Stone (1990), Smith (1985), and Tunison (1991, 1992).

Firethorn (Pyracantha angustifolia)

Firethorn is a shrub that has escaped from cultivation and is now naturalized in the Kokee area on Kauai and rapidly spreading in the Volcano area on Hawaii (Wagner *et al.* 1990). Tanimoto and Char (1992) also list this species for control by DOFAW on Maui. Firethorn is still fairly localized in the survey area along the main road near the Kalalau Lookout.

We found no published information on controlling this weed in Hawaii. Either control methods have not been developed for this species, or they are not widely known.

Prickly Florida blackberry (Rubus argutus)

Prickly Florida blackberry is an invasive shrub that forms impenetrable thickets and is naturalized in a variety of disturbed habitats, including mesic to wet forests and subalpine grasslands at elevations between 200 and 2,300 meters (660 and 7,540 feet) on Kauai, Oahu, Molokai, Maui, and Hawaii (Smith 1985, Wagner *et al.* 1990). It is principally dispersed by non-native, fruit-eating birds and is capable of vigorous vegetative reproduction (Cuddihy and Stone 1990). Prickly Florida blackberry is widespread in the survey area. It is frequent on the plateau, and less common on the valley walls.

Mechanical and manual control are usually not feasible because prickly Florida blackberry resprouts readily from the roots remaining in the soil (Tunison 1991). Chemical methods of control have been somewhat successful (Holt 1992, Santos *et al.* 1992, Tunison 1991). Several biocontrol agents have been introduced to control this noxious weed. Some of these agents have helped control blackberry species in open pasture lands, but have not been as effective in natural areas (Gardner 1992, Hawaii Natural Heritage Program 1994).

Glory bush, lasiandra, princess flower (Tibouchinia urvilleana var. urvilleana)

Glory bush is a shrub or small tree commonly cultivated in Hawaii and now naturalized between 200 and 1,700 meters (660 and 5,580 feet) in elevation on Kauai, Oahu, Maui, and Hawaii (Almeda 1990, Smith 1985). It forms dense thickets in wet habitats and crowds or shades out native plants (Cuddihy and Stone 1990, Smith 1985). It appears to spread primarily vegetatively by rooting of cut, broken, or decumbent branches. Glory bush is still localized in the survey area. It was observed only in the area around the Kalalau Lookout.

Methods of control are discussed in Santos *et al.* (1986), Smith (1985), Tunison (1992), Tunison and Zimmer (1992). The potential for biocontrol has not been fully explored.

Non-Native Animals

With the exception of a small native bat, there are no native land mammals in Hawaii. All of the large ungulates in Hawaiian forests today are introduced, whether feral (escaped domestic animals such as pigs (*Sus scrofa scrofa*) and goats (*Capra hircus hircus*)), or introduced game animals such as deer (*Odocoileus* spp.) and mouflon (*Ovis musimon*). Hawaiian plants, having evolved in a system lacking large mammals, in general have lost defenses such as poisons and thorns. As a result they are particularly vulnerable to the effects of ungulates (hoofed animals).

On Kauai, the most important ungulate threats in natural areas are pigs, goats, and black-tailed deer (*Odocoileus hemionus*). These animals damage native species by direct browsing and disturbance of the ground through trampling and rooting. They also spread non-native plants via seeds passed through their feces or caught in their coats. Non-native plants germinate and spread in areas disturbed by feral ungulates. In addition, pigs can also contribute to the spread of mosquito-borne diseases such as avian malaria and avian pox by creating wallows that serve as mosquito breeding sites.

In areas with rare plants that are threatened by pigs and/or goats and/or deer, it is important to reduce ungulate populations to the lowest levels possible through organized, monitored control strategies. Usually the complete removal of feral ungulates is the long-term goal.

Several methods of ungulate control are currently used in Hawaii's protected areas. These include hunting and fencing. The use of unattended snares is a controversial, but effective means of controlling feral pigs in areas where hunting is infeasible due to the inaccessibility or fragility of an area. It is important to choose a combination of control strategies suitable to the terrain, access, and threat, and to monitor the effectiveness of the control program, refining techniques as necessary.

Pigs (*Sus scrofa scrofa*)

The Polynesians brought domestic pigs to Hawaii when they first settled the islands. These relatively small pigs were used for food, but some were also kept as pets. Later, Europeans introduced larger, Old World pigs to Hawaii and subsequent cross-breeding led to the eventual disappearance of the original Polynesian form (Kramer 1971, van Riper and van Riper 1982, Tomich 1986).

Since their introduction to Hawaii, many escaped or released domestic pigs have become feral. Today, feral pigs can be found on Niihau, Kauai, Oahu, Molokai, Maui, and Hawaii. They range from sea level to about 3,050 meters (10,000 feet) in elevation, but they prefer forested regions at mid-elevations (approximately 450 to 2,100 meters [1,500 to 7,000 feet]), inhabiting both wet and dry areas dominated by native or non-native vegetation (Kramer 1971, van Riper and van Riper 1982, Tomich 1986).

Feral pigs are a serious threat to rare native herbs, seedlings and saplings of shrubs and trees, and some mature shrubs and trees because of their browsing, rooting, and root trampling. Feral pig activity encourages the establishment of non-native plants. Feral pigs also disseminate non-native plant seeds through their feces and on their bodies, accelerating the spread of non-native plants through native forest (Cuddihy and Stone 1990, Stone 1985). Because mosquitoes breed in pig wallows, feral pigs probably also play an important role in the spread of mosquito-borne avian diseases such as pox and malaria.

Pig sign (scat, tracks, evidence of rooting) was present in the survey area but seemed old, and light to moderate in intensity.

Goats (*Capra hircus hircus*)

The first domestic goats arrived in Hawaii with Captains Cook and Vancouver in the late 1700s. Almost immediately many became feral. Since that time, feral populations have spread throughout much of Hawaii and can now be found on Kauai, Oahu, Molokai, Maui, and Hawaii. Although feral goats can be found in wet forests, they prefer arid environments and can survive with little or no water (Kramer 1971, van Riper and van Riper 1982, Tomich 1986).

Feral goats will browse on almost any type of vegetation from non-native grasses to young native Hawaiian trees and rare plants. Their constant trampling adds to soil erosion problems, and their ability to reach the most remote locations means very few plant species are safe from their foraging (Kramer 1971, van Riper and van Riper 1982, Tomich 1986).

Goats were seen and heard frequently in the survey area, and goat sign (scat, tracks, evidence of browsing) was severe and chronic on the steeper slopes of the Kalalau rim. Goats are currently causing severe degradation of the forests along, and below the rim.

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Glossary

'A'a: one of two general types of lava flow, distinguished by a rough, spiny clinker surface overlying a dense, sometimes massive, core. See **Pahoehoe**.

Aeolian Ecosystem: ecosystems largely lacking vegetation; usually dominated by invertebrates; where nutrient input is wind-borne from adjacent habitat. In Hawaii, aeolian ecosystems occur on fresh lava flows and in alpine regions.

Alien: (same as exotic, introduced, or non-native) a taxon that is not native, i.e., one introduced accidentally or purposefully by man. In Hawaii, these include Polynesian introductions (such as kukui, coconut, pig, rat, and jungle fowl) and many post-Cook introductions (such as guava, Christmas berry, mosquitoes, pigs, goats, cattle, deer, and sheep). See **Endemic, Indigenous, Native**.

Alpine: one of five elevation zones used to classify Hawaiian natural communities. The Hawaiian alpine zone is above 3,000 meters (roughly 9,000 feet) elevation and only exists on the islands of Maui and Hawaii. See **Elevation Zones**.

Amphipod: small, often aquatic shrimp-like invertebrates, with bodies often flattened side to side.

Anchialine pool: a land-locked body of water with no surface connection to the ocean, but showing measurable salinity and tidal fluctuations in water level. The pools are habitat for rare Hawaiian shrimp and endangered waterbirds.

Basalt: a dark, dense volcanic rock commonly occurring in Hawaiian lava flows.

Biota: all plants and animals of a given area. A general term for living things.

Biotic: pertaining to plants and animals and characteristics related to their presence.

Candidate Species: any species considered by the USFWS for possible addition to the List of Endangered and Threatened Species. See **Federal Status**.

Canopy: the highest vegetation cover of a community. In a forest, the canopy is made up of the tallest and most numerous trees. In a shrubland, the canopy is the tallest shrub layer. Closed canopies are those where the foliage interlocks to form a continuous layer over the underlying vegetation or ground. Open canopies are those where there are gaps in the foliage, and more light may reach the lower vegetation layers or ground.

Coastal: one of five elevation zones used to classify Hawaiian natural communities. The Hawaiian coastal zone extends from sea level to 30 meters (roughly 100 feet) elevation

but varies with the extent of coastal influence (e.g., waves, sea spray, and sea cliffs). See **Elevation Zones**.

Codominant: in a natural community, a condition in which two or more plant taxa constitute at least 50 percent of the existing vegetation cover in a given area. By Heritage definition, codominant species each must make up 25 percent or more of the total vegetation cover. See **Dominant, Natural Community**.

CPSU: Cooperative National Park Resource Study Unit.

Crustacean: any invertebrate of the class Crustacea, including aquatic forms such as lobster, shrimp, and crabs.

Current Occurrence: See **Element Occurrence**.

Degraded: physically altered in such a way as to decrease the habitat quality for native species, or invaded by alien species. A community is considered degraded if alien weeds constitute more than 40 percent of the vegetation cover.

Diadromy: a strategy in which an animal uses two habitats $\frac{1}{2}$ freshwater stream and the ocean $\frac{1}{2}$ to complete its life cycle.

DLNR: Hawaii Department of Land and Natural Resources.

Dominant: in a vegetated community, the plant species contributing the most canopy cover in a given area. Dominant species may also be the most numerous in a natural community. By Heritage definition, a dominant species must make up 25 percent or more of the total vegetation cover. See **Natural Community**.

Dry: a moisture category describing habitat in areas with less than 1,300 millimeters (50 inches) annual rainfall, or subject to seasonal drought, or bearing generally dry prevailing soil conditions. See **Moist, Wet**.

Ecosystem: an assemblage of animals and plants and its interaction with the environment. See **Natural Community**.

Element: a plant, animal, or natural community (i.e., collectively, the elements of natural diversity).

Element Occurrence (EO): a place where an element is found. It is a location or area which sustains or otherwise contributes to the survival of a population of a particular element. Typically, "current" occurrences are EOs that have been observed within the past 15 years.

Element Occurrence Record (EOR): the basic building block of the Heritage database. The EOR is a summary of all available information for a single element at a single location or occurrence.

Elevation Zones: broad regions defined by elevation range and used to classify natural communities (ecosystems). There are five elevation zones defined by the Hawaiian Natural Community Classification: coastal, lowland, montane, subalpine, and alpine. Each is defined separately.

Endangered Species: a species officially recognized by federal or state agencies to be in immediate danger of extinction due to natural or man-made factors. See Federal Status.

Endemic: naturally restricted to a locality. Most of Hawaii's native plants and animals are endemic (restricted) to the Hawaiian Islands. Many are restricted to a single island, mountain range, or even gulch. See Allen, Native, Indigenous.

Endemism: the extent to which the species of a region are unique to that region. See Endemic.

Eutrophication: the process whereby a body of water becomes rich in dissolved nutrients. This can enhance the growth of algae and lead to periods of low dissolved oxygen.

Exotic: not native. See Allen.

Falconiform: belonging to the Order Falconiformes, a taxonomic group of birds that includes hawks and eagles.

Fauna: the animals of a specified region.

Federal Status: official U.S. Fish and Wildlife Service categories for endangered and candidate endangered taxa (USFWS 1993a, 1993b):

- LE = Taxa formally listed as endangered.
- PE = Taxa already proposed to be listed as endangered.
- LT = Taxa formally listed as threatened.
- C1 = Candidate taxa for which the USFWS has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.
- C1* = Category 1 candidate taxa that are possibly extinct. These taxa retain a high priority for listing if extant populations are confirmed.
- C2 = Taxa for which information now in the possession of the USFWS indicates that proposing to list as endangered or threatened is possibly appropriate, but for which sufficient data on

Federal Status continued.

- vulnerability and threat are not currently available to support proposed rules.
- 3A = No longer candidates for listing. Taxa for which the USFWS has persuasive evidence of extinction. If rediscovered, such taxa might acquire high priority for listing.
- 3B = No longer candidates for listing. Names that, on the basis of current taxonomic understanding, do not represent distinct taxa. Such supposed taxa could be reevaluated in the future on the basis of new information.
- 3C = No longer candidates for listing. Taxa that have proven to be more abundant or widespread than previously believed and/or those that are not subject to any identifiable threat. If further research or changes in habitat indicate a significant decline in any of these taxa, they may be reevaluated for possible inclusion in categories 1 or 2.
- = No federal status. Recommended as rare by Hawaiian biologists and confirmed by Heritage data.

Feral: formerly domesticated animals reverted to wild state or living in wild habitat.

Feral Ungulate Activity: detectable damage or sign of feral ungulates including: scat, browsing, trails, trampling, wallows, and rooting.

Global Rank: an indicator of rarity or imperilment of an element on a world-wide level. This ranking system is used by Heritage Programs throughout the country to establish The Nature Conservancy's protection priorities.

- G1 = Species critically imperiled globally (typically 1 to 5 current occurrences).
- G2 = Species imperiled globally (typically 6 to 20 current occurrences).
- G3 = Restricted range (typically 21 to 100 current occurrences).
- G4 = Species apparently globally secure (> 100 current occurrences).
- G5 = Species demonstrably globally secure.
- G#? = Global rank tentative, insufficient data available to assign definite rank.
- GH = Species known only from historical occurrences (typically no observations in past 15 years).
- GX = Extinct.
- G1G2 = Global rank tentative, 1 to 20 current viable occurrences, insufficient data available to assign definite rank.
- T1 = Subspecies or variety critically imperiled globally.
- T2 = Subspecies or variety imperiled globally.
- TH = Subspecies or variety known only from historical occurrences.
- T#? = Global rank of subspecies or variety tentative, insufficient data available to assign definite rank.

HINHP: Hawaii Natural Heritage Program.

Hypogeal: utilizing underground interstices as prevalent habitat.

Imperiled: rare or threatened by extinction. In Heritage terminology, it is a plant, animal, or natural community with 20 or fewer viable occurrences, all or most of which are immediately threatened by such factors as alien invasion, direct destruction, or loss of habitat.

Indicator Species: species that require specific ecological conditions and are, therefore, used to measure the quality of the habitat. For example, certain native Hawaiian aquatic animals are indicator species of quality streams.

Indigenous: naturally occurring in a given area as well as elsewhere. Indigenous Hawaiian taxa also occur naturally outside of the Hawaiian Islands (e.g., naupaka kahakai [*Scaevola sericea*] is indigenous to Hawaii, found in Hawaii and throughout the South Pacific). See **Allen, Endemic, Native.**

Ined.: abbreviation for "ineditus," referring to a scientific name that has not been published, or a manuscript prepared for publication that has not yet received formal review.

Intact: maintaining at least 60 percent cover in native species.

Introduced: See **Alien.**

Invertebrates: animals without backbones, including such groups as insects, spiders, shrimps, and snails. Some Hawaiian invertebrates are rare and endangered.

Lava Tube: a cave-like structure often formed in pahoehoe lava flows.

Littoral: intertidal; referring to the horizontal zone between high and low tide.

Low Salinity Anchialine Pool: pools with bottom salinity less than 12 parts per thousand dissolved chlorides

Lowland: one of five elevation zones used to classify Hawaiian natural communities. The Hawaiian lowland zone lies above the coastal zone, up to about 1,000 meters (roughly 3,000 feet) elevation. There is lowland zone on all of the main islands. See **Elevation Zones.**

Mesic: an area receiving 1,280 to 1,920 millimeters (50 to 75 inches) of annual rainfall, or otherwise provided with sufficient water to result in moist soil conditions. See **Wet, Dry.**

Mixohaline: brackish waters resulting from a mix of fresh and ocean water.

Mollusk: invertebrates in the phylum Mollusca. Common representatives are snails, mussels, clams, oysters, squids, and octopuses.

Monotypic Genus: a genus with only a single species.

Montane: one of five elevation zones used to classify Hawaiian natural communities. The Hawaiian montane zone lies above the lowland zone and runs from 1,000 meters (roughly 3,000 feet) to 2,000 meters (roughly 6,000 feet) elevation. There are montane zones on Kauai, Oahu, Molokai, Maui, Lanai, and Hawaii. See Elevation Zones.

Native: found naturally in an area, not introduced accidentally or purposefully by man; includes both indigenous and endemic taxa. See Alien, Endemic, Indigenous.

Natural Community: a natural assemblage of plants and animals that occurs within certain elevation, moisture, and habitat conditions; sometimes used loosely to mean "ecosystem." However, "ecosystem" includes abiotic environmental factors, so that (natural community + environment) = ecosystem.

Non-native: See Alien.

Occurrence: See Element Occurrence.

Orthophotoquad: any of a series of aerial photographs, generally printed at 1:24,000 scale, corresponding to USGS topographic quadrangle maps.

Pahoehoe: one of two general types of lava flow, distinguished by relatively smooth, sometimes glassy, or ropy surface. See 'A'a.

Periostracum: the outermost proteinaceous shell layer of many species of bivalves and gastropods, including terrestrial snails. In terrestrial snails, the periostracum is a thin, shiny, pigmented coating that is readily distinguished from inner calcareous shell layers.

Physiognomy: general descriptive term for habitat, including categories such as bog, grassland, shrubland, forest, desert, and cliff.

Poeciliid Live Bearers: non-native, freshwater fish belonging to the Family Poeciliidae. Females bear live young.

ppt: parts per thousand.

Priority Weed: an alien plant with known ability to disrupt the vegetation of native ecosystems. Control of such weeds is a high priority. For example, *Clidemia hirta* is a priority weed that has displaced native understory plants in much of Oahu's forests.

Pristine: undisturbed by humans and completely lacking alien taxa; entirely native.

Protected: legally dedicated to the perpetuation of native resources and managed to mitigate or remove threats to those resources, if necessary. Areas lacking either legal protection or management are considered incompletely protected.

Puu: hill or peak.

Rare: imperiled or threatened by extinction due to low numbers. In Heritage terminology, a plant, animal, or natural community with 20 or fewer viable occurrences, all or most of which are immediately threatened by such factors as alien invasion, direct destruction, or loss of habitat.

spp.: abbreviation for more than one species.

ssp.: See **Subspecies**.

Subalpine: one of five elevation zones used to classify Hawaiian natural communities. The Hawaiian subalpine zone lies above the montane zone and runs from 2,000 meters (roughly 6,000 feet) to 3,000 meters (roughly 9,000 feet) elevation. There are subalpine zones only on the islands of Maui and Hawaii. See **Elevation Zones**.

Subspecies: (abbreviated *ssp.*) a taxonomically distinguishable geographic or ecological subdivision of a species. See **Variety**.

Taxon (plural = Taxa): a group of plants or animals making up one of the categories or formal units in taxonomic classification. In this report a taxon can be a species, subspecies, variety, or form. This distinction is important because certain species have endemic Hawaiian subspecies and varieties that are considered rare.

Threatened: as it applies to species or taxa, officially recognized by federal or state agencies to be in immediate danger of extinction throughout all or a significant portion of its range due to natural or man-made factors.

Troglobitic: cave-dwelling species, usually displaying adaptations to cave life, such as blindness and loss of pigmentation.

UH: University of Hawaii.

Ungulate: a subdivision of hoofed mammals including pigs, goats, cattle, sheep, mouflon, and deer.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

Variety: (abbreviated var.) a taxonomically distinguishable subdivision of a species or subspecies. See **Subspecies**.

Vertebrate: an animal with a backbone; native terrestrial vertebrate species in Hawaii include fish, birds, a bat, and a seal. See **Invertebrate**.

Viable: Capable of persisting and reproducing under favorable conditions.

Weed: an undesirable plant. In native ecosystems all alien plants are weeds. See **Priority Weed**.

Wet: an area receiving more than 1,920 millimeters (75 inches) of annual rainfall, or situated near groundwater or surface water, such that availability of water is not a major limiting factor to plants or animals there. See **Dry, Mesic**.

Appendix A
Kalalau Rim Survey Area Vascular Plant Species List

The plant taxa listed below are the native and naturalized vascular plants observed on the Hawaii Natural Heritage Program field survey. The taxonomy and nomenclature of the flowering plants are according to Wagner *et al.* (1990), except where more recent studies and new discoveries have necessitated modifications.

There has been no comprehensive treatment of the Hawaiian ferns and fern allies in recent decades. However, there are two unpublished lists of Hawaiian ferns and fern allies currently in use: Lamoureux (1988) and Wagner and Wagner (1992). This species list uses the names listed in Wagner and Wagner (1992). If the Lamoureux list gives a different name for a given taxon, that name is placed in brackets following the name used in Wagner and Wagner (1992).

Status Codes:

+ = Rare

E = Endemic, native only to the Hawaiian Islands

I = Indigenous, native to the Hawaiian Islands and elsewhere

A = Alien, not native to the Hawaiian Islands (purposely or accidentally introduced by humans)

STATUS	TAXON	COMMON NAME
	FERNS AND FERN ALLIES	
	Adiantaceae	
E	<i>Coniogramme pilosa</i> (Brack.) Hieron.	Lo'ulu
I	<i>Pteris cretica</i> L.	
I	<i>Pteris excelsa</i> Gaud.	Waimakanui
E	<i>Pteris irregularis</i> Kaulf.	Mana, 'ahewa
	Aspleniaceae	
E	<i>Asplenium florentinum</i> W.H. Wagner sp. nov. ined.	
I	<i>Asplenium normale</i> Don	
E	<i>Asplenium sphenotomum</i> Hillebr.	
	Blechnaceae	
A	<i>Blechnum occidentale</i> L.	
E	<i>Doodia kunthiana</i> Gaud.	'Okupukupula'i
E	<i>Sadleria cyatheoides</i> Kaulf.	'Ama'u, ma'u
E	<i>Sadleria pallida</i> Hook. & Arnott	'Ama'u, ma'u
E	<i>Sadleria seuletiana</i> (Gaud.) T. Moore	'Ama'u, ma'u
	Cyatheaceae	
E	<i>Cibotium menziesii</i> Hook. [<i>C. chamissoi</i> Kaulf.]	Hapa'u 'i, treefern
E	<i>Cibotium glaucum</i> (Sm.) Hook. & Arnott (including <i>C. s.-johnii</i> Krajina)	Hapa'u pua, treefern
	Dennstaedtiaceae	
I	<i>Microlepta strigosa</i> (Thunb.) Presl	Palaipala
E	<i>Pteridium decompositum</i> Gaud. [<i>P. aquilinum</i> (L.) Kuhn ssp. <i>decompositum</i> (Gaud.) C.H. Lamoureux comb. nov. ined.]	

STATUS	TAXON	COMMON NAME
	Dryopteridaceae	
E	<i>Athyrium microphyllum</i> (J. Sm.) Alston	Akolea
A	<i>Deparia petersenii</i> (Kunze) M. Kato	
E	<i>Diplazium sandwichianum</i> (Presl) Diels	Ho'i'o, pohole
E	<i>Dryopteris acutidens</i> C. Chr.	
E	<i>Dryopteris fusco-atra</i> (Hillebr.) Rob.	
E	<i>Dryopteris wallichiana</i> (Spreng.) Hyl.	
E	<i>Elaphoglossum aemulum</i> (Kaulf.) Brack.	
E	<i>Elaphoglossum crassifolium</i> (Gaud.) Anders. & Crosby	
I	<i>Elaphoglossum paleaceum</i> (Hook. & Grev.) Sledge [<i>E. hirtum</i> (Sw.) C. Chr. ssp. <i>micans</i> (Mett.) C.H. Lamoureux comb. nov. ined.]	
E	<i>Elaphoglossum wawrae</i> (Luerst.) C. Chr.	
I	<i>Nephrolepis cordifolia</i> (L.) Presl	Kupukupu, ni'ani'an
	Gleicheniaceae	
I	<i>Dicranopteris linearis</i> (N. L. Burm.) Underw.	Ulube
I	<i>Diplazium pinnatum</i> (Kunze) Nakai	Ulube lau au
E	<i>Sticherus owbyensis</i> (Hook.) Ching	
	Grammitidaceae	
E	<i>Oligadenus pinnatifidus</i> (Gaud.) W.H. Wagner comb. nov. ined. [<i>Adenophorus pinnatifidus</i> Gaud.]	
	Hymenophyllaceae	
E	<i>Mecodium recurvum</i> (Gaud.) Copel.	
E	<i>Sphaerocionium lanceolatum</i> (Hook. & Arnott.) Copel.	
E	<i>Vandenboschia cyrtotheca</i> (Hillebr.) Copel.	
E	<i>Vandenboschia davallioides</i> (Gaud.) Copel.	
	Marattiaceae	
E	<i>Marattia douglasii</i> (Presl) Baker	Pala
	Psilotaceae	
I	<i>Psilotum complanatum</i> Sw.	Moa
	Selaginellaceae	
E	<i>Selaginella arbuscula</i> (Kaulf.) Spring	Lepelpe-a-moa
	Thelypteridaceae	
E	<i>Pseudophegopteris keraudreniana</i> (Gaud.) Holttum	
E	<i>Thelypteris cyatheoides</i> (Kaulf.) Fosberg [<i>Christella cyatheoides</i> (Kaulf.) Holtt.]	Kikawao
A	<i>Thelypteris parasitica</i> (L.) Fosberg [<i>Christella parasitica</i> (L.) Levl.]	
E	<i>Thelypteris globulifera</i> (Brack.) Reed [<i>Anauropetta globulifera</i> (Brack.) Holtt.]	Palapalai-a-kamapua'a
E	<i>Thelypteris sandwicensis</i> (Brack.) Fosberg [<i>Pnerumopteris sandwicensis</i> (Brack.) Holtt.]	Ho'i'o kula

STATUS	TAXON	COMMON NAME
	GYMNOSPERMS	
	FLOWERING PLANTS: DICOTS	
	Amaranthaceae	Amaranth family
E	<i>Chenopodium ellipticum</i> (Hillebr.)	Papala
+E	<i>Nototrichum</i> sp. 1	Kulu'i
	Aquifoliaceae	Holly family
E	<i>Ilex anomala</i> Hook. & Arnott	Kawa'u
	Araliaceae	Ginseng family
E	<i>Cheirodendron fauriei</i> Hochr.	'Olapa
E	<i>Cheirodendron forbesii</i> (Sherff) Lowry	'Olapa
E	<i>Cheirodendron platyphyllum</i> (Hook. & Arnott) Seem. ssp. <i>kauaiense</i> (Kraj.) Lowry	Lapalapa
E	<i>Cheirodendron trigynum</i> (Gaud.) A. Heller ssp. <i>helleri</i> (Sherff) Lowry	'Olapa
E	<i>Tetraplasandra waimeae</i> Wawra	'Ohe kiko'ola
	Asteraceae	Sunflower family
E	<i>Artemisia australis</i> Less.	Hinahina, hinahina kuahiwi
E	<i>Bidens sandwicensis</i> Less. ssp. <i>sandwicensis</i>	Ko'oko'olan, koko'olau
A	<i>Cirsium vulgare</i> (Savi) Ten.	Buli thistle
A	<i>Conyza bonariensis</i> (L.) Cronq.	Hairy horseweed, iloha
E	<i>Dubautia knudsenii</i> Hillebr. ssp. <i>knudsenii</i>	Na'ena'e
+E	<i>Dubautia laevigata</i> A. Gray	Na'ena'e
E	<i>Dubautia laxa</i> Hook. & Arnott	Na'ena'e
+E	<i>Dubautia microcephala</i> Skottsb.	Na'ena'e
E	<i>Dubautia raillardoides</i> Hillebr.	Na'ena'e
A	<i>Erechtites valerianifolia</i> (Wolf) DC	Fireweed
A	<i>Erigeron karwinskianus</i> DC	Daisy fleabane
A	<i>Hypochoeris radicata</i> L.	Hairy cat's ear, gomoro
E	<i>Lipochaeta connata</i> (Gaud.) DC var. <i>acris</i> (Sherff) Gardner	Nehe
A	<i>Sonchus oleraceus</i> L.	Sow thistle, pualele
E	<i>Wilkesia gymnoxiphium</i> A. Gray	Ilioa
	Begoniaceae	Begonia family
E	<i>Hillebrandia sandwicensis</i> Oliver	Pua maka nui
	Brassicaceae	Mustard family
+E	<i>Lepidium serra</i> H. Mann	'Aneane, naneae, kmama
	Campanulaceae	Bellflower family
+E	<i>Lobelia niihauensis</i> St. John	'Oha, haha, 'ohawai
+E	<i>Lobelia vuccoides</i> Hillebr.	Panaunau
	Caprifoliaceae	Honeysuckle family
A	<i>Lonicera japonica</i> Thunb.	Japanese honeysuckle

STATUS	TAXON	COMMON NAME
	Caryophyllaceae	Pink family
A	<i>Cerastium fontanum</i> Baumg. ssp. <i>triviale</i> (Link) Jalas	Common mouse-ear chickweed
+E	<i>Schiedea membranacea</i> St. John	
	Celastraceae	Bittersweet family
E	<i>Perrottetia sandwicensis</i> A. Gray	Olomea
E	<i>Perrottetia</i> sp. 1	Olomea
	Corynocarpaceae	Karakanut family
A	<i>Corynocarpus laevigatus</i> J. R. Forster & G. Forster	New Zealand laurel, Karakanut
	Crassulaceae	Orpine family
A	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Air plant, 'oliwa ku kahakai
	Elaeocarpaceae	Elaeocarpus family
E	<i>Elaeocarpus bifidus</i> Hook. & Arnott	Kalia
	Epacridaceae	Epacris family
I	<i>Stryphalia tameiameia</i> (Cham. & Schlechtend.) F. v. Muell.	Pukiawe
	Ericaceae	Heath family
E	<i>Vaccinium calycinum</i> Sm.	'Obelo kau la'au
	Euphorbiaceae	Spurge family
+E	<i>Chamaesyce remyi</i> (A. Gray ex Boiss.) Croizat & Degener var. <i>remyi</i>	'Akoko, koko, kokomalei
	Fabaceae	Pea family
A	<i>Leucaena leucocephala</i> (Lam.) de Wit	Haole koa, koa haole, ekoa
	Gesneriaceae	African violet family
E	<i>Cyrtandra kauaiensis</i> Wawra	Ha'iwale, kanawao ke'oke'o
	Goodeniaceae	Goodenia family
E	<i>Scaevola glabra</i> Hook. & Arnott	'Ohe naupaka
E	<i>Scaevola procera</i> Hillebr.	Naupaka
	Hydrangeaceae	Hydrangea family
E	<i>Broussaisia arguta</i> Gand.	Kanawao, pu'ahanui
	Lamiaceae	Mint family
+B	<i>Stenogyne kealiae</i> Wawra	
E	<i>Stenogyne purpurea</i> H. Mann	
	Lauraceae	Laurel family
E	<i>Cryptocarya mannii</i> Hillebr.	Holio
	Loganiaceae	Logania family
E	<i>Labordia degeneri</i> Sherff	Kamakahala

STATUS	TAXON	COMMON NAME
	Lythraceae	Loosestrife family
I?	<i>Lythrum maritimum</i> Kunth	Pukamole
	Melastomataceae	Melastoma family
A	<i>Tibouchina urvilleana</i> (DC) Cogn. var. <i>urvilleana</i>	Glory bush, lasiandra, princess flower
	Myricaceae	Bayberry family
A	<i>Myrica faya</i> Aiton	Firetree
	Myrsinaceae	Myrsine family
E	<i>Embellia pacifica</i> Hillebr.	Kilioe
E	<i>Myrsine alyxifolia</i> Hosaka	Kolea
E	<i>Myrsine kauaiensis</i> Hillebr.	Kolea
E	<i>Myrsine lessertiana</i> A. DC	Kolea
+E	<i>Myrsine linearifolia</i> Hosaka	Kolea
E	<i>Myrsine punctata</i> (H. Lev.) Wilbur	Kolea
E	<i>Myrsine wawraea</i> (Mez) Hosaka	Kolea
	Myrtaceae	Myrtle family
E	<i>Metrosideros polymorpha</i> Gaud. var. <i>dieteri</i> J. Wyndham Dawson & Stemmermann	'Ohi'a, 'ohi'a lehua, lehua
E	<i>Metrosideros polymorpha</i> Gaud. var. <i>glaberrima</i> (H. Lev.) St. John	'Ohi'a, 'ohi'a lehua, lehua
A	<i>Psidium cattleianum</i> Sabine	Strawberry guava, waiawi
E	<i>Syzygium sandwicensis</i> (A. Gray) Nied.	'Ohi'a ha
	Oleaceae	Olive family
E	<i>Nestegis sandwicensis</i> (A. Gray) Degener, L. Degener & L. Johnson	Olopuu, pua
	Passifloraceae	Passion flower family
A	<i>Passiflora mollissima</i> (Kunth) L. H. Bailey	Banana poka
	Phytolaccaceae	Pokeweed family
A	<i>Phytolacca octandra</i> L.	Southern pokeberry
	Piperaceae	Pepper family
E	<i>Peperomia cookiana</i> C. DC	'Ala'ala wai nui
E	<i>Peperomia hesperomani</i> Wawra	'Ala'ala wai nui
E	<i>Peperomia membranacea</i> Hook. & Arnott	'Ala'ala wai nui
	Pittosporaceae	Pittosporum family
E	<i>Pittosporum gyanum</i> Rock	Ho'awa
	Plantaginaceae	Plantain family
A	<i>Plantago lanceolata</i> L.	Narrow-leaved plantain
A	<i>Plantago major</i> L.	Broad-leaved plantain, laukahi
+E	<i>Plantago princeps</i> Cham. & Schlechtend. var. <i>anomala</i> Rock	Ala

STATUS	TAXON	COMMON NAME
	Primulaceae	Primrose family
E	<i>Lysimachia gluinosa</i> Rock	
+E	<i>Lysimachia kalalauensis</i> Skottsbo.	
	Rosaceae	Rose family
A	<i>Eriobotrya japonica</i> (Thunb.) Lindl.	Loquat
A	<i>Fragaria vesca</i> L.	European strawberry
A	<i>Pyracantha angustifolia</i> (Franch.) C. K. Schneid.	Firethorn
A	<i>Rubus argutus</i> Link	Prickly Florida blackberry
A	<i>Rubus rosifolius</i> Sm.	Thimbleberry
	Rubiaceae	Coffee family
E	<i>Coprosma kauensis</i> (A. Gray) A. Heller	Pilo
E	<i>Coprosma waimaea</i> Wawra	Pilo
E	<i>Hedyotis acuminata</i> (Cham. & Schlechtend.) Steud.	Au
E	<i>Hedyotis foggiana</i> Fosb.	
E	<i>Hedyotis terminalis</i> (Hook. & Arnott) W. L. Wagner & Herbst	Manono
E	<i>Psychotria greenwelliae</i> Fosb.	Kopiko, 'opiko
E	<i>Psychotria hexandra</i> H. Mann ssp. <i>hexandra</i> var. <i>hexandra</i>	Kopiko, 'opiko
	Rutaceae	Rue family
E	<i>Melicope anisata</i> (H. Mann) T. Hartley & B. Stone	Alani
E	<i>Melicope feddei</i> (H. Lev.) T. Hartley & B. Stone	Alani
E	<i>Melicope kavaiensis</i> (H. Mann) T. Hartley & B. Stone	Alani
+E	<i>Melicope pallida</i> (Hillebr.) T. Hartley & B. Stone	Alani
+E	<i>Melicope puberula</i> (St. John) T. Hartley & B. Stone	Alani
E	<i>Platydesma spathulata</i> (A. Gray) B. Stone	Pilo kea
E	<i>Zanthoxylum dipetalum</i> H. Mann var. <i>dipetalum</i>	Kawa'u
E	<i>Zanthoxylum kavaense</i> A. Gray	Hea'e, a'e
	Santalaceae	Sandalwood family
+E	<i>Exocarpos luteolus</i> C. Forbes	Hesa
	Sapindaceae	Soapberry family
I	<i>Dodonaea viscosa</i> Jacq.	'A'ali'i
	Sapotaceae	Sapodilla family
E	<i>Pouteria sandwicensis</i> (A. Gray) Bachi & Degener	'Ala'a
	Scrophulariaceae	Figwort family
A	<i>Veronica serpyllifolia</i> L.	Thyme-leaved speedwell
	Solanaceae	Nightshade family
+E	<i>Nothocestrum pelianum</i> Skottsbo.	'Aia
I?	<i>Solanum americanum</i> Mill.	Glossy nightshade, Popolo
	Theaceae	Tea family
+E	<i>Eurya sandwicensis</i> A. Gray	Anini

STATUS	TAXON	COMMON NAME
		'Akia family
	Thymelacaceae	'Akia
E	<i>Wikstroemia</i> sp.	
		Nettle family
	Urticaceae	
E	<i>Boehmeria grandis</i> (Hook. & Arnott) A. Heller	
+E	<i>Neraudia melastomifolia</i> Gaud.	Ma'aloa, ma'oloa, 'oloa
E	<i>Pipturus kauaiensis</i> A. Heller	Mamaki
E	<i>Pipturus ruber</i> A. Heller	Mamaki
E	<i>Touchardia latifolia</i> Gaud.	Oloa
		Verbena family
	Verbenaceae	
A	<i>Verbena litoralis</i> Kunth	Ha'uoi, oi
		Mistletoe family
	Viscaceae	
E	<i>Korthalsella cylindrica</i> (Tiegh.) Engl.	Hulumoa, kaumahana
		FLOWERING PLANTS: MONOCOTS
		Agave family
	Agavaceae	
E	<i>Pleomele aurea</i> (H. Mann) N. E. Brown	Halapepe
		Palm family
	Arecaceae	
E	<i>Pritchardia minor</i> Bocc.	Loulu
		Sedge family
	Cyperaceae	
E	<i>Carex kauaiensis</i> R. Krauss	
I	<i>Carex meyenii</i> Nees	
E	<i>Carex wahuensis</i> C. A. Mey.	
E	<i>Gahnia beecheyi</i> H. Mann	
E	<i>Gahnia vitiensis</i> Rendle ssp. <i>kauaiensis</i> (Benl) T. Koyama	
I	<i>Machaerina angustifolia</i> (Gaud.) T. Koyama	'Uki
A	<i>Mariscus meyenianus</i> (Kunth) Nees	
I	<i>Pycnus polystachyos</i> (Robbt.) P. Beauv.	
I	<i>Uncinia uncinata</i> (L. fil.) Kukenth.	
		Iris family
	Iridaceae	
A	<i>Crocasmia x crocosmiiflora</i> (Lemoine ex E. Morr.) N. E. Brown	Montbretia
		Lily family
	Liliaceae	
E	<i>Astelia argyrocoma</i> A. Heller ex Skotts.	Pa'iniu
E	<i>Astelia menziesiana</i> Sm.	Pa'iniu
I	<i>Dianella sandwicensis</i> Hook. & Arnott	'Uki uki
		Grass family
	Poaceae	
I	<i>Agrostis avenacea</i> J. G. Gmelin	He'upueo
E	<i>Eragrostis grandis</i> Hillebr.	Kaweia
E	<i>Eragrostis variabilis</i> (Gaud.) Steud.	Kaweia, 'emoloa
A	<i>Holcus lanatus</i> L.	Common velvet grass

STATUS	TAXON	COMMON NAME
A	<i>Lolium multiflorum</i> Lam.	Italian ryegrass
+E	<i>Panicum beecheyi</i> Hook. & Arnott	
A	<i>Paspalum urvillei</i> Steud.	Vasey grass
A	<i>Pennisetum clandestinum</i> Chiov.	Kikuyu grass
+A	<i>Poa mannii</i> Munro ex Hillebr.	
+E	<i>Poa siphonoglossa</i> Hack.	
A	<i>Setaria gracilis</i> Kunth	Yellow foxtail
A	<i>Setaria palmifolia</i> (J. Konig) Stapf	Palmgrass
A	<i>Vulpia bromoides</i> (L.) S. F. Gray	Brome fescue
	Smilacaceae	Catbrier family
E	<i>Smilax melastomifolia</i> Sm.	Hoi kuahiwi
	Zingiberaceae	Ginger family
A	<i>Hedychium coronarium</i> J. Konig	White ginger, 'awapuhi ke'oke'o
A	<i>Hedychium flavescens</i> N. Carey ex Roscoe	Yellow ginger, 'awapuhi melemele
A	<i>Hedychium gardnerianum</i> Ker-Gawl.	Kahili ginger

Appendix E

**Archaeological Reconnaissance Survey of a
Portion of Kahuama'a Flat, Koke'e State Park,
Hanalei District, Island of Kaua'i.
TMK: 5-9-01:1 (por.) & 16 (por.).**

Prepared By:

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and
Martha Yent, M.A.**

ARCHAEOLOGY SECTION



**State of Hawaii
Department of Land and Natural Resources
DIVISION OF STATE PARKS**

February 1994

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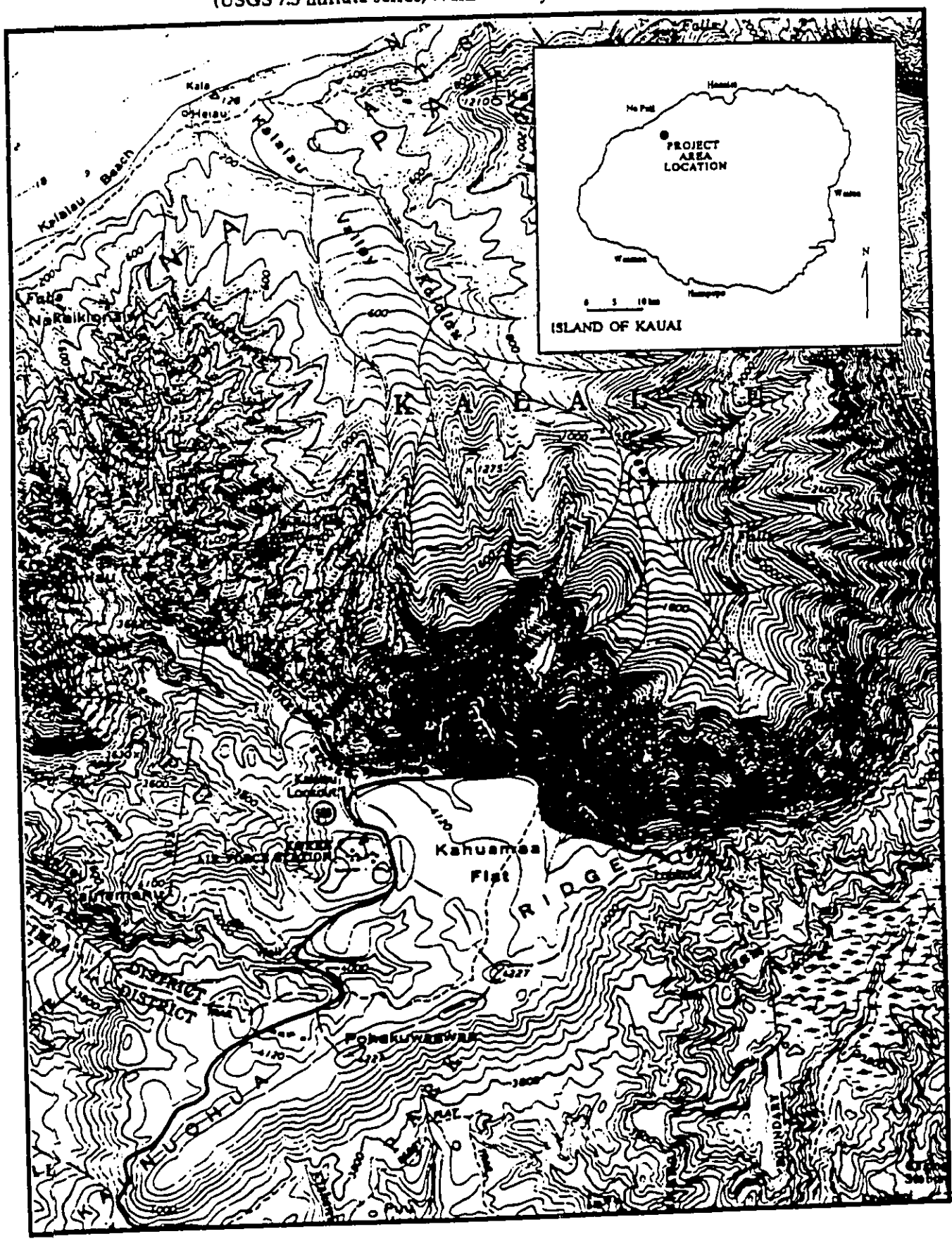
INTRODUCTION

At the request of the Division of Forestry and Wildlife (DOFAW), State Parks Archaeologists Alan Carpenter and Martha Yent conducted an archaeological reconnaissance survey of a parcel of land located within Koke'e and Na Pali Coast State Parks, Hanalei District, Kaua'i. This area is being considered for the creation of a native plant sanctuary which will encompass a portion of these two State Park areas. The portion of the project area located within Na Pali Coast State Park is at the upper rim of Kalalau Valley. This proposed "Kalalau Rim Plant Sanctuary" will set aside approximately 115 acres of land for a plant sanctuary to be developed, maintained, and managed by the Division of Forestry and Wildlife through a Memorandum of Agreement with the Division of State Parks (Telfer 1993). The survey was conducted on December 8 and 9, 1993. Proposed developments for the area consist of the installation of fences to deter feral pig and goat traffic through the area and manual weeding out of non-native plant species. An additional long-term goal of the project is to construct a boardwalk or fenced walkway to guide visitors through the area on an interpretive nature trail. While no archaeological sites were known to exist in this area, the installation of fences could potentially impact sites if they did exist. Koke'e is rather poorly understood archaeologically, and essentially all areas of the Hawaiian Islands were visited and utilized, if not inhabited, by Hawaiians in prehistory and therefore potentially contain evidence of this use in the form of archaeological sites.

PROJECT LOCATION AND DESCRIPTION

The project area is located at the extreme northern extent of Koke'e State Park in an area known as Kahuama'a Flat, which extends to the upper rim of Kalalau Valley, and continues down the steep side of the valley to the 3000 foot contour. This steep portion of the project area is located within the Na Pali Coast State Park (Figure 1). This area is located between the Kalalau Lookout and the Pu'u o Kila Lookout on the north side of Pu'u o Kila Road, specifically extending from a drainage located .3 mile east of the Kalalau Lookout to a drainage located .15 mile west of the Pu'u o Kila Lookout. The southern boundary of the project area is defined by the road and

FIGURE 1: Survey Project Area on Upper Edge of Kalalau Valley
(USGS 7.5 minute series, Waimea Canyon Quad, 1"=2000').

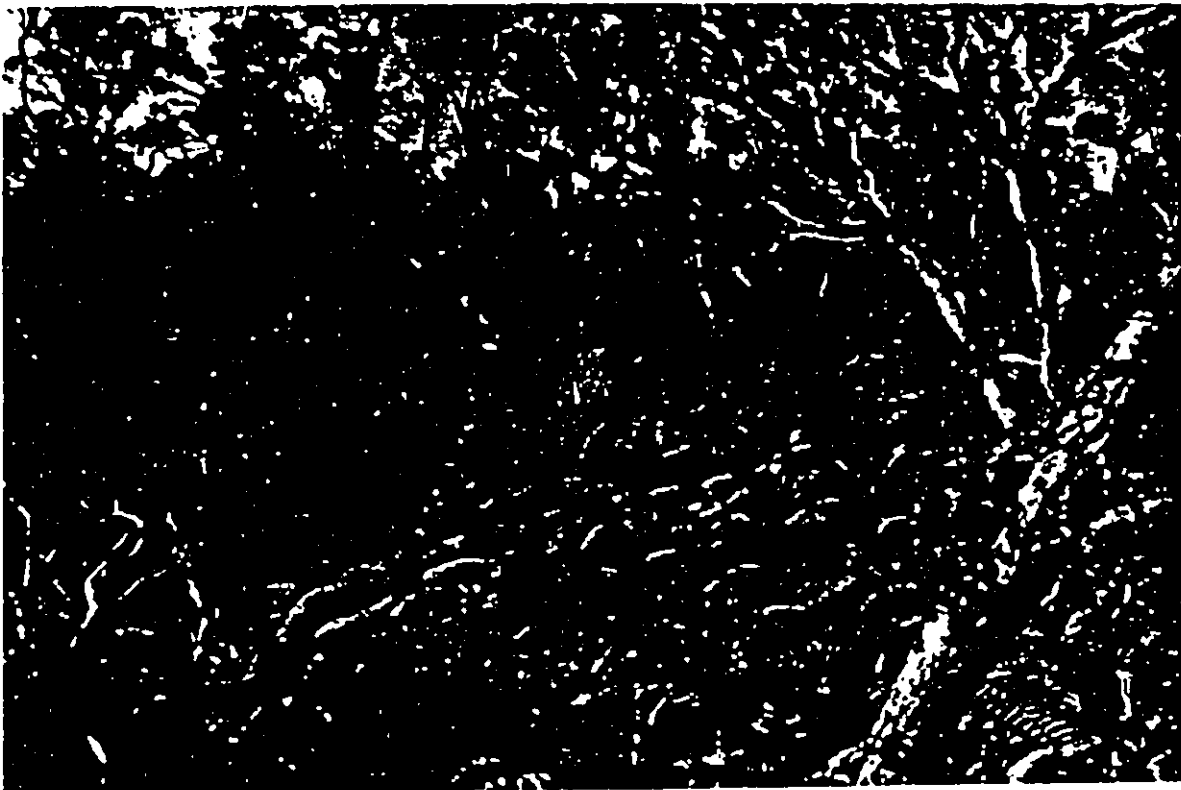


the northern boundary is defined by the 3000 foot contour. This comprises an area approximately 115 acres in size. The upper, flat portion of the project area is at an elevation of approximately 4100 feet above sea level.

Vegetation in the project area is characterized as Lowland Mesic Forest (Wagner et. al. 1990), dominated by a canopy of *Ohia* (*Metrosideros polymorpha* var. *dieteri*), and an understory of dense *Uluhe* fern (*Dicranopteris linearis*), which can reach heights of five feet, making survey extremely difficult (Photo 1). Additional vegetation consists of introduced blackberry (*Rubus* sp.), Daisy fleabane (*Erigeron karvinskianus*) which grows in low dense mats, and a variety of other native and introduced ferns, shrubs, and low-growing trees.

Soil for this area is classified as Koke'e silty clay loam on the upper flat (well-drained soils weathered from igneous rock, probably mixed with volcanic ash), and rough,

PHOTO 1: Typical Project Area Vegetation of *Ohia* and Fern



mountainous land on the valley wall (very steep land broken by numerous drainages, very thin soil mantle if any, much of surface is rock, rock outcrop, and eroded spots). Rainfall averages 60-70 inches annually (Foote et. al. 1972).

The extremely steep nature of the slope of the valley wall prevented survey of that portion of the project area, therefore the survey encompassed only the upper flat area, which coincides to the Koke'e State Park portion of the project area. Due to the steepness of the slope, the likelihood of finding archaeological sites in the Na Pali (Kalalau) portion of the project area is very small.

PREVIOUS ARCHAEOLOGY

There are few archaeological sites recorded in the uplands of Koke'e. This area is generally thought to have been a resource-gathering zone rather than an area of permanent habitation. The nearest recorded archaeological sites are in the valleys of the Na Pali coast, most notably Kalalau. While these areas are spatially very near to each other, they are isolated from each other by 3000 or more feet of sheer cliffs.

Thomas Thrum conducted an island-wide survey of *heiau* sites in 1906, and recorded the following sites in the Koke'e area:

Ahuloulu Heiau:

At the foot of the crater cone of Puukapele is a series of three platforms. On account of the conformation of the mountain these are irregular in shape. The lower platform is of earth. It seems to have had no regular sides or edges, the ground being simply leveled off to give a place to stand on. The longest axis is about 60 feet. The longest at right angle to this is about 50 feet. Rising four feet above this is a walled enclosure 12x30, but not exactly rectangular. The stone walls are about three feet high, and badly dilapidated. The third platform is a small niche in the mountain side about 8x10, evidently only a house floor. No special significance seems to be attached to this so-called heiau.

Ka-unu-aiea Shrine:

Ka-unu-aiea is a small shrine in the dense koa forest of Milolii. It was only an "unu", or

shrine, for the shifting population of the forest belt. There is no platform left to indicate its existence (Thrum 1906).

Thrum described the location of this site as Kaunuohua Ridge, in the forest of Miloli'i. The exact location is not known, but it would seem from this description that it was situated relatively near our present project area. Kaunuohua Ridge runs roughly northeast to southwest immediately south of the project area (see Figure 1). The site may have been located approximately where the NASA tracking station is presently, as indicated by the forest name of Miloli'i.

Wendell Bennett, in his 1928-29 survey of Kauai archaeological sites, further described this site, calling it a *heiau*, and giving its name as Kaumuaiea. Bennett claims the name applies to a small clearing containing a line of stones forming no outline or platform. He also describes its location as being "in the forest above Halemanu" (Bennett 1931).

These sites are of special interest in that they provide evidence that potentially significant sites can be located in isolated upland areas where there was little or no permanent habitation.

Bennett did not record any additional sites in Koke'e, although he did record two house site complexes on or near Pu'u Ka Pele crater in addition to Ahuloulu Heiau. The nearest sites to the project area recorded by Bennett are in Kalalau Valley, which was extensively terraced for agriculture and contained numerous habitation sites and two *heiau*. However, the upland portion of our project area and the valley floor of Kalalau are separated by three to four thousand feet of steep cliffs, and the amount of contact between the two areas is unclear.

An archaeological reconnaissance survey along ridge roads in the Koke'e uplands was conducted by Nancy McMahon of the State Historic Preservation Division in 1993 (McMahon 1993). This included the ridges of Lapa, Ha'ele'ele, Polihale,

Ka'aweiki, Kuaaho, Makaha, Miloli'i, and Pu'u Opae. A single archaeological site (State site # 50-30-05-499) was found at the end of Polihale Ridge Road. It consisted of a 5 meter long stone alignment one to two courses high interpreted to be a sweet potato planting area because of the soil fill behind the facing. No other sites were found, although the possible locations of several plantation camps and house sites associated with the development of sugarcane cultivation in the late 1800's were recorded. No surface remains were noted at these camp locations. A great deal of ground disturbance has taken place in this century due to the the cane plantation and the military, which may have destroyed evidence of archaeological sites in the survey area.

A single archaeological site (State site # 50-30-06-707) was recorded in the area of the Waimea Canyon Lookout by State Parks archaeologists in 1993 (Carpenter 1993). This site, located about 80 meters southwest of the men's restroom at the lookout, consists of a clear, level area atop a ridge outlined by a single row of stones on three sides. This site was likely a temporary habitation site, possibly even a shelter related to the sandalwood trade. It could also represent a canoe making site, as the uplands in this area were known for logging and working of canoe wood (Handy and Handy 1972).

Brief reconnaissance surveys by Ching (1978a, b), Kikuchi (1982), Yent (1982), Walker and Rosendahl (1990), and Chaffee and Spear (1993) recorded no new archaeological sites.

HISTORICAL BACKGROUND

As previously conjectured, the upland area of Koke'e and the Alakai Swamp were likely utilized in prehistory as resource gathering zones, as opposed to areas of permanent habitation or agriculture. Several legends refer to this area to suggest this use. One attributes the road of sticks through the Alakai Swamp to the *menehune* (Rice 1923). Another refers to Lahi (or Lauhaka), a young man who would eat only birds, and traveled to the top of Kilohana (a lookout at the edge of the Alakai Swamp) where the *Uwa'u* bird nested to satisfy his hunger (ibid). Pu'u ka Pele is referred to as an area for gathering *koa* canoe logs and other building materials:

At one time the Menehune built two canoes of koa in the mountains near Puu-ka-Pele. As they were dragging them down to the lowlands, they were caught by a heavy rain-storm, and were forced to leave the canoes across the little valley. the storm covered the canoes with debris, and later, a road was built across them, over which all the materials to build the village of Waimea were hauled (ibid).

Further evidence for the gathering of canoe logs from the uplands comes from the narrative of the Dutch merchant Captain Jacobus Boelen, who visited Waimea in 1828. While his ship was being loaded with sandalwood, he spent some time exploring the region and included the following observation:

On that day we visited Quequaheva's [Kaikio'ewa's] shipyard, which consisted of large sheds where the largest and most beautiful canoes that can be found in the islands were made. We were assured that the island of Atooi [Kauai] had always been the principal workshop of the islands in these matters. Under one very neatly made roof I saw two of the largest double canoes I have ever seen . . . Long, narrow, and lightly built, although of a strong and heavy type of wood [*koa*], they have only a shallow draught. . . some of these vessels - especially those double canoes of the largest sort, which the highest chiefs use - are up to seventy or eighty feet long . . . (Broeze 1988).

It is obvious from this description that *koa* trees of exceptional size were being

harvested in the uplands, where they were undoubtedly being partially worked to lessen their weight prior to transport to the coast.

Handy (1940) does not specifically mention Koke'e with respect to Hawaiian agriculture, although he does state that "the upper gulches and forests in and above Waimea Canyon should be favorable localities for yams" (p. 171) He also mentions that boggy areas in the uplands were utilized for the cultivation of *olona*.

There are trails recorded which ran from the Na Pali valleys to Koke'e and Waimea Canyon. Bennett (1931) recounted several trails connecting different areas of the Na Pali coast with the uplands. Handy and Handy (1972) recount the following:

More anciently the old Hawaiians used a number of overland trails. The Kamalle trail descended into Nu'ulolo [Nualolo] Valley inland. There was a trail connecting Nu'ulolo with Honopu. A good trail overland connects Kalalau with Ha'ena. There is a trail from Koke'e in the mountains above Kekaha down into Kalalau. From Polihale travelers could go on foot, with a little swimming, to Miloli'i, and a trail connected Miloli'i with Nu'ulolo flats. Another trail connects Miloli'i with Koke'e. And there was the path (*ala*), said to have been built by King 'Oia, that led from Waimea Delta up the canyon to Koke'e, over the Alaka'i Swamp, where it was said to have been paved with sticks (*kipapa*), and thence down Maunahina ridge into Wainiha by way of Koke'e [Handy and Handy 1972]

This trail system suggests a connection between the north and south sides of the island, although whether the trails facilitated trade or simply travel between the two areas is not known. It can be assumed that the upland forests were utilized as resource gathering zones for such items as hardwoods, bird feathers, and medicinal plants, as well as freshwater resources such as *o'opu* and *opae*. Undoubtedly a substantial trail existed between the upper Waimea Canyon and Waimea Village to facilitate the transport of large canoe logs.

The Reverend Hiram Bingham traveled from Waimea to Hanalei in 1821 along the

old established route passing through Koke'e. The trail consisted of a "narrow, winding, slippery foot-path, sometimes on sharp ridges, here ascending and there descending rugged steeps". He described the uplands as being uninhabited, but mentioned several temporary shelters along the way which he attributed to sandalwood cutters, and reported abundant sandalwood forests still in existence at that time (Bingham 1981).

Queen Emma, in 1871, made a trek from Waimea to the "Kilohana of Hanalei", at the edge of Wainiha Valley. A party of about one hundred people accompanied the queen, along a route which again likely followed the old trail. At that time the trail was very overgrown but still recognizable. Among the more interesting anecdotes of the trip was a stop the party made on the edge of Kauaikinana Valley where Queen Emma, overcome by the beauty of the spot, insisted upon a hula performance. The trip then continued through the Alaka'i Swamp where the party spent the night. The trail through the swamp was described as a "corduroy road", built of tree-fern logs placed side by side. They reached the Kilohana the next morning and then retraced their steps to Waimea (Knudsen 1940).

The sandalwood trade dominated the Kaua'i economy in the early nineteenth century. Beginning in 1810 and reaching a peak in 1821-22, commoners were forced to leave their taro fields and head into the mountains to cut the precious wood. The resource was controlled by King Kaumuali'i, who exchanged the commodity for ships and other western luxuries. Unfortunately, this took a great toll upon the people as well as the sandalwood forests, which were all but depleted by the mid-1830's. Waimea was the sole port of export on Kaua'i for the wood, which came almost exclusively from the upland gulches of Waimea Canyon and Koke'e (Joesting 1984).

Valdemar Knudsen obtained a lease to much of the present day Koke'e State Park in the mid-1800's. He used the land to run cattle, which provided beef to provision the whaling vessels. The cattle industry on Kaua'i diminished greatly by 1900 due to the

decline of the whaling business (Joesting 1984).

The decline of cattle overlapped with the onset of the sugar industry. Beginning in the late 1800's and continuing into early this century, an irrigation system tapping the uplands (the Waimea Canyon-Kekaha ditch) was constructed to irrigate the cane lands of Kaua'i's west side. In conjunction with this development, plantation camps were constructed in the uplands to house the mainly Chinese workers who built and maintained the ditch system.

Land use in Koke'e during this century consists mainly of recreational and military activities (Heathcote 1993). Wealthy sugar plantation owners built vacation cabins in Koke'e to escape the summer heat of the lowland plains. Hunters traveled on horseback to the uplands in search of pigs and goats. A large network of trails was built and existing trails were refurbished by the Civilian Conservation Corps following the Great Depression. During World War II, the Army laid a telephone line through the Alaka'i Swamp and down to Hanalei, as well as establishing a radar station in Koke'e. In the 1940's, the road to Koke'e was improved, and the lookouts at Waimea Canyon and Kalalau were constructed. The Koke'e Museum and Lodge were established in the 1950's. The last major developments in Koke'e were in the 1960's with the establishment of a Hawai'i Air National Guard installation and a NASA tracking station constructed as part of the National Space Program.

SURVEY RESULTS

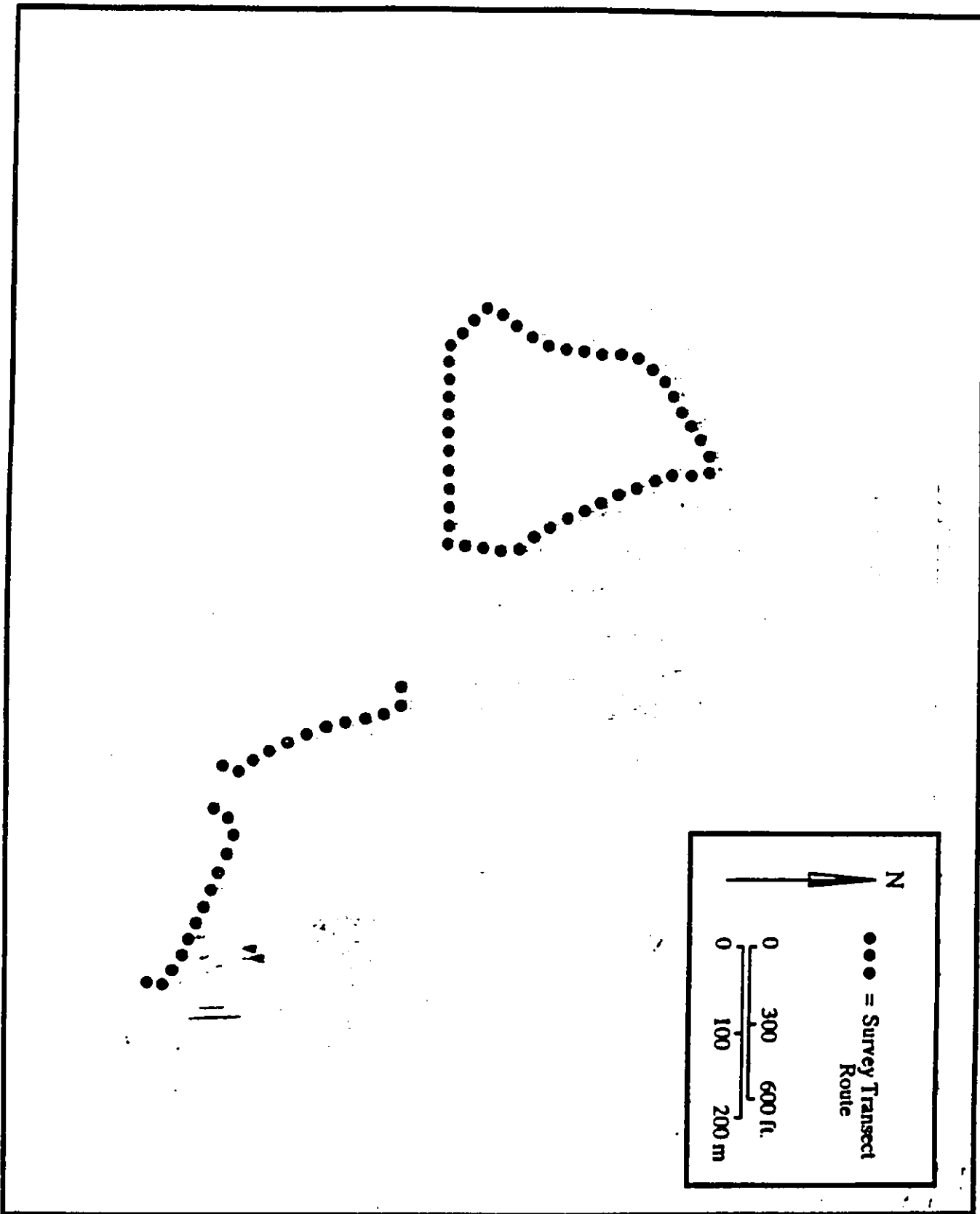
Methodology

The survey area consists in great part of extremely steep cliffs on the southwest side of Kalalau Valley. These cliffs, as previously mentioned, precluded survey of that portion of the project area. The remainder of the project area consists of the upper flat on the rim of the valley, representing perhaps one third (roughly 40 acres) of the project area. This upper area was divided into three sections, defined by two drainages which were too steep to be passable. Each was surveyed in a separate transect, aimed at covering a cross-section of each area (Figure 2). In addition to State Parks archaeologists Alan Carpenter and Martha Yent, Nevin Reinard, a volunteer from the Koke'e Museum assisted in the two-day field survey. As previously mentioned, the dense vegetation was a prohibiting factor in terms of locating sites. While we did not expect to find sites in the area, if they were present we would have had to literally walk over them to locate them in most areas. Special attention was paid to a 100 foot wide corridor to the immediate north of the Pu'u o Kila Road, as that is where a proposed fence would be installed as the first measure to attempt to control feral pig access to the sanctuary area. A more intensive survey would not likely have produced any more accurate results due to the aforementioned dense vegetation (see Photo 1).

Findings

No archaeological sites or features were encountered during the survey, which supports use of this area by Hawaiians as a resource gathering zone, with no permanent habitation. Evidence for this type of use could include trails and small temporary habitation features, which would easily be deteriorated by the ravages of time, especially in an area of such high rainfall and dense vegetation growth. The upper edge of the valley rim was traversed in several places, and the relatively barren steep slopes also showed no evidence of use. No caves or rockshelters were noted on the cliffs. Once again, the nature of the vegetation would likely have prevented us from seeing all but the most impressive of sites, and we cannot

FIGURE 2: Survey Transect Routes.



unequivocally state that there are no archaeological sites located within the project area.

Additionally, large trees unearthed during Hurricane Iniki provided an opportunity to examine the upper layer of the soil stratigraphy throughout the area. Nothing other than natural reddish brown clay deposits were noted, and no cultural materials were observed within this matrix.

RECOMMENDATIONS

Although no archaeological sites or features were noted during the course of this survey, the potential for significant sites in this area has been documented (Thrum 1906, Bennett 1931 - see *Previous Archaeology* above). As previously outlined, the dense vegetation in this area greatly hindered adequate survey of this parcel. Although the likelihood of encountering sites appears to be very small, nonetheless the possibility does exist. Because of the inability to accurately survey the area and the slight potential of unrecorded archaeological sites being encountered during development of the plant sanctuary, the following precautions should be adhered to:

-All ground disturbing clearing efforts should be monitored by an archaeologist so that any potential surface archaeological sites are not disturbed, especially in the event that heavy equipment is utilized. Alternately, all clearing activities that do not disturb the ground surface should be inspected by an archaeologist immediately following the clearing to determine the presence or absence of sites.

-The installation of fences for feral animal control should be monitored by an archaeologist to assure that potential surface features as well as potential subsurface cultural deposits are not disturbed by these activities.

-If at any time during the development of the plant sanctuary archaeological

features are encountered, DOFAW will notify the Division of State Parks archaeologists. Additionally, if DOFAW activities could impact any archaeological feature, those activities will cease until such time as the feature is evaluated by an a qualified archaeologist.

-The potential for encountering human remains is judged to be extremely slight. However, if activities extend into the steep cliff portion of the project area which was not surveyed, the potential for encountering rockshelters or caves (features known to be used by Hawaiians for interment of the dead) does exist. In the advent that human remains are inadvertently discovered, those remains shall not be disturbed and the Burials Program of the State Historic Preservation Division shall be immediately notified in accordance with Hawaii Revised Statutes, Chapter 6E.

SUMMARY

State Parks archaeologists conducted a reconnaissance survey in the area of Kahuama'a Flat in Koke'e State Park, Kaua'i at the request of the State Division of Forestry and Wildlife. This area is being considered for the creation of a native plant sanctuary to be developed and maintained by DOFAW. No archaeological sites or features were encountered during this survey. However, due to the dense vegetation and steep slopes found in the project area, a complete evaluation of the area was not possible. While it is unlikely that any significant archaeological sites exist in this area, it is nonetheless possible. Therefore, recommendations were made to assure that any potential sites are not impacted by the minimal construction proposed in conjunction with the development of this preserve. If these recommendations are adhered to, we feel that the project will have no adverse effect on the cultural resources of the area. Furthermore, we feel that the development of such a sanctuary will add to the interpretive resources of Koke'e State Park, and the long term goal of establishing a nature trail through the sanctuary for educational purposes (Telfer 1993:2) would heighten the public's awareness of Hawai'i's unique botanical resources.

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Thrum, Thomas G.

1906 *Hawaiian Almanac and Annual for 1907*. Thomas G. Thrum, Honolulu.

Wagner, Warren L., Derral R. Herbst and S.H. Sohmer

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Walker, A.T. and P.H. Rosendahl

1990 *Archaeological Inventory Survey USN Radio Telescope Project Area, Land of Waimea, Waimea District, Island of Kauai*. On file at the Historic Preservation Division, Honolulu.

Yent, Martha

1982 *Archaeological Reconnaissance: Proposed Kokee Hydropower Project, Kokee State Park, Waimea Canyon State Park, and Upper Kekaha, Waimea District, West Kauai*. On file at the Division of State Parks, Honolulu.

APPENDIX F

Comments on the Proposed Project

- F-1. Letter from Mr. Don Hibbard, Administrator State Historic Preservation Division dated February 6, 1997.
- F-2. Letter with comments from Mr. Wayne H. Souza, Kauai State Parks Superintendent dated February 12, 1997.
- F-3. Letter from Mr. K. R. Wood, National Tropical Botanical Garden, Research Botanist dated February 28, 1997
- F-4. Letter with comments from Mr. Brooks Harper, Field Supervisor, Ecological Services Division, U. S. Fish and Wildlife Service, Dept. of Interior dated April 25, 1997.
- F-5. Letter from Mr. Clayton, Sakahashi, Chairman, Kauai Aquatic Life and Wildlife Advisory Committee dated April 25, 1997.
- *F-6. Letter from Mr. Randall Ogata, Administrator, Office of Hawaiian Affairs dated July 14, 1997.
- *F-7. Letter from Mr. Gary Gill, Director, Office of Environmental Quality Control dated July 22, 1997.

Note: Copies of the Draft E. A. were sent to the following agencies, and no responses or comments were received from:

Kokee Natural History Museum

Kauai Hunting Association

Kauai Branch, D.L.N.R. Division of Conservation and Resources Enforcement

* Indicates letters received during the initial 30 day comment period.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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

February 6, 1997

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

DEPUTIES

GILBERT COLOMA-AGARAN

AQUACULTURE DEVELOPMENT
PROGRAM

AQUATIC RESOURCES
CONSERVATION AND

RESOURCES ENFORCEMENT
CONVEYANCES

FORESTRY AND WILDLIFE
HISTORIC PRESERVATION

DIVISION
LAND DIVISION
STATE PARKS
WATER AND LAND DEVELOPMENT

MEMORANDUM

TO: Thomas C. Telfer, District Wildlife Biologist
Division of Forestry and Wildlife

LOG NO: 18835 ✓
DOC NO: 9702NM04

FROM: Don Hibbard, Administrator
State Historic Preservation Division

SUBJECT: **Historic Preservation Review -- DEA for the Proposed Kalalau Rim
Endangered Plant Enclosure and Out planting Site
TMK; 5-9-01: 1 (por.) & 16 (por.)
Koke'e, Hanalei, Kauai**

Thank you for submitting the above document for our review. We have reviewed your report in Appendix E - *Archaeological Reconnaissance Survey of Portion of Kahuama's Flat, Koke'e State Park* (Carpenter and Yent, 1994) and believe it is an adequate inventory survey report. No significant historic sites were found. Therefore, we believe that this project will have "no effect" on significant historic sites, with the understanding that the compliance steps listed on page 13-14 of this report will be followed. Please notify our office if archaeological features are found; a field inspection report should follow-up this notification process

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

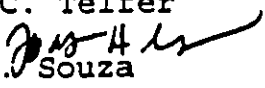
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Appendix F-1

State of Hawaii
Department of Land and Natural Resources
DIVISION OF STATE PARKS

February 12, 1997

MEMORANDUM

TO: Thomas C. Telfer
FROM: Wayne H. Souza 
SUBJECT: DEA FOR KALALAU RIM ENDANGERED PLANT ENCLOSURE AND OUT-PLANTING SITES

We reviewed the draft environmental assessment and have the following comments:

1. The enclosure will be a joint management effort between our divisions.
2. Kokee Road and Puu O Kila Road in Kokee State Park are park roads. Highway 550 stops at the intersection with Halemanu Road.
3. Will the treated wooden fence posts have any adverse impacts to the environment, e.g. chemicals leaching into the ground (p.2)?
4. Once the fenceline is cleared, will it be maintained or will native vegetation be allowed to grow back (p.2)?
5. When clearing alien plants, whole or cut plants could be left in place to decay as long as the reproductive parts are removed, and it does not create a fire hazard or a significant visual impact. Otherwise the green waste will have to be hauled out. Composting should not be considered on-site. Our department does not have the staffing to do it properly and the consequences can be catastrophic.
6. The classification system for Zone C2 should be given (p.3)?
7. Our state parks crew will also be involved in the monitoring and over-seeing the work done (p.6) and the designation of the fenceline (p.8).

Appendix F-2

Memorandum - Thomas C. Telfer
Page 2
February 12, 1997

8. The adverse visual impacts need to be minimized particularly as viewed from the roadway and the two neighboring lookouts. Consideration should be given to painting those sections of the fenceline that will not be hidden or screened by the vegetation. The access to the fenceline should be temporary and include a "dogleg" to avoid direct view from Puu O Kila Road (pp. 7-8).
9. The labelling of the enclosure design (Appendix B) is not consistent with the descriptions on page 2: 1) one strand barbed wire vs two strands and 2) 200' intervals vs 100' intervals.
10. The location of specific rare species should not be disclosed. It's okay for the Distribution of Rare Plants map to show the locations but it should not list what rare plants are found at specific sites. This is necessary to protect the plants from vandals, collectors and other human threats.

If there are any questions regarding this matter, please contact me.

cc: Ralston Nagata



NATIONAL TROPICAL BOTANICAL GARDEN
 CHARTERED BY CONGRESS TO CREATE A NATIONAL RESOURCE IN TROPICAL BOTANY

Tom Telfer
District Wildlife Biologist
Department of Land and Natural Resources
Division of Fish and Wildlife

February 28, 1997

Tom,

Thank you for sending over your Divisions proposal for the Kalalau Rim Endangered Plant Exlosure & Outplanting Site [Draft Environmental Assessment (including The Archaeological Reconnaissance, your Faunal Survey, and TNC's Biological Database reports)]. As a rare plant specialist here at the NTBG I find that the botanical resources of this 11.5 acre sight have been clearly addressed and the numerous rare plant taxa of this area have been well mapped.

I'm sure I speak for all the staff here at NTBG when I offer our assistance in programs focusing on conservation biology. Lets work together on this mid elevation nursery. I think we can help as a source of seeds for this ongoing project.

One of the many areas I'm interested in now include the mesic forests from Makaha to Honopu. Over these next few years a re-evaluation of the Kuia NAR is appropriate, and as it falls right in the middle of this realm I will be addressing Kuia. In the recent past I've gathered much information and will try to bring to light the current status of these ecosystems . I'm sure I can be of assistance to you in your concerns toward preservation of appropriate areas within these dynamic mesic forests. If I publish a paper on this area would you or Ed like to contribute in some way? I think we can come up with some solutions toward the deer in our more diverse mesic locations and I'm curious about your concerns.

K.R. Wood Δ Research Botanist
Plant Science Department
National Tropical Botanical Garden

DNV OF EC. SYSTEMS

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Appendix F-3



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Ecoregion
300 Ala Moana Blvd, Room 3108
P.O. Box 50088
Honolulu, HI 96850

phone: 808-541-3441; fax: 808-541-3470

DATE RECEIVED		FILE NUMBER	
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KOGA		APP ACTION	
KYONO		DRAFT REPLY	
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PIVERA		SEE ME	
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In Reply Refer To: Kalalau Plant Exclosure (MMB)

APR 25 1997

Mr. Thomas Telfer
District Wildlife Manager
Division of Forestry and Wildlife
Department of Land & Natural Resources
3060 Eiwa Street, Room 306
Lihue, HI 96766

Dear Tom,

Thank you for the opportunity to comment on the preliminary draft environmental assessment (EA) for the Kalalau Rim Endangered Plant Exclosure and Outplanting Site, Waimea, Kauai. The Fish and Wildlife Service (Service) would like to offer the following comments on the preliminary draft EA.

Section I. Description of Proposed Action

Page 1, paragraph 3: The Service recommends that the last sentence be modified to indicate that it is difficult at this time to protect these habitats rapidly enough to prevent extinctions of many endangered plant species. The Service and the State Division of Forestry and Wildlife (DOFAW), as part of our cooperative agreement for long-range planning to protect and recover endangered plant species on the island of Kauai, has discussed plant sanctuaries and outplanting areas as short-term solutions to prevent extinction while long-term management of habitat is developed. In addition, one future use of the exclosure could include a source for seeds for outplanting in other historical habitat, once the long-term management has begun.

Page 2, paragraph 2: Alternative methods for clearing the fenceline should be considered, since there are numerous native tree species in the area. The company hired to do the fencing, Wellington Fencing Company, is very familiar with clearing fenceline with minimal impact on native vegetation. It may be possible to use a combination of tractor clearing and hand clearing to minimize impacts.

Page 2, paragraph 3: The EA states that "significant" native plants will be left intact during the clearing of non-native vegetation. The definition of "significant" should be included. Does this mean all native plants, only endangered native plants, or are some other criteria used? For threatened and endangered (T&E) and species of concern (SOC) species, there needs to be more discussion of how these species will be protected during weed control. Steps need to be taken to

Appendix F-4

ensure that volunteer weeders are familiar with the T&E and SOC species and will not impact any of them that are found or outplanted on the site. The Service recommends that all T&E and SOC species within the enclosure be flagged and that weeding directly around these species be conducted by staff or highly trained volunteers.

A list of species intended to be outplanted should be included in the EA, along with some discussion of what pattern of outplanting will be implemented. DOFAW's previous discussions with the Service regarding this enclosure indicated that this would be a habitat restoration project that would include common and T&E species only from that habitat type, but this is unclear in the EA.

Page 2, paragraph 4: It is clear that the weed control and outplanting within the enclosure will take an extensive amount of time. If possible, a tentative time line should be included. Will it take five years to complete the initial clearing? Ten years? Twenty years? There should also be some indication of how the weed control will progress through the enclosure and some indication that the project will require ongoing low level maintenance even after the initial clearing is completed.

Page 3, paragraph 4: If the fence will not protect the plants on the cliffs adjacent to the enclosure, what measures are being taken to ensure that there will not be increased ungulate impacts to these cliff-dwelling plants immediately outside the fence?

Section III. Impacts and Alternatives to the Proposed Action

Page 5, paragraph 6: Three impacts are identified and discussed: disruption of wildlife and removal of some native plants from fence building and weeding, disposal of the weedy vegetation removed, and aesthetic considerations within Kokee State Park. Another impact that should be considered is the negative impact to the wild populations of those T&E and SOC plant species that will be collected for the purposes of outplanting into this site. The EA should identify who will be doing the collecting and how it will be done (see comments below regarding Page 8).

Page 6, paragraph 3: As mentioned above (Page 1), when discussing the purpose of this enclosure, it should be made clear that there is no other practical means to protect these plants from ungulate damage and extinction at this time, since the long-term planning DOFAW is undertaking with the Service cannot be implemented fast enough to protect these plants.

Page 6, paragraph 4: If the composting from the removal of alien weeds is to remain on site, the discussion on impacts should include what precautions will be taken to ensure that the compost material does not contribute seed or vegetative material to the reinvasion of cleared areas within the enclosure.

Section IV. Proposed Mitigation Measures

Page 8, paragraph 1: In addition to the precaution of having staff botanists on hand to designate the fenceline and monitor the weeding, the potential presence of nene should be addressed. In

the event that nene are seen in the area during any activities, all activities should halt until such time as the nene leave the area.

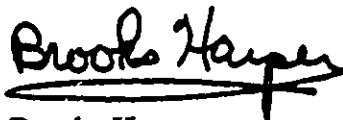
Page 8: An additional paragraph should be added on the proposed mitigation for the collection of material from T&E and SOC plant species. Emergency T&E and SOC species should be collected by botanical experts, to ensure that the wild population is not damaged or over-harvested. For the non-emergency species, no more than 10% of seed from any one population should be collected, and propagation material should be collected from at least 10 different individuals, but more if possible. In addition, the Service recommends including a discussion of what measures will be taken to ensure that outplants will be disease- and pest-free, so that additional threats will not be introduced to the T&E species in adjacent areas. Or will outplanting be addressed in a separate EA?

Appendix C: Since rats are known to occur in the area, the EA should include monitoring to ensure that rats do not damage the outplanted individuals. If damage is observed, it may be necessary to deploy rat bait stations to control rats in the site.

Appendix D, Page 10: While the Service understands that the map will not be included in the draft EA that goes out for public review, we would appreciate a copy to allow us to better assess any potential impacts to T&E species.

We appreciate the opportunity to comment on the preliminary draft EA for the Kalalau endangered plant enclosure prior to public review. The Service supports DOFAW in this effort to manage and restore habitat in one of Kauai's most biologically diverse habitats and to continue with emergency efforts to prevent extinctions of the rare species in that area. We look forward to working with you on this and other such projects in the future. If you have any questions regarding these comments, please call me or Marie Bruegmann at 808-541-3441.

Sincerely,



Brooks Harper
Field Supervisor
Ecological Services

April 25, 1997

Department of Land and Natural Resources
Division of Forestry and Wildlife
3060 Eiwa Street
Lihue, HI 96716

Dear Thomas C. Telfer.

Our committee has reviewed the proposed Kalalau Rim Endangered and Out-planting Site environmental assessment. We find the location of the an excellent choice. Our committee hopes you will have great success in this endeavor.

Thank you for allowing us to review and comment on this project.

Sincerely,



Clayton Sakahashi
KALAWAC Chairman.



STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAII 96813-5249
PHONE (808) 594-1888
FAX (808) 594-1865
July 14, 1997

DIV. OF FORESTRY & WILDLIFE-KAUAI

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JUL 29 1997	
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Mr. Thomas C. Telfer
Kauai District Wildlife Manager
Department of Land and Natural Resources
3060 Ewia St., Room 306
Lihue, HI 96766-1875

Subject: Draft Environmental Assessment (DEA) for Kalalau
Rim Endangered Plant Exclosure and OutPlanting
Site, Waimea, Island of Kauai.

Dear Mr. Telfer:

Thank you for the opportunity to review the Draft Environmental Assessment (DEA) for Kalalau Rim Endangered Plant Exclosure and OutPlanting Site, Waimea, Island of Kauai. The State proposes to construct an 11.5 acre seven foot high fenced exclosure within Kokee State Park to protect native and rare plant species from weed infestation and feral activity.

The Office of Hawaiian Affairs (OHA) strongly supports efforts by your agency to restore and protect wildlife habitats within Kokee Park State. OHA has no concerns at this time to the proposed protective measure. The fenced exclosure appears to be a sound management strategy to (i) control weed infestation and ungulate damage, (ii) provide indigenous species with an environment conducive to rapid reconvey and growth, and (iii) provide continuous and cost-effective monitoring and protection.

APPENDIX F-6

Letter to Mr. Telfer
Page two

Please contact Lynn Lee, Acting Officer of the Land and Natural Resources Division, or Luis A. Manrique, should you have any questions on this matter.

Sincerely yours,



Randall Ogata
Administrator

LM:lm

cc Trustee Clayton Hee, Board Chair
Trustee Abraham Aiona, Board Vice-Chair
Trustee Rowena Akana, Land & Sovereignty Chair
Trustee Haunani Apoliona
Trustee Billie Beamer
Trustee Frenchy DeSoto
Trustee Moses Keale
Trustee Colette Machado
Trustee Hannah Springer
CAC, Island of Kauai

FN
SP

BENJAMIN J. CAYETANO
GOVERNOR

Post-it Fax Note	7671	Date	8/4/97	# of Pages	1
To	Ed Pettigrew/Tom Jellner	From	Nelson Angeles		
Co/Ded/	Kauai DOFAW	Co.	Admin. DEFW		
Phone #	274-3433	Phone #	587-0166		
Fax #	274-3438	Fax #	587-0160		

STA:

OFFICE OF ENVIRONMENTAL QUALITY CONTROL

238 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4367

DEPT. OF LAND
& NATURAL RESOURCES
STATE OF HAWAII

RECEIVED
JUL 31 AM 10:05

July 22, 1997

Mr. Michael Wilson, Chair
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Wilson:


Subject: Draft Environmental Assessment for the Kalalau Rim
Endangered Plant Exclosure and Outplanting Site

This is in response to the review of the subject document. We have
the following questions and comments.

1. The Kalalau Rim Endangered Plant Exclosure and Outplanting site is located close to the highway. What are the advantages and disadvantages of this location? Does such a close proximity to exotic plants along the roadway increase the chances for alien species to be introduced to the site? Would an alternative location further away from the roadway reduce exposure to aggressive non-native plants?
2. Please list the names of the flora that will be planted in the Kalalau Rim site.
3. Please list all the federal, state and county permits and approvals that would be required for this project.
4. Please justify the finding of no significant impact determination based on the criteria set forth in section 11-200-12 of the EIS rules.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,


Gary Gill
Director

APPENDIX G

Responses to Comments on the Proposed Project

- G-1. Letter from Thomas C. Telfer to Wayne H. Souza, Kauai State Parks Superintendent responding to comments on E. A. dated February 26, 1997.
 - G-2. Letter from Thomas C. Telfer to Mr. Brooks Harper, Field Supervisor, Ecological Services Division, U.S.D.I. Fish and Wildlife Service dated May 19, 1997.
 - *G-3. Letter from Thomas C. Telfer to Mr. Gary Gill, Director, Office of Environmental Quality Control dated August 8, 1997.
 - *G-4. Letter from Thomas C. Telfer to Mr. Randall Ogata, Administrator, Office of Hawaiian Affairs dated August 27, 1997.
- * Indicates responses to letters received during the initial 30 day comment period.

Department of Land and Natural Resources
Division of Forestry and Wildlife
Kauai District
3060 Eiwa St., Room 306
Lihue, HI 96766-1875
(808) 274-3433/(808) 274-3438 (Fax)



February 26, 1997

MEMORANDUM

TO: Wayne H. Souza, Kauai State Parks Superintendent
FROM: Thomas C. Telfer, Kauai District Wildlife Manager
SUBJECT: Response to Comments on Kalalau Rim Endangered Plant Exclosure and Outplanting Site

Thank you for your 12 February 1997 comments on our subject draft environmental assessment. The following are responses to your specific comments:

1. We acknowledge that this is a joint project, being located on State Parks lands. We will appreciate any input and/or assistance you can provide.
2. Your correction concerning the status of the Kalalau Rim Road will be included in the final draft.
3. It is unlikely that the treated wooden fence posts will have any adverse impact on the local environment. The copper sulfate treated posts we use are commonly used for fence construction in Hawaii, and have never resulted to our knowledge in any adverse effects to the environment. Commercially available chemically treated wood products fall under the purview of rules administered by the E.P.A. for its intended purpose. The treated wood posts will be spaced on 100 foot centers, making the significance of any leaching insignificant, if any at all.
4. The fenceline will require some maintenance and trimming of larger tree branches, should they overgrow it, whether native nor alien. This will be necessary to protect the fence from damage caused by fallen limbs. Some reduction of alien plants that tend to climb the fence wire may require trimming, to prevent unnecessary moisture and corrosion to the fence. Our intent is to permit native vegetation re-grow within the fenceline cleared for fence construction. However, our weeding effort will be primarily inside the exclosure, where we hope to encourage recovery of the native plants.
5. Leaving most of the alien plant material in place to decay is not a good option in most cases. It would be impractical to remove the fruit and seeds of most of the alien weeds, such as daisy fleabane, firebush, blackberry, ginger, airplant, glorybush and others. The

Appendix G-1

Wayne H. Souza
February 26, 1997

page 2

clearing of weeds and out-planting will be done incrementally on a very small scale. It may take many years to completely clear and restore the total 11 acre site. There are several severely eroded gulches within the area that could eventually be re-habilitated by composting mulched weed materials. Our forestry staff has sufficient expertise to compost properly, and if done properly, it is a means of destroying the viability of many of the undesirable weed seeds that will be accumulated. If this material is not removed from the localities where we are trying to outplant, we will have an almost impossible task of weed control. It would be much more disruptive to the enclosure site and State Park environs to haul all of this material out of the area, because it would require heavy equipment to enter the area over a long term period of time.

6. Your comment is noted. Our final draft will reference vegetation zone C₂ (after Ripperton and Hosaka) in Detailed Land Classification - Island of Kauai, Land Study Bureau, University of Hawaii. Bulletin No. 9. 1967.
7. Your staff is welcome to monitor and help oversee the work done.
8. Your suggestion that visible portions of the fence be painted to make it less visible from lookout areas will be employed if found necessary. The access route to the fenceline will employ a "dog-leg" to avoid a direct view from the Puu O Kila Road. These considerations will be addressed in the final draft.
9. The inconsistencies noted will be corrected in the final draft.
10. The information included in the Biological Data Base & Botanical Field Survey of Kalalau Rim, Island of Kauai, by T.N.C. is public information, purchased with public funds, and therefore is public information. The scale of the maps depicting the plant locations are such that it is highly unlikely anyone would find them, let alone know what the plant looks like to collect it. Most of the plants shown are located on cliffs, requiring access by ropes.

Again, thank you for your thorough review of the draft E.A.



HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
KAUAI DISTRICT
3060 EIWA STREET, ROOM 306
LIHUE, KAUAI, HAWAII 96766-1675

May 19, 1997

IN REPLY REFER TO

Mr. Brooks Harper
Field Supervisor
Ecological Services
U.S. Dept. of Interior
Fish and Wildlife Service
P. O. Box 50088
Honolulu, HI. 96850

Subject: Kalalau Plant Exclosure (MMB) Environmental Assessment

Dear Mr. Harper:

This responds to your 25 April 1997 letter commenting on our subject E.A.

First, please note that we feel many of the comments and suggestions made by your agency are not germane to the subject EA, but stray outside the issue at hand: (ie) The environmental impact of fence construction and utilization of the proposed Kalalau Rim as a threatened and endangered outplanting site.

Our responses to your specific comments are as follows:

**Section I. Description of Proposed Action
Page 1, paragraph 3:**

Although the Service may have different opinions than the State Division of Forestry and Wildlife (DOFAW) with respect to the short term versus long term possibilities of endangered plant and ecosystem recovery, this E.A. proposes only to construct an 11.5 acre exclosure for the outplanting and propagation of threatened and endangered plants. It is not the place to discuss overall agency philosophies. Our proposed action is indeed an "emergency" action to provide a safe place to outplant rare plant materials and protect them from known harm. It is one of DOFAW's mandates to preserve and perpetuate T & E species. Outplanting certainly has the potential to provide a seed source for future outplantings of endangered plants into suitable habitats outside the exclosure, but that is not the subject of this EA.

Appendix G-2

Mr. Brooks Harper
May 19, 1997

page 2

Page 2, paragraph 2:

We concur. We would not want to use any more disruptive method than necessary to clear the fenceline. However, we did indicate in the E.A. that a small tractor/mulcher may be used where large amounts of hurricane debris are encountered. We are well aware of Wellington Fence Company's clearing methods. You must remember, however, that this will be a seven foot high fence, not a four foot high fence as constructed in the Alakai bogs, which will take a bit more working space. There is considerably more hurricane debris (fallen trees) within the Kalalau Rim Area than in the Alakai bogs. This may require some machinery to deal with properly, and we wanted to recognize the possibility of using such equipment in the E.A.

Page 2, paragraph 3:

What we mean by "significant native plants" are all those that can be practically saved in the fence building and weeding phases. Obviously, not every single native plant can be preserved during the fence building and weeding process because clearing will involve grubbing and pulling weeds by hand, use of chain saws, hand tools, and even in some cases use of herbicides. The densities of weeds in some areas are so thick that their removal will undoubtedly result in the unavoidable loss of some native plants here and there. As the botanical survey stated, there are no known listed species within the proposed fence area. If endangered species or species of concern are found during construction, or clearing, they will certainly be preserved. As the E.A. states, we have the qualified staff to survey the area to be cleared and to monitor volunteer weeders.

You suggest that a list of species intended for outplanting should be included in the EA, along with a discussion as to the pattern of outplanting that will be implemented. We do not feel that this is necessary. It would limit us in preservation of rare plants that are even yet to be found. We do not know at this point which species can or will be successfully propagated and out planted. But our intention is to establish healthy stock of rare plants that grow in this mid-elevation of Kauai, where we can preserve them and monitor them for survival, phenology, diseases, insects, and other inimical factors, as well as to collect seed for future propagation. Obviously, we are not proposing to plant monocultures of any one species, but will be picking out micro-sites within the fenced area, where each species of plant has the best chance of surviving. The whole 11.5 acre area certainly will not be endangered plants, but incrementally the hope is that the whole area can be restored to some semblance of a native ecosystem. That means: Removing weed plants, leaving significant native plants in situ where they exist, and where possible establishing rare species within the best perceived sites for their survival. A good deal of this out planting will be experimental in nature. No one has enough knowledge about many of these plants to set forth a comprehensive plan for outplanting at this time.

Mr. Brooks Harper
May 19, 1997

page 3

Page 2, paragraph 4:

We could make a tentative time line for completion of the project, but it would be meaningless. Much depends upon funding, effectiveness of weed removal and control, establishment success of plants outplanted, availability of volunteer help, and etc.. As we envision it, the project will likely be never ending. We seriously doubt that weed control within the enclosure will ever be unnecessary. There will always be new weed encroachment. Our goal is to start where we can to save some of these imperilled plants from almost sure extinction. By focusing attention on a more manageable area, we can likely achieve greater success, and save more plants than trying to spread ourselves too thin.

Page 3, paragraph 4

DOFAW is managing ungulates on the cliffs outside the enclosure. In our opinion, the spread of noxious weeds is by far the most serious threat to plants at this time. The construction of the proposed enclosure has no bearing on our management activities outside the enclosure. The purpose of the enclosure is to protect plants, not to alleviate the need for animal control outside it.

Section III. Impacts and Alternatives to the Proposed Action

Page 5, paragraph 6:

Your suggested additional impact is outside the context of this EA. DOFAW will obtain the plant material from the various reliable sources that are available to us as a wildland managing agency.

Page 6, paragraph 4:

As the EA states, there are several small eroded gullies within the enclosure site in which the compost material can be deposited. The sheer numbers of weed seeds on site, and immediately adjacent to the site is immense. Consolidating the weed material removed and concentrating it where it can decompose would be useful for building up the soil in these eroded gullies. That is preferable to the disturbance that would be caused by making the roads and trails necessary to totally remove the weed material from the site. We would not be bringing more weed seeds onto the site, but concentrating them where they can be managed more effectively.

Section IV. Proposed Mitigation Measures

The nene that have been seen in the vicinity of Kalalau Lookout are the result of DOFAW's introduction of them (from captive stock) to the most remote parts of the Na Pali Coast. These birds have moved on their own to the tourist lookouts nearby and have

Mr. Brooks Harper
May 19, 1997

page 4

learned to beg food from tourists despite our best efforts to educate the public not to feed them. If the nene should happen to visit the enclosure site during construction, we would likely have them, to move to another area. It is naive to think that stopping work when nene are attracted to humans is beneficial to them. They must learn to avoid people and potential threats to them, rather than be encouraged to associate with them. Stopping all activities would be exactly the wrong thing for us to do, otherwise they would become used to visiting and hanging around people where they could become imperiled. Of course, we would look out for their safety (when and if) they should visit the site, but we would not stop all activity.

Page 8:

As stated before, the subject you raise about "mitigation for the collection of material from T&E and SOC plant species" to be planted in the enclosure is not germane to this EA.

Appendix C:

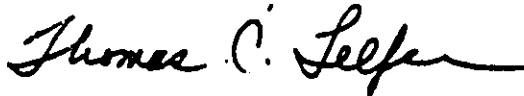
Rats to our knowledge exist in every terrestrial habitat on Kauai. Of course, while monitoring the plants that are outplanted, if we observe significant rat damage, we would take whatever remedial action is considered necessary.

Appendix D, Page 10:

A map of the T & E species in Appendix D is attached as you requested.

Thank you for your comments. We look forward to making progress on the endangered plant recovery program.

Sincerely,



Thomas C. Telfer
District Wildlife Manager

enclosure: map

cc: E. Petteys
M. G. Buck



HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
KAUAI DISTRICT
3080 EIWA STREET, ROOM 308
LIHUE, KAUAI, HAWAII 96766-1875

August 8, 1997

IN REPLY REFER TO

Mr. Gary Gill
Director
Office of Environmental Quality Control
236 South Beretania Street Suite 702
Honolulu, HI 96813

Dear Mr. Gill:

Subject: Draft Environmental Assessment for the Kalalau Rim Endangered Plant
Exclosure and Outplanting Site

Chairperson Michael Wilson forwarded your letter to us for response. The following are answers to the questions you submitted in your 22 July 1997 letter:

1. Your question as to the advantages or disadvantages of the exclosure's proximity to the highway is largely explained by the last paragraph on page 2 of the draft E.A.. Several criteria were used to select this site.
 - A. The proposed exclosure site has close proximity to a large number of known rare plants that exist over the cliff edge of Kalalau Rim where we cannot build fences. This location supplies micro habitat conditions similar to those inhabited by a large number of these known endangered plants.
 - B. It is readily accessible from the Kokee Highway, which will facilitate fence construction and maintenance. It will greatly reduce the cost of fence construction because it will not require helicopter access. It will make it easy to employ the use of volunteers to assist qualified DOFAW personnel in clearing weeds, outplanting and maintenance the exclosure.
 - C. The location is close to the highway, which will facilitate regular monitoring, inspection for various threats to the plants, such as insect damage, rat depredations and allow for variable and seasonal seed collection for additional propagation. It will also enable better enforcement against undesirable human disturbance factors, because it will be a locked fenced area, only accessible under supervised conditions. It has the long term potential benefit of providing for interpretive use, so that the general public can enjoy these plants under highly supervised and controlled conditions.
 - D. It has the added benefit of being an area that does not conflict with

APPENDIX G-3

Mr. Gary Gill
August 11, 1997

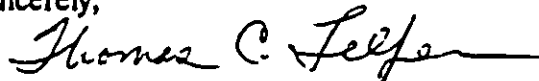
page 2

other public uses such as hiking, hunting, picnicking, and Kokee plum picking. Therefore it will not adversely impact the public as another area might.

- E. The fourth paragraph on page 3 of the E.A. clearly describes the nature of the habitat. It is remnant native forest that is already infested with a large variety of weeds, which will require aggressive control work. (see also paragraph 4 on page 2). Although it already has many good native plant species, the non-native plants will need to be incrementally removed. This is one reason why we chose a location close to the highway. It will require a high degree of management effort, equipment and manpower.
2. A list of plants that we will attempt to propagate at the nearby Kokee Mid-elevation Nursery for outplanting in the enclosure is attached. Because many of these plants have not been propagated before, and there are yet additional plants that may be discovered, or may become imperiled, we cannot confine ourselves to a firm list. It is our intention to use this enclosure to establish outplantings of plants typical to the area. In some cases, even common native plants of this locality may be planted in conjunction with the rare species, to provide an ecological niche conducive to rare plant survival.
 3. To our knowledge, no federal, state or county permits are required, as this project is on State land, within the jurisdiction of the Division of State Parks, Department of Land and Natural Resources. Public health or building code requirements do not apply to this type of project.
 4. We have reviewed all of the criteria set forth in section 11-200-12 of the EIS rules, and determine that the proposed project will enhance environmental quality by removing noxious weed plants, and enhance the survival of several listed endangered and/or threatened plant species. No significant negative comments were received from any agencies or party consulted in the E.A. process.

Please consider this a finding of no significant impact, and re-publish the May 1997 draft as the final draft in the O.E.Q.C. Bulletin as prescribed. Please contact me at 274-3433 if you have additional questions.

Sincerely,



Thomas C. Telfer
District Wildlife Manager

attachments

cc: M. Wilson, Chairperson
M. Buck, DOFAW Admin.
E. Pettys, Kauai Branch Mgr.

Division of Forestry and Wildlife, Department of Land and Natural Resources

Plants Proposed for Propagation at the Kokee Mid-Elevation Nursery, and Outplanting
at the Kalalau Rim Exclosure*

USFWS List Status	Scientific Name	Species Recovery Priority Number	Propagation Priority
E	<i>Alectryon macrococcus</i> var. <i>macrococcus</i>	05	1
C1	<i>Alisinidendron lychnoides</i>	05	1
C1	<i>Alisinidendron viscosum</i>	05	1
E	<i>Bonamia menziesii</i>	05	2
E	<i>Caesalpinia kavaiensis</i>	05	3
E	<i>Chamaesyce halemanui</i>	02	1
C2	<i>Cyanea leptostegia</i>		1
C1	<i>Cyperus trachysanthos</i>	05	3
E	<i>Cyrtandra limahuliensis</i>	14	1
E	<i>Delissea rhytidosperma</i>	02	1
E	<i>Diellia pallida</i>	02	1
E	<i>Dubautia latifolia</i>	05	1
C1	<i>Euphorbia haelealeana</i>	08	2
C2	<i>Eurya sandwichensis</i>		1
E	<i>Exocarpus luteolus</i>	02	1
E	<i>Flueggea neowawraea</i>	05	1
E	<i>Gouania meyenii</i>	08	1
C1	<i>Hibiscadelphus</i> sp. nov.	05	1
C1	<i>Isodendrion laurifolium</i>	05	1
C1	<i>Kokia kauaiensis</i>	08	1
E	<i>Lipochaeta fauriei</i>	02	1
E	<i>Lipochaeta micracantha</i> var. <i>micracantha</i>	08	2
E	<i>Lipochaeta waimeaensis</i>	02	2
E	<i>Lobelia niihauensis</i>	11	1
C2	<i>Lysimachia daphnoides</i>		1
E	<i>Lysimachia filifolia</i>	05	1
C2	<i>Lysimachia kalalauensis</i>		1
C2	<i>Myrsine mezii</i>		2
E	<i>Nothoestrum peltatum</i>	05	1
C1	<i>Phyllostegia knudsenii</i>	05	1
C2	<i>Platydesma rostata</i>		1
E	<i>Poa mannii</i>	05	1
E	<i>Poa sandvicensis</i>	02	1
E	<i>Poa siphonoglossa</i>	02	1
C1	<i>Pritchardia viscosa</i>	05	1
C2	<i>Psychotria hobdyi</i>		2

Plants Proposed for Propagation at the Kokee Mid-Elevation Nursery, and Outplanting
at the Kalalau Rim Exclosure*

USFWS List Status	Scientific Name	Species Recovery Priority Number	Propagation Priority
C2	<i>Pteralyxia kauaiensis</i>	05	2
E	<i>Remya montgomeryi</i>	05	1
C1	<i>Schidea nuttallii</i>	05	1
E	<i>Solanum sandwichense</i>	05	1
C2	<i>Tetraplasandra kawaiensis</i>	02	2
E	<i>Wilkesia hobdyi</i>	05	1
E	<i>Xylosma crenatum</i>	02	1
E	<i>Zanthoxylum hawaiiense</i>		

* This list is preliminary only, and does not necessarily imply that all these plants can be or will be successfully propagated and outplanted. It does not include other plant species that may be found, or may become imperiled in the future. Furthermore, common native plant species that already exist on site may be propagated and outplanted to provide restoration of an ecosystem typical of the area, and beneficial to the survival of the rare plants listed above.



HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
KAUAI DISTRICT

3060 EIWA STREET, ROOM 306
LIHUE, KAUAI, HAWAII 96766-1875

August 27, 1997

IN REPLY REFER TO

Mr. Randall Ogata
Administrator
Office of Hawaiian Affairs
711 Kapi'olani Boulevard, Suite 500
Honolulu, HI 96813-5249

Subject: Draft E.A. for Kalalau Rim Endangered Plant Exclosure and Outplanting Site,
Waimea, Kauai

Dear Mr. Ogata:

Thank you for your letter of 14 July 1997 supporting our proposed endangered plant exclosure and outplanting site at Kalalau Rim, Kauai.

We indeed do hope to restore and protect endemic and indigenous plants and wildlife as a result of this project. Mahalo for your review of our environmental assessment.

Sincerely,

A handwritten signature in cursive script that reads "Thomas C. Telfer".

Thomas C. Telfer
Kauai Branch Wildlife Manager

APPENDIX G-4