

STATE OF HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Forestry and Wildlife
Honolulu, Hawai'i 96813

May 25, 2018

Chairperson and Members
Board of Land and Natural Resources
State of Hawai'i
Honolulu, Hawai'i

Land Board Members:

SUBJECT: REQUEST APPROVAL OF THE KONA HEMA FOREST STEWARDSHIP MANAGEMENT PLAN AND FOREST STEWARDSHIP AGREEMENT WITH THE NATURE CONSERVANCY, TAX MAP KEY NUMBERS (3) 8-8-001:001, (3) 8-9-001:001, (3) 8-9-006:030, (3) 8-9-006:031, (3) 8-9-006:033, SOUTH KONA, ISLAND OF HAWAI'I

AND

REQUEST APPROVAL OF DECLARATION OF EXEMPTION TO CHAPTER 343, HAWAI'I REVISED STATUTES FOR THE PROJECT.

BACKGROUND:

The State of Hawai'i Forest Stewardship Program (FSP) provides technical and financial assistance to private landowners and land managers committed to the stewardship, conservation, and restoration of important forest resources across the state. These private properties provide a variety of public benefits for the residents of Hawai'i, including but not limited to fresh water capture and production, decreased soil erosion, wildlife habitat, forest products, recreational and educational opportunities, and local jobs. The assistance provided by FSP enables private landowners to develop and implement long-term multi-resource management plans to conserve, restore, and maintain forested areas on their property.

The Forest Stewardship Program was established through Chapter 195F-6, Hawai'i Revised Statutes (HRS) and provides the Department of Land and Natural Resources with the authority to provide financial assistance to approved Forest Stewardship projects for private landowners to manage, protect, and restore important natural resources on forested and formerly forested properties. The Forest Stewardship Program is implemented pursuant to Chapter 195F, HRS, and Section 109, Hawaii Administrative Rules (HAR). The program provides cost-share reimbursement for the development of long-term forest management plans and for the implementation of approved Forest Stewardship management plans.

To participate in FSP, interested landowners and managers follow a sequence of application steps in the process of developing a long-term Forest Stewardship management plan. All interested landowners submit their project for review by the Forest Stewardship Advisory Committee (FSAC). The FSAC reviews the project based on program eligibility requirements and assures the proposed project is in line with the program's goals of conservation, restoration and/or forest production. Further, the FSAC recommends the development of and reviews all Forest Stewardship management plans. The Forest Stewardship management plan is created by landowners in partnership with natural resource professional/experts and reviewed and approved by both Division and the FSAC, and may be recommended for approval by the Department.

The award of cost-share support for Forest Stewardship management plan implementation follows a similar process to the development of a management plan. Upon approval of a project's Forest Stewardship management plan, the FSAC reviews the implementation schedule and budget summary to ensure that the practice costs are reasonable and follow the program's approved cost-share rates. The FSAC recommends cost-share support for project implementation based on the 10-year implementation schedule that is submitted to the Board of Land and Natural Resources (Board) for consideration. Review and approval of the Forest Stewardship project and management plan, as well as authorization of cost-share support for the project by the Board is required for the Department to enter into the Forest Stewardship Agreement. The Division has previously worked with the Department of the Attorney General to developing a Forest Stewardship Agreement template (Exhibit A) for eligible projects.

The Kona Hema Forest Stewardship project proposes to actively manage and restore approximately 8,072.7 acres of native forest on Tax Map Key numbers (3) 8-8-001:001, (3) 8-9-001:001, (3) 8-9-006:030, (3) 8-9-006:031, and (3) 8-9-006:033, in the South Kona District of Hawai'i County. The Forest Stewardship project area is designated by the State of Hawai'i as Agriculture District and as Agriculture by the County of Hawai'i. Kona Hema Preserve is comprised of three adjoining management units (Honomalino, Papa, and Kapu'a) that were purchased by The Nature Conservancy (TNC) between 1999 and 2003. The U.S. Forest Service, via the Forest Legacy Program, in partnership with TNC also established conservation easements across these three management units. The preserve is located on the western flank of Mauna Loa directly below Hawai'i Volcanoes National Park, occupying the central region of South Kona between South Kona Forest Reserve to the west, Kipahoe Natural Area Reserve (NAR) to the north and Manukā NAR to the south. The Preserve is characterized as having koa/'ōhi'a montane mesic forest and 'ōhi'a montane wet forest, which were degraded by logging, grazing, lava flows, and fire. TNC's primary objectives at the Kona Hema Preserve are to protect watershed values, promote the recovery of native plants, animals, and natural communities, and explore and demonstrate the potential of compatible economic activities.

The FSAC approved the Kona Hema Forest Stewardship management plan at their meeting on September 8, 2017 and the State Forester/Division Administrator approved the Forest Stewardship Management Plan on 05/02/2018 (Exhibit B).

DISCUSSION:

The Division is requesting approval of a Forest Stewardship Agreement with The Nature

Conservancy for the implementation of the Kona Hema Forest Stewardship management plan and project. Over the course of the 10-year management plan, TNC intends to promote the recovery and protection of the native forest primarily within their Honomalino (4,021 acres) management unit by maintaining and enhancing their current restoration efforts. Two hundred and forty (240) acres of strawberry guava invaded forest will also be treated in the Papa management unit over the course of five years. The Honomalino unit consists of a koa/‘ōhi‘a montane mesic forest on the upper portion of the unit, and an ‘ōhi‘a montane wet forest on the lower portion. The wet forest is being invaded by non-native weeds such as kikuyu grass and strawberry guava on the lower edge of the reserve, but the sub-canopy and overstory are fairly undisturbed. The mesic forest has a dominant koa/‘ōhi‘a overstory with non-native species such as meadow ricegrass and kikuyu grass in the understory. Remnant lava flows from 1916 and 1926 run through the Honomalino unit, and are sparsely vegetated. The lava flows serve as natural barriers to suppress the spread of wildfires.

In 2005, a management plan was prepared for Kona Hema Preserve by TNC in support of their Forest Legacy conservation easements. Since then, many of the proposed objectives in the plan have been completed. The primary objective of the previous management plan was threat abatement to control issues regarding feral ungulates, invasive species, and wildfire. Other objectives included site and habitat restoration, forest management, monitoring, research, and environmental education. The preserve boundary and all three management units are completely enclosed with ungulate-proof fencing, a fire management plan was created, and invasive weeds are continuously being treated. There is ongoing outplanting of rare species and monitoring of threatened and endangered bird and invertebrate species known to the property.

The Forest Stewardship management plan has been updated to set new management objectives, strategies, and practices for the next 10-year period. The management activities proposed for the Forest Stewardship Agreement include fence maintenance, monitoring of ungulate activity, weed control, fire prevention, forest thinning, and outplanting of rare native species. Weed control actions will be focused in the Honomalino unit with changes to the native vegetation and the abundance of invasive species surveyed and documented yearly. A dense 240-acre stand of strawberry guava in the Papa unit will be treated and controlled over the course of five years. Wildfire prevention includes fuelbreak maintenance every six months, and the maintenance of a fire-camera operated by TNC that serves as an early detection system for the entire region. TNC is collaborating with Hawai‘i Plant Extinction Prevention Program to establish endangered species in the Honomalino unit. Loulu palms, (*Pritchardia schattaueri*), meameame (*Flueggea neowawraea*), haha (*Cyanea marksiii*), haha (*C. stictophylla*) and other species will be planted with the goal of planting approximately 200 endangered plants annually. Active maintenance of the endangered plants will include monitoring, watering, and weed control. Approximately 330 acres in the Honomalino unit were scarified between 2003 and 2009 and are now overstocked with koa saplings. A 58 acre plot will be treated with tree thinning practices to remove a portion of the saplings and increase growth rates of selected crop trees.

The Nature Conservancy is seeking cost-share support for the implementation of their management plan from FSP. The management plan through FSP also meets the requirement of the US Forest Service Forest Legacy Program, which requires that projects must have a multi-resource management plan, which will be updated every 10 years.

A total of **\$736,500** in state Forest Stewardship funding is requested to provide cost-share support for the Kona Hema Forest Stewardship management plan and The Nature Conservancy Forest Stewardship Agreement. The Nature Conservancy will be contributing an equal amount of **\$736,500** toward the implementation of their project through FSP. The costs associated with the proposed practices are consistent with the intensity of management required for this type of project. Cost-share funds are provided as reimbursement payments for implementation of approved management practices through the State fiscal year 2028. In addition, The Nature Conservancy has agreed to continue maintenance of the installed Forest Stewardship practices for an additional twenty years following the completion of the State cost-share contributions, or through State fiscal year 2048.

CHAPTER 343 – ENVIRONMENTAL ASSESSMENT

In accordance with the requirements of Chapter 343, Hawai‘i Revised Statutes (HRS), and Section 11-200-8, Hawai‘i Administrative Rules (HAR), and the Exemption List for the Department of Land and Natural Resources as approved by the Environmental Council on June 5, 2015, the subject project is exempt from the preparation of an environmental assessment pursuant to the exemption classes listed in Exhibit C.

Exemption consultation

Agency	Comment
U.S. Department of Agriculture - Natural Resources Conservation Service	No Comments Received
U.S. Department of Interior - Fish and Wildlife Service	No Comments Received
DLNR - Commission on Water Resource Management	No Comments Received
County of Hawai‘i – Department of Planning	No Comments Received

RECOMMENDATIONS:

That the Board:

1. Approve the Kona Hema Forest Stewardship management plan;
2. Approve cost-share support in the amount of **\$736,500** for the implementation of the Kona Hema Forest Stewardship management plan;
3. Authorize the Chairperson to amend, finalize and execute a Forest Stewardship Agreement with The Nature Conservancy to participate in the State Forest Stewardship Program subject to the following:
 - A. Availability of State Forest Stewardship funds; and
 - B. Review and approval as to form of the Forest Stewardship Agreement by

the Department of the Attorney General.

4. Declares, after considering the potential effects of the proposed project as provided by Chapter 343, HRS, and Chapter 11-200, HAR, that this project will likely have minimal or no significant effect on the environment and is therefore exempt from the preparation of an environmental assessment under the exemption classes listed in the Declaration of Exemption (Exhibit C).

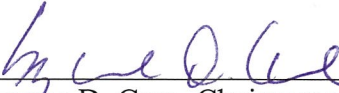
Respectfully submitted,



David G. Smith, Administrator
Division of Forestry and Wildlife

Attachments: (Exhibit A, B, C)

APPROVED FOR SUBMITTAL:



Suzanne D. Case, Chairperson

**STATE OF HAWAII
FOREST STEWARDSHIP AGREEMENT**

This AGREEMENT, made this _____ day of _____
_____, 20____, by and between the BOARD OF LAND AND NATURAL
RESOURCES, STATE OF HAWAII ("STATE"), by its Chairperson, whose address is
1151 Punchbowl Street, Honolulu, Hawaii 96813, and _____, ("LANDOWNER")
whose address and federal and state taxpayer identification numbers are as follows: _____

Business address

*Federal and state taxpayer identification
numbers*

RECITALS

WHEREAS, Chapter 195F, Hawaii Revised Statutes (HRS), provides for the establishment of a forest stewardship program to encourage and assist private landowners in managing, protecting, and restoring important watersheds, native vegetation, fish and wildlife habitats, isolated populations of rare and endangered plants, and other forest lands that are not recognized as potential natural area reserves; and

WHEREAS, in accordance with HRS Chapter 195F and Title 13, Subtitle 5, Part 1, Chapter 109 of the Hawaii Administrative Rules (HAR), the LANDOWNER has applied, and qualifies, for participation in the forest stewardship program; and

WHEREAS, the LANDOWNER has submitted a forest stewardship management plan, as set forth in Exhibit A hereto, that the STATE agrees is consistent with the policies, goals, and objectives of the forest stewardship program; and

WHEREAS, the STATE desires to assist the LANDOWNER in implementing the forest stewardship management plan with financial and other assistance; and

WHEREAS, money is available to fund this agreement pursuant to: Act 195, SLH 1993, Hawaii Revised Statutes, Section 247-7.

NOW, THEREFORE, in consideration of the promises contained in this AGREEMENT, the STATE and the LANDOWNER agree as follows:

A. SCOPE OF SERVICES

The LANDOWNER hereby agrees to implement the forest stewardship management plan set forth in Exhibit A and the project described in the "Scope of Services" set forth in Attachment S1 in proper and satisfactory manner as determined by the STATE, both of which are hereby made a part of this AGREEMENT. The STATE hereby agrees to assist the LANDOWNER in implementing the forest stewardship management plan, all in accordance with the terms and conditions set forth in Attachments S1, S2, S3, S4, S5, and S6, attached hereto.

B. COMPENSATION

The LANDOWNER shall be compensated for performance of the project under this AGREEMENT according to the "Compensation and Payment Schedule," set forth in Attachment S2, which is hereby made a part of this Agreement.

C. TIME OF PERFORMANCE

The performance required of the LANDOWNER under this AGREEMENT shall be completed in accordance with the "Time of Performance" set forth in Attachment S3, which is hereby made a part of this AGREEMENT.

D. CERTIFICATE OF EXEMPTION FROM CIVIL SERVICE

The "State of Hawaii Certificate of Exemption from Civil Service," set forth in Attachment S4, is hereby made a part of the AGREEMENT.

E. OTHER TERMS AND CONDITIONS

The "State of Hawaii Special and General Conditions for Forest Stewardship Program Agreements," set forth in Attachment S5, and the General Conditions attached hereto, are hereby made a part of this AGREEMENT. For the purposes of this AGREEMENT the term "CONTRACTOR" in the "General Conditions" shall mean the LANDOWNER.

F. STANDARDS OF CONDUCT DECLARATION

The "Standards of Conduct Declaration" by LANDOWNER, set forth in Attachment S6, is hereby made a part of this AGREEMENT. For the purposes of this AGREEMENT the term "CONTRACTOR" in the "Standards of Conduct Declaration" shall mean the LANDOWNER.

Exhibit A

IN WITNESS WHEREOF, the parties execute this AGREEMENT by their signatures to be effective as of the date first above written.

STATE

By _____
Chairperson of the Board of Land and Natural
Resources

Print Name

Date _____

LANDOWNER

By _____

Print Name

Date _____

Approved by the Board of
Land and Natural Resources on

_____.

APPROVED AS TO FORM:

Deputy Attorney General

LANDOWNER'S ACKNOWLEDGMENT

STATE OF HAWAII)
) SS.
COUNTY OF _____)

On this _____ day of _____, 20____, before me personally appeared _____, to me personally known, who being by me duly sworn, did say the he/she is the _____, the LANDOWNER named in the foregoing instrument, and the he/she is authorized to sign said instrument on behalf of the LANDOWNER, and acknowledges that he/she executed said instrument as the free act and deed of the LANDOWNER.

Notary Public, State of Hawaii

My Commission Expires: _____

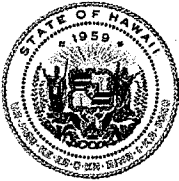
Date of the Notarized Document: _____

Number of Pages: _____

Identification or Description of the Document being Notarized: _____

Printed Name of Notary: _____ Circuit

Notary's Signature and Notary's Official Stamp or Seal Date



STATE OF HAWAII
CONTRACTOR'S
STANDARDS OF CONDUCT DECLARATION

For the purposes of this declaration:

"Agency" means and includes the State, the legislature and its committees, all executive departments, boards, commissions, committees, bureaus, offices; and all independent commissions and other establishments of the state government but excluding the courts.

"Controlling interest" means an interest in a business or other undertaking which is sufficient in fact to control, whether the interest is greater or less than fifty per cent (50%).

"Employee" means any nominated, appointed, or elected officer or employee of the State, including members of boards, commissions, and committees, and employees under contract to the State or of the constitutional convention, but excluding legislators, delegates to the constitutional convention, justices, and judges. (Section 84-3, HRS).

On behalf of _____, CONTRACTOR, the undersigned does declare as follows:

1. CONTRACTOR ☐ is* ☐ is not a legislator or an employee or a business in which a legislator or an employee has a controlling interest. (Section 84-15(a), HRS).
2. CONTRACTOR has not been represented or assisted personally in the matter by an individual who has been an employee of the agency awarding this Contract within the preceding two years and who participated while so employed in the matter with which the Contract is directly concerned. (Section 84-15(b), HRS).
3. CONTRACTOR has not been assisted or represented by a legislator or employee for a fee or other compensation to obtain this Contract and will not be assisted or represented by a legislator or employee for a fee or other compensation in the performance of this Contract, if the legislator or employee had been involved in the development or award of the Contract. (Section 84-14 (d), HRS).
4. CONTRACTOR has not been represented on matters related to this Contract, for a fee or other consideration by an individual who, within the past twelve (12) months, has been an agency employee, or in the case of the Legislature, a legislator, and participated while an employee or legislator on matters related to this Contract. (Sections 84-18(b) and (c), HRS).

CONTRACTOR understands that the Contract to which this document is attached is voidable on behalf of the STATE if this Contract was entered into in violation of any provision of chapter 84, Hawaii Revised Statutes, commonly referred to as the Code of Ethics, including the provisions which are the source of the declarations above. Additionally, any fee, compensation, gift, or profit received by any person as a result of a violation of the Code of Ethics may be recovered by the STATE.

* Reminder to Agency: If the "is" block is checked and if the Contract involves goods or services of a value in excess of \$10,000, the Contract must be awarded by competitive sealed bidding under section 103D-302, HRS, or a competitive sealed proposal under section 103D-303, HRS. Otherwise, the Agency may not award the Contract unless it posts a notice of its intent to award it and files a copy of the notice with the State Ethics Commission. (Section 84-15(a), HRS).

CONTRACTOR

By _____
(Signature)
Print Name _____
Print Title _____
Name of Contractor _____
Date _____



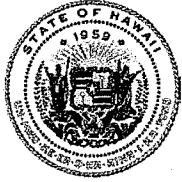
STATE OF HAWAII

SCOPE OF SERVICES

SECTION 1 - SCOPE OF WORK

- 1.1 MANAGEMENT AREA - The project area to be managed is the _____ Forest Stewardship project area; TMK NUMBER(S) _____ as designated on maps found in _____ to this AGREEMENT.
- 1.2 THE PRIMARY OBJECTIVES - The STATE and LANDOWNER shall direct their efforts under this AGREEMENT to do the following: fund the management of and manage the natural resources of the _____ Forest Stewardship project area ("Forest Stewardship project area") in accordance with the MANAGEMENT PLAN, attached as _____ to this AGREEMENT, and all approved amendments thereto, with the intention of _____ in the _____ community.
- 1.3 SCOPE OF WORK - The LANDOWNER shall perform the following technical and professional services:
- (a) Management plan. The LANDOWNER shall carry out the management activities outlined in the approved MANAGEMENT PLAN, attached as _____ to this AGREEMENT.
 - (b) Consultation. The LANDOWNER shall be available for consultation regarding progress, upon request by the STATE.
- 1.4 AUTHORITY TO CARRY OUT MANAGEMENT PLAN - The LANDOWNER hereby represents that it has authority to carry out the MANAGEMENT PLAN and that it is the landowner of "Forest Stewardship project area" as defined in Section 195F-2, Hawaii Revised Statutes, as amended.
- 1.5 NO INCONSISTENT ACTIVITIES - The LANDOWNER shall not take any action on the "Forest Stewardship project area", which will undermine or conflict with the approved MANAGEMENT PLAN.

II. SECTION 2 - CONTROL AND PROGRESS OF THE WORK



STATE OF HAWAII

SCOPE OF SERVICES

2.1 REPORTS - The LANDOWNER shall submit to the STATE, reports showing work accomplished at the following times:

- (a) Progress Reports. A progress report shall be due on December 31 of each year under this AGREEMENT for which funding has been approved. This report shall include a description of the approved MANAGEMENT PLAN accomplishments and activities, areas needing technical advice, an accounting of expenditures with documentation, and proposed modifications to the current year's management activities. This report shall be submitted to the STATE within 30 days following the due date. If the LANDOWNER would like more than 2 reimbursements per year, a progress report shall accompany each reimbursement request and the "Forest Stewardship project area" shall be made available for a site visit by Department of Land and Natural Resources personnel.
- (b) Annual Report. An annual report shall be due on or before June 30 of each year under this AGREEMENT for which funding has been approved. In the event the contract is executed less than 6 months prior to June 30, then no annual report is due on June 30 of that year. This report shall include a description of MANAGEMENT PLAN accomplishments and activities, areas needing technical advice, and proposed modifications to the next year's approved management objectives, projects and budget. This report shall also include a detailed accounting of expenditures for the preceding 12-month period to provide the basis for the annual reconciliation of the STATE's and the LANDOWNER's respective shares of funding as determined pursuant to Attachment S2, Section 1.1. This report shall be submitted to the STATE within 60 days of due date. This report may also request, subject to approval by the STATE, changes to the management plan, for either or both the practice implementation schedule and/or the budget/payment schedule in order to best consolidate and rectify the past year's outcomes or lack thereof.



STATE OF HAWAII
SCOPE OF SERVICES

- 2.2 DELEGATION OF AUTHORITY - As used herein and throughout this AGREEMENT, unless the context clearly indicates otherwise, the STATE shall include the State of Hawaii Department of Land and Natural Resources and its authorized employees, agents and representatives.



STATE OF HAWAII

COMPENSATION AND PAYMENT SCHEDULE

SECTION 1 – PAYMENT

1.1 SCOPE OF PAYMENT -

- (a) STATE's Payment. In full satisfaction of the STATE's funding share of the approved MANAGEMENT PLAN, which is contingent upon satisfactory completion by the LANDOWNER of the management activities described in the approved MANAGEMENT PLAN, attached as Exhibit A to this AGREEMENT, the STATE agrees to pay the LANDOWNER a total sum not to exceed ____
____ 00/100 Dollars (\$) _____) according to the schedule outlined below that includes fiscal year 20XX through 20XX for completion of the management activities described in the approved MANAGEMENT PLAN. Payments shall be made by the STATE to the LANDOWNER as partial annual reimbursements for actual expenditures made by the LANDOWNER in completing the management activities described in the approved MANAGEMENT PLAN only after the corresponding progress or annual report has been reviewed by the STATE and all reported management activity accomplishments have been verified following an inspection of the "Forest Stewardship project area" by the STATE. Actual expenditures may include but are not limited to in-kind services such as heavy equipment operation and sources of labor. All funds to be paid by the STATE to the LANDOWNER shall be encumbered on an annual basis for the forthcoming fiscal year provided that the STATE has approved the continuation of management activities outlined in _____ of this AGREEMENT for the forthcoming fiscal year.

If in any fiscal year the allocated annual funds are not exhausted due to the LANDOWNER not completing all management activities described in the MANAGEMENT PLAN for that year, the LANDOWNER may request that these funds be incorporated in the following year's encumbrances to complete the management activities which were not completed. If there are sufficient funds available to accommodate LANDOWNER's request and the STATE approves the



STATE OF HAWAII

COMPENSATION AND PAYMENT SCHEDULE

request, this change will be incorporated by written amendment to the AGREEMENT.

If in any fiscal year the STATE does not appropriate, and/or the STATE does not approve the expenditure of, funds sufficient to meet the STATE's funding share of the approved MANAGEMENT PLAN, this AGREEMENT shall automatically terminate without penalty at the end of the last fiscal year for which any funds have been appropriated and approved, subject to Attachment S5, Section 4.1, regarding partial State funding.

- (b) LANDOWNER's Share. In full satisfaction of the LANDOWNER's funding share of the approved MANAGEMENT PLAN, the LANDOWNER agrees to fully complete the management activities described in the approved MANAGEMENT PLAN, and to initially assume all corresponding actual annual expenditures in expectation of the STATE's partial reimbursement for satisfactory completion of these management activities. Expenditures for implementation of the approved MANAGEMENT PLAN which are less than the amounts allocated in the approved budget may be made by the LANDOWNER in its discretion so long as the quality of materials and work as called for in the approved MANAGEMENT PLAN are not adversely affected.



STATE OF HAWAII
COMPENSATION AND PAYMENT SCHEDULE

PATRICK & SHEILA CONANT FOREST STEWARDSHIP

PROJECT BUDGET/PAYMENT SCHEDULE:

YEAR	Total Budget	Land Owner share	State Share
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Total			

1.2 PAYMENT SCHEDULE –

- (a) Progress Payment. Within 30 days following receipt of the progress report as provided in Attachment S1, Section 2.1(a) for each year for which the STATE has agreed to pay the LANDOWNER as outlined in the schedule above and for which funding has been appropriated, the STATE shall pay to the LANDOWNER a portion of the STATE's funding share of the approved MANAGEMENT PLAN as a partial reimbursement of actual expenditures made to complete approved management activities. This payment shall be subject to the LANDOWNER's satisfactory completion of the corresponding approved management activities described in the approved MANAGEMENT PLAN, attached as Exhibit A to this AGREEMENT, and calculated on the basis of actual expenditures made by the LANDOWNER. This payment shall also be subject to the STATE's approval of such progress report.
- (b) Annual/Final Payment. Within 30 days of receipt of the annual report as provided in Attachment S1, Section 2.1(b), the STATE shall pay to the LANDOWNER the balance of the STATE's approved annual funding share. This payment shall be subject to the LANDOWNER's satisfactory completion of the corresponding



STATE OF HAWAII

COMPENSATION AND PAYMENT SCHEDULE

annual management activities described in the approved MANAGEMENT PLAN, attached as Exhibit A to this AGREEMENT, and calculated on the basis of actual expenditures made by the LANDOWNER.

- (1) Annual or Final Acceptance and Payment - Annual or final acceptance means a written notice from the STATE to the LANDOWNER advising the LANDOWNER of the satisfactory fulfillment of the AGREEMENT's annual or final requirements.

- 1.3 UNAUTHORIZED WORK - The LANDOWNER shall not receive matching STATE funds for management activities not designated in the approved MANAGEMENT PLAN. All work completed by the LANDOWNER prior to receipt of a fully-executed copy of this AGREEMENT, and prior to STATE approval of funding for any subsequent years and prior to STATE approval of any subsequent amendments to the approved MANAGEMENT PLAN, shall be at the LANDOWNER's own volition and risk, including work performed during the period of any deliberations by the STATE in anticipation of approval; provided, however, that if funding and/or amendments applicable to such work are subsequently approved, the LANDOWNER may be paid for such work even if performed prior to such approval.

SECTION 2 - FISCAL RECORDS MAINTENANCE, RETENTION, AND ACCESS

- 2.1 The LANDOWNER shall maintain, in accordance with generally acceptable accounting practices, fiscal records and supporting documents and related files, papers and reports that adequately reflect all direct and indirect expenditures and management and fiscal practices materially related to the LANDOWNER's performance of services paid for by State funds under this AGREEMENT.
 - (a) The STATE, the Comptroller of the State of Hawaii, and any of their authorized representatives, the committees (and their staff) of the Legislature of the State of Hawaii, and the Legislative Auditor of the State of Hawaii shall have the right of access to any book, document, paper, file, or other records of the LANDOWNER



STATE OF HAWAII

COMPENSATION AND PAYMENT SCHEDULE

that is materially related to the performance by the LANDOWNER of services funded by the STATE under this AGREEMENT, in accordance with generally accepted audit procedures, for the purposes of monitoring and evaluating the LANDOWNER's performance of services and the LANDOWNER's management program and fiscal practices to assure the proper and effective expenditure of funds under this AGREEMENT; provided, however, that no party conducting any such audit or examination shall copy, distribute, or retain any of such information or records, with the understanding that it is not the intention that the LANDOWNER's financial and other records and information be made public.

- (b) The right of access shall not be limited to the required retention period but shall last as long as the records are retained. The LANDOWNER shall retain all records related to the LANDOWNER's performance of services funded under this AGREEMENT for at least 3 years after the date of submission of the LANDOWNER's annual reports for any designated period and payment for such expenditures by the STATE in accordance with its matching share, except that if any litigation, claim, negotiation, investigation, audit, or other action involving the records has been started before the expiration of the 3-year period, the LANDOWNER shall retain the records until completion of the action and resolution of all issues that arise from it or until the end of the regular 3-year retention period, whichever occurs later.



STATE OF HAWAII

TIME OF PERFORMANCE

SECTION 1 - EXECUTION OF AGREEMENT

- 1.1 EXECUTION OF AGREEMENT - This AGREEMENT shall be promptly executed by the STATE and the LANDOWNER upon approval by each party.
- 1.2 CERTIFICATION AND APPROVAL OF AGREEMENT - This AGREEMENT shall not be considered binding upon the STATE, unless the availability of the funds therefore has been duly certified as prescribed by Section 103-39, Hawaii Revised Statutes, as amended. Further, this AGREEMENT shall not be considered to be fully executed unless the Office of the Attorney General of the State of Hawaii has approved this AGREEMENT as to form.

SECTION 2 - TERM

- 2.1 INITIAL TERM - The initial term will be for a minimum of _____ () years following the completion of any and all management practices for which the LANDOWNER has received cost-share assistance. Accordingly, this AGREEMENT shall commence on the date of full execution hereof and shall be in effect until _____; subject, however to earlier termination as provided in this AGREEMENT.
- 2.2 STATE FUNDING CONDITION - This AGREEMENT is subject to continued funding of the STATE's share of the approved management budget as outlined in Attachment S2, Section 1.1. Annual funding is provided by the Conveyance Tax pursuant to Act 195, SLH 1993, Section 247-7, Hawaii Revised Statutes, whereby twenty-five percent of the amount collected from this tax shall be paid into the natural area reserve fund from which funds are dispersed to the natural area partnership and forest stewardship programs, and by way of Act 269, SLH 2000 to projects undertaken in accordance with watershed management plans. Payments are then made through the forest stewardship program to reimburse landowners for implementing approved stewardship management practices. Any balance remaining in this fund at the end of any fiscal year shall be carried forward



STATE OF HAWAII
TIME OF PERFORMANCE

into the fund for the next fiscal year. If in any fiscal year the STATE does not appropriate, and/or the STATE does not approve the expenditure of, funds sufficient to meet its share of the approved management budget, this AGREEMENT shall automatically terminate without penalty at the end of the last fiscal year for which any funds have been appropriated and approved, subject to Attachment S5, Section 4.1, regarding partial State funding.



STATE OF HAWAII

**CERTIFICATE OF EXEMPTION
FROM CIVIL SERVICE**

1. By Heads of Departments Delegated by the Director of the Department of Human Resources Development (“DHRD”).*

Pursuant to a delegation of the authority by the Director of DHRD, I certify that the services to be provided under this Contract, and the person(s) providing the services under this Contract are exempt from the civil service, pursuant to § 76-16, Hawaii Revised Statutes (HRS).

(Signature)

(Date)

(Print Name)

(Print Title)

* This part of the form may be used by all department heads and the heads of attached agencies to whom the Director of DHRD expressly has delegated authority to certify § 76-16, HRS, civil service exemptions. The specific paragraph(s) of § 76-16, HRS, upon which an exemption is based should be noted in the contract file. If an exemption is based on § 76-16(b)(15), the contract must meet the following conditions:

- (1) It involves the delivery of completed work or product by or during a specific time;
- (2) There is no employee-employer relationship; and
- (3) The authorized funding for the service is from other than the "A" or personal services cost element.

NOTE: Not all attached agencies have received a delegation under § 76-16(b)(15). If in doubt, attached agencies should check with the Director of DHRD prior to certifying an exemption under § 76-16(b)(15). Authority to certify exemptions under §§ 76-16(b)(2), and 76-16(b)(12), HRS, has not been delegated; only the Director of DHRD may certify §§ 76-16(b)(2), and 76-16(b)(12) exemptions.

2. By the Director of DHRD, State of Hawaii.

I certify that the services to be provided under this Contract, and the person(s) providing the services under this Contract are exempt from the civil service, pursuant to § 76-16, HRS.

(Signature)

(Date)

(Print Name)

(Print Title, if designee of the Director of DHRD)



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SECTION 1 – INSPECTIONS

- 1.1 The STATE shall have the right to make inspections of the “Forest Stewardship project area” after prior notice to the LANDOWNER. In addition, the STATE shall be obligated to inspect the work on the “Forest Stewardship project area” not less frequently than once per year under this AGREEMENT, and more frequently in the case of a LANDOWNER default as provided in Section 4.1(d) below or when the LANDOWNER makes more than 2 reimbursement requests per year as provided in Attachment S1, Section 2.1. The STATE shall notify the LANDOWNER within a reasonable time thereafter of any perceived defaults in the LANDOWNER's implementation of the approved MANAGEMENT PLAN. The LANDOWNER hereby represents that it has authority to allow access to the “Forest Stewardship project area” by the STATE in connection with this AGREEMENT, conditional upon receipt of a liability waiver, acceptable to the LANDOWNER for all state personnel visiting the “Forest Stewardship project area”.

SECTION 2 - AMENDMENTS

- 2.1 The LANDOWNER may propose for approval by the STATE, and the STATE may approve, minor alterations to the approved MANAGEMENT PLAN, which will not have a material adverse impact on the achievement of the overall management objectives of the approved MANAGEMENT PLAN. This includes minor changes to the practice implementation schedule and/or changes in the budget/payments schedule so long as the total management activities do not subtract from or exceed the total scope of the approved MANAGEMENT PLAN and the budget/payments schedule does not exceed the total annual budget allocations up to and including the budget request for that year, and so long as the STATE has sufficient funding available to accommodate such a request.
- 2.1 The LANDOWNER may propose for approval by the STATE, and the STATE may approve, significant changes to the approved MANAGEMENT PLAN or budget to adapt to current conditions. Significant amendments to the approved MANAGEMENT PLAN shall include an amended budget, which will increase the overall STATE's funding share



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above the total amount set forth in the approved budget/payment schedule. The STATE shall make the proposed amendments available for public review prior to final approval.

- 2.3 The proposed amendments may include, without limitation, re-establishment of management priorities, increase or reduction of the specified work, increases to the budget/payments schedule, or time for performance of specified tasks, all as determined considering the natural conditions of the “Forest Stewardship project area,” existing management priorities, threats, potential for decline of the natural resource during any period under consideration, availability of specialized labor or technical expertise, permitting requirements and time needed to obtain permits, and other material factors.
- 2.4 Any proposed expenditures which will increase the overall STATE's funding share above the amount set forth in the approved budget of the approved MANAGEMENT PLAN, which are proposed either as a result of additional costs required to implement the approved MANAGEMENT PLAN or as a result of amendments to the approved MANAGEMENT PLAN, must be mutually agreed upon in advance by and between the STATE and the LANDOWNER. If so agreed upon the approval of these expenditures shall be incorporated in written amendment to this AGREEMENT.
- 2.5 Economic Hardship. Notwithstanding other provisions of this AGREEMENT, in the event that the LANDOWNER determines in good faith that it is financially unable without undue economic hardship to fulfill its funding share as provided in Attachment S2, Section 1.1(b), or to carry out fully the management activities described in the approved MANAGEMENT PLAN, attached as Exhibit A to this AGREEMENT, within the budget and time period established thereby, the LANDOWNER may apply to the STATE to renegotiate the terms thereof.
- (a) Negotiation of Amendment. In such event, the STATE and the LANDOWNER shall meet and negotiate in good faith an acceptable amendment to the approved MANAGEMENT PLAN that seeks to accomplish the significant objectives of the approved MANAGEMENT PLAN reasonably within the LANDOWNER's



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financial means. The amendment may include, without limitation, re-establishment of management priorities and reduction and/or deferral of the specified work, involving significant costs, and/or extension of time for performance of specified tasks, all as determined considering the natural conditions of the “Forest Stewardship project area,” existing management priorities, threats, potential for decline of the natural resource during any period under consideration, other potential sources of funding, and other material factors.

- (b) Disputes. If the STATE and the LANDOWNER are unable to agree reasonably and in good faith on a suitable amendment to the approved MANAGEMENT PLAN, the parties shall refer any such disputes to arbitration as provided in the General Conditions, Section 11.
- (c) No Termination for Economic Hardship. This provision shall not be construed to allow the LANDOWNER or the STATE to terminate this AGREEMENT for economic hardship; it is rather intended to provide a mechanism for reasonable revisions to the approved MANAGEMENT PLAN for economic hardship.

SECTION 3 - PAYBACK OF STATE FUNDS

- 3.1 In the event that the LANDOWNER sells, conveys, or otherwise transfers LANDOWNER’s right, title, or interest in the “Forest Stewardship project area,” or any portion thereof, during the initial term of this AGREEMENT as defined in Attachment S3, Section 2.1, the LANDOWNER shall within 90 days of the sale, conveyance or transfer of title or interest in the “Forest Stewardship project area,” pay back to the STATE a portion of the amount paid by the STATE to the LANDOWNER pursuant to this AGREEMENT. The amount to be paid back to the STATE shall be that fraction of the total matching funds received by the LANDOWNER under this AGREEMENT that is equal to the fraction of the “Forest Stewardship project area” that is sold, conveyed or otherwise transferred by the LANDOWNER.



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3.2 In the event that the LANDOWNER sells, conveys, or otherwise transfers LANDOWNER's right, title, or interest in the "Forest Stewardship project area," or any portion thereof, during the initial term of this AGREEMENT as defined in Attachment S3, Section 2.1, the LANDOWNER will not be required to reimburse the STATE as set forth in Attachment S5, Section 3.1 for the cost-share assistance received if the person(s) who acquire the property contractually agree to assume full responsibility for this AGREEMENT for the initial term of the AGREEMENT, including but not limited to management and financial responsibilities and penalties contained herein. See Agenda Item _____, as amend, approved at the Board of Land and Natural Resources meeting. Nothing in this provision shall relieve the LANDOWNER of its obligations under this AGREEMENT.

SECTION 4 - TERMINATION; DEFAULT; PENALTY PAYBACK

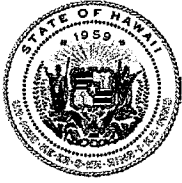
4.1 TERMINATION OF THE AGREEMENT - It is mutually agreed that this AGREEMENT may be terminated for any one of the following reasons on the following terms:

- (a) No State Funding. This AGREEMENT shall be terminated if the STATE does not approve funding for the forthcoming fiscal year of the approved MANAGEMENT PLAN. In such event, this AGREEMENT shall automatically terminate without penalty at the end of the funding period then in effect.
- (b) Partial State Funding. This AGREEMENT may be terminated by the LANDOWNER if the STATE approves only a portion of its share of funding for the forthcoming fiscal year as outlined in the budget provided in the approved MANAGEMENT PLAN.
 - (1) In such event, the LANDOWNER shall elect, by written notice to the STATE, either:
 - (A) to terminate this AGREEMENT without penalty at the end of the funding period then in effect; or



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- (B) to revise the approved MANAGEMENT PLAN and budget in the LANDOWNER's reasonable discretion to accomplish significant management goals which can reasonably be funded with the amount of STATE funding actually approved.
- (c) Transfer to Government Agency. This AGREEMENT may be terminated without penalty if the "Forest Stewardship project area" is transferred or sold to a government agency committed to forest stewardship and that possesses the technical and professional skills to manage the "Forest Stewardship project area" natural resources.
- (d) LANDOWNER Default. This AGREEMENT may be terminated by the STATE upon substantial evidence that progress being made by the LANDOWNER in carrying out the approved MANAGEMENT PLAN is inadequate, incorrect, or insufficient to substantially complete on a timely basis the work called for in the approved MANAGEMENT PLAN subject to the lack of performance notification provisions set forth below.
- (1) Penalties Apply. In the event of termination for default in accordance with these provisions, the penalty payback provisions set forth below shall apply.
- (2) Lack of Performance Notification. In such event, the STATE may terminate for default, provided the STATE adheres to the following procedures for notice and opportunity to cure prior to termination:
- (A) The STATE shall first notify the LANDOWNER in writing of any perceived inadequacy, incorrectness or insufficient progress. The STATE and the LANDOWNER shall meet within two weeks



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thereafter, and every three months thereafter until one year following the date of the notice, and discuss in good faith the perceived failure and the reasons therefore and any subsequent progress or lack thereof. If the reason for the failure is a good faith inability of the LANDOWNER to carry out the terms of the MANAGEMENT PLAN for reasons beyond the LANDOWNER's reasonable control, including without limitation economic hardship as described in Attachment S5, Section 2.5 above, the STATE and the LANDOWNER shall specifically consider the need to amend the approved MANAGEMENT PLAN, including extending the time to carry out the work called for in the approved MANAGEMENT PLAN and/or revising the budget established in the approved MANAGEMENT PLAN, subject to the provisions of Attachment S1, Section 1.5 and Attachment S5, Section 2 of this AGREEMENT regarding amendments to this AGREEMENT and the approved MANAGEMENT PLAN. Following the date of the notice, the STATE shall be obligated to inspect the "Forest Stewardship project area" once each quarter after notifying the LANDOWNER, to determine the updated status of the perceived default.

- (B) Following the expiration of the one year period following notice of default given by the STATE to the LANDOWNER and failure of the LANDOWNER to remedy the default, or to make significant progress to remedy the default if by its nature the default cannot reasonably be remedied within one year, the STATE may elect to notify the LANDOWNER of its intention to terminate this AGREEMENT for default. Such notice shall be in writing, shall state that the STATE will terminate the AGREEMENT for default on a date not less than 3 months thereafter if the LANDOWNER



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does not remedy the default, or to make significant progress to remedy the default if by its nature the default cannot reasonably be remedied within 3 months, and shall specify that penalties as provided under this AGREEMENT shall apply.

- (C) If the LANDOWNER fails to remedy the default within 3 months thereafter, or to make significant progress to remedy the default if by its nature the default cannot reasonably be remedied within 3 months, the STATE may terminate this AGREEMENT effective immediately for default by written notice thereof to the LANDOWNER.
 - (D) The STATE shall be deemed to have complied with these provisions if it attempts in good faith to meet with the LANDOWNER and to inspect the "Forest Stewardship project area" as provided above, whether or not the LANDOWNER cooperates in such procedures.
- (3) All disputes regarding default and termination under this AGREEMENT, which cannot be resolved by the parties, shall be referred to arbitration as provided in the General Conditions, Section 11.
 - (4) If the LANDOWNER has not fully performed its work under this AGREEMENT on expiration or termination of this AGREEMENT, the STATE may withhold the final payment to the LANDOWNER pending full completion of the LANDOWNER's work. This withheld payment shall be paid by the STATE to the LANDOWNER on final acceptance and tax clearance as provided in Attachment S2, Section 1.2 (b) and the General Conditions, Section 17.



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4.2 PENALTY PAYBACK -

- (a) Payback and Penalties. In the event that the LANDOWNER defaults on this AGREEMENT as provided in Attachment S5, Section 4.1(d) above and the STATE has followed the Lack of Performance Notification procedures as outlined in Attachment S5, Section 4.1(d)(2) above, the LANDOWNER shall promptly pay to the STATE the following payback and penalty monies:
- (1) Refund of State Funds - 3 Years. All funds paid from the initial date of this AGREEMENT by the STATE to the LANDOWNER in the previous 3 years (or such portion thereof as STATE shall have funded if this AGREEMENT shall have been in effect for less than 3 years) shall be returned to the STATE. In the event that this AGREEMENT shall have been in effect for more than 3 years, the LANDOWNER shall be liable to pay back State funds for the immediately preceding 3 years. In addition, the LANDOWNER shall pay to the STATE a penalty of two percent of the total of funds that are returned to the STATE.
- (b) No Other Party Liable. Only the LANDOWNER receiving State funding under the FOREST STEWARDSHIP PROGRAM shall be liable to the STATE under this AGREEMENT for the payback and penalty.
- (c) Disputes. The LANDOWNER shall have the right to submit any disputes to the arbitration procedure as outlined in the General Conditions, Section 11 if it feels that the imposition of payback, and/or additional penalties is unwarranted.

4.3 VIOLATIONS OF AGREEMENT - It is expressly understood and agreed that violations which are not caused by the LANDOWNER shall not constitute or give rise to a default by the LANDOWNER under this AGREEMENT and no penalty provisions shall apply to the LANDOWNER.



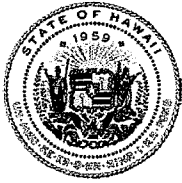
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4.4 EFFECT OF EMINENT DOMAIN -

- (a) Full Condemnation. If any action in eminent domain for the condemnation of the fee title of the entire “Forest Stewardship project area” described herein is filed, or if the “Forest Stewardship project area” is acquired in lieu of eminent domain for a public improvement by a public agency or person or whenever there is any such action or acquisition by the federal government or the state government or any person, instrumentality or agency acting under authority or power of the federal government or the state government, this AGREEMENT shall be deemed null and void without penalty as to the land actually being condemned or so acquired as of the date the action is filed, and upon the termination of such a proceeding, this AGREEMENT shall be null and void without penalty for all land actually taken or acquired.
- (b) Partial Condemnation. When such an action to condemn or acquire less than all the entire “Forest Stewardship project area” is filed, this AGREEMENT shall be deemed null and void without penalty as to the portion so condemned or acquired.
- (c) Adjustment of approved MANAGEMENT PLAN. The land actually taken by the means set forth above in this Section shall be removed from this AGREEMENT and the approved MANAGEMENT PLAN and budget adjusted accordingly on a reasonable basis by the STATE and the LANDOWNER.

SECTION 5 - INCORPORATION OF CHAPTER 195F, HAWAII REVISED STATUTES

- 5.1 Incorporation. The provisions of chapter 195F, Hawaii Revised Statutes, as amended, are incorporated by reference into this AGREEMENT. In the event that there is any conflict between the provisions of this AGREEMENT and the provisions of chapter 195F, Hawaii Revised Statutes, the latter shall be controlling.



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- 5.2 Renumbering. In the event that chapter 195F, or any of the sections under chapter 195F, Hawaii Revised Statutes, are renumbered, any references to the chapter or sections in this AGREEMENT shall be deemed renumbered accordingly.

EXHIBIT A

_____ Forest Stewardship Management Plan.

GENERAL CONDITIONS

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1. Coordination of Services by the STATE. The head of the purchasing agency ("HOPA") (which term includes the designee of the HOPA) shall coordinate the services to be provided by the CONTRACTOR in order to complete the performance required in the Contract. The CONTRACTOR shall maintain communications with HOPA at all stages of the CONTRACTOR'S work, and submit to HOPA for resolution any questions which may arise as to the performance of this Contract. "Purchasing agency" as used in these General Conditions means and includes any governmental body which is authorized under chapter 103D, HRS, or its implementing rules and procedures, or by way of delegation, to enter into contracts for the procurement of goods or services or both.
2. Relationship of Parties: Independent Contractor Status and Responsibilities, Including Tax Responsibilities.
 - a. In the performance of services required under this Contract, the CONTRACTOR is an "independent contractor," with the authority and responsibility to control and direct the performance and details of the work and services required under this Contract; however, the STATE shall have a general right to inspect work in progress to determine whether, in the STATE'S opinion, the services are being performed by the CONTRACTOR in compliance with this Contract. Unless otherwise provided by special condition, it is understood that the STATE does not agree to use the CONTRACTOR exclusively, and that the CONTRACTOR is free to contract to provide services to other individuals or entities while under contract with the STATE.
 - b. The CONTRACTOR and the CONTRACTOR'S employees and agents are not by reason of this Contract, agents or employees of the State for any purpose, and the CONTRACTOR and the CONTRACTOR'S employees and agents shall not be entitled to claim or receive from the State any vacation, sick leave, retirement, workers' compensation, unemployment insurance, or other benefits provided to state employees.
 - c. The CONTRACTOR shall be responsible for the accuracy, completeness, and adequacy of the CONTRACTOR'S performance under this Contract. Furthermore, the CONTRACTOR intentionally, voluntarily, and knowingly assumes the sole and entire liability to the CONTRACTOR'S employees and agents, and to any individual not a party to this Contract, for all loss, damage, or injury caused by the CONTRACTOR, or the CONTRACTOR'S employees or agents in the course of their employment.
 - d. The CONTRACTOR shall be responsible for payment of all applicable federal, state, and county taxes and fees which may become due and owing by the CONTRACTOR by reason of this Contract, including but not limited to (i) income taxes, (ii) employment related fees, assessments, and taxes, and (iii) general excise taxes. The CONTRACTOR also is responsible for obtaining all licenses, permits, and certificates that may be required in order to perform this Contract.
 - e. The CONTRACTOR shall obtain a general excise tax license from the Department of Taxation, State of Hawaii, in accordance with section 237-9, HRS, and shall comply with all requirements thereof. The CONTRACTOR shall obtain a tax clearance certificate from the Director of Taxation, State of Hawaii, and the Internal Revenue Service, U.S. Department of the Treasury, showing that all delinquent taxes, if any, levied or accrued under state law and the Internal Revenue Code of 1986, as amended, against the CONTRACTOR have been paid and submit the same to the STATE prior to commencing any performance under this Contract. The CONTRACTOR shall also be solely responsible for meeting all requirements necessary to obtain the tax clearance certificate required for final payment under sections 103-53 and 103D-328, HRS, and paragraph 17 of these General Conditions.
 - f. The CONTRACTOR is responsible for securing all employee-related insurance coverage for the CONTRACTOR and the CONTRACTOR'S employees and agents that is or may be required by law, and for payment of all premiums, costs, and other liabilities associated with securing the insurance coverage.

- g. The CONTRACTOR shall obtain a certificate of compliance issued by the Department of Labor and Industrial Relations, State of Hawaii, in accordance with section 103D-310, HRS, and section 3-122-112, HAR, that is current within six months of the date of issuance.
- h. The CONTRACTOR shall obtain a certificate of good standing issued by the Department of Commerce and Consumer Affairs, State of Hawaii, in accordance with section 103D-310, HRS, and section 3-122-112, HAR, that is current within six months of the date of issuance.
- i. In lieu of the above certificates from the Department of Taxation, Labor and Industrial Relations, and Commerce and Consumer Affairs, the CONTRACTOR may submit proof of compliance through the State Procurement Office's designated certification process.

3. Personnel Requirements.

- a. The CONTRACTOR shall secure, at the CONTRACTOR'S own expense, all personnel required to perform this Contract.
- b. The CONTRACTOR shall ensure that the CONTRACTOR'S employees or agents are experienced and fully qualified to engage in the activities and perform the services required under this Contract, and that all applicable licensing and operating requirements imposed or required under federal, state, or county law, and all applicable accreditation and other standards of quality generally accepted in the field of the activities of such employees and agents are complied with and satisfied.

4. Nondiscrimination. No person performing work under this Contract, including any subcontractor, employee, or agent of the CONTRACTOR, shall engage in any discrimination that is prohibited by any applicable federal, state, or county law.

5. Conflicts of Interest. The CONTRACTOR represents that neither the CONTRACTOR, nor any employee or agent of the CONTRACTOR, presently has any interest, and promises that no such interest, direct or indirect, shall be acquired, that would or might conflict in any manner or degree with the CONTRACTOR'S performance under this Contract.

6. Subcontracts and Assignments. The CONTRACTOR shall not assign or subcontract any of the CONTRACTOR'S duties, obligations, or interests under this Contract and no such assignment or subcontract shall be effective unless (i) the CONTRACTOR obtains the prior written consent of the STATE, and (ii) the CONTRACTOR'S assignee or subcontractor submits to the STATE a tax clearance certificate from the Director of Taxation, State of Hawaii, and the Internal Revenue Service, U.S. Department of Treasury, showing that all delinquent taxes, if any, levied or accrued under state law and the Internal Revenue Code of 1986, as amended, against the CONTRACTOR'S assignee or subcontractor have been paid. Additionally, no assignment by the CONTRACTOR of the CONTRACTOR'S right to compensation under this Contract shall be effective unless and until the assignment is approved by the Comptroller of the State of Hawaii, as provided in section 40-58, HRS.

- a. Recognition of a successor in interest. When in the best interest of the State, a successor in interest may be recognized in an assignment contract in which the STATE, the CONTRACTOR and the assignee or transferee (hereinafter referred to as the "Assignee") agree that:

- (1) The Assignee assumes all of the CONTRACTOR'S obligations;
- (2) The CONTRACTOR remains liable for all obligations under this Contract but waives all rights under this Contract as against the STATE; and
- (3) The CONTRACTOR shall continue to furnish, and the Assignee shall also furnish, all required bonds.

- b. Change of name. When the CONTRACTOR asks to change the name in which it holds this Contract with the STATE, the procurement officer of the purchasing agency (hereinafter referred to as the "Agency procurement officer") shall, upon receipt of a document acceptable or satisfactory to the

Agency procurement officer indicating such change of name (for example, an amendment to the CONTRACTOR'S articles of incorporation), enter into an amendment to this Contract with the CONTRACTOR to effect such a change of name. The amendment to this Contract changing the CONTRACTOR'S name shall specifically indicate that no other terms and conditions of this Contract are thereby changed.

- c. Reports. All assignment contracts and amendments to this Contract effecting changes of the CONTRACTOR'S name or novations hereunder shall be reported to the chief procurement officer (CPO) as defined in section 103D-203(a), HRS, within thirty days of the date that the assignment contract or amendment becomes effective.
 - d. Actions affecting more than one purchasing agency. Notwithstanding the provisions of subparagraphs 6a through 6c herein, when the CONTRACTOR holds contracts with more than one purchasing agency of the State, the assignment contracts and the novation and change of name amendments herein authorized shall be processed only through the CPO's office.
7. Indemnification and Defense. The CONTRACTOR shall defend, indemnify, and hold harmless the State of Hawaii, the contracting agency, and their officers, employees, and agents from and against all liability, loss, damage, cost, and expense, including all attorneys' fees, and all claims, suits, and demands therefore, arising out of or resulting from the acts or omissions of the CONTRACTOR or the CONTRACTOR'S employees, officers, agents, or subcontractors under this Contract. The provisions of this paragraph shall remain in full force and effect notwithstanding the expiration or early termination of this Contract.
8. Cost of Litigation. In case the STATE shall, without any fault on its part, be made a party to any litigation commenced by or against the CONTRACTOR in connection with this Contract, the CONTRACTOR shall pay all costs and expenses incurred by or imposed on the STATE, including attorneys' fees.
9. Liquidated Damages. When the CONTRACTOR is given notice of delay or nonperformance as specified in paragraph 13 (Termination for Default) and fails to cure in the time specified, it is agreed the CONTRACTOR shall pay to the STATE the amount, if any, set forth in this Contract per calendar day from the date set for cure until either (i) the STATE reasonably obtains similar goods or services, or both, if the CONTRACTOR is terminated for default, or (ii) until the CONTRACTOR provides the goods or services, or both, if the CONTRACTOR is not terminated for default. To the extent that the CONTRACTOR'S delay or nonperformance is excused under paragraph 13d (Excuse for Nonperformance or Delay Performance), liquidated damages shall not be assessable against the CONTRACTOR. The CONTRACTOR remains liable for damages caused other than by delay.
10. STATE'S Right of Offset. The STATE may offset against any monies or other obligations the STATE owes to the CONTRACTOR under this Contract, any amounts owed to the State of Hawaii by the CONTRACTOR under this Contract or any other contracts, or pursuant to any law or other obligation owed to the State of Hawaii by the CONTRACTOR, including, without limitation, the payment of any taxes or levies of any kind or nature. The STATE will notify the CONTRACTOR in writing of any offset and the nature of such offset. For purposes of this paragraph, amounts owed to the State of Hawaii shall not include debts or obligations which have been liquidated, agreed to by the CONTRACTOR, and are covered by an installment payment or other settlement plan approved by the State of Hawaii, provided, however, that the CONTRACTOR shall be entitled to such exclusion only to the extent that the CONTRACTOR is current with, and not delinquent on, any payments or obligations owed to the State of Hawaii under such payment or other settlement plan.
11. Disputes. Disputes shall be resolved in accordance with section 103D-703, HRS, and chapter 3-126, Hawaii Administrative Rules ("HAR"), as the same may be amended from time to time.
12. Suspension of Contract. The STATE reserves the right at any time and for any reason to suspend this Contract for any reasonable period, upon written notice to the CONTRACTOR in accordance with the provisions herein.
- a. Order to stop performance. The Agency procurement officer may, by written order to the CONTRACTOR, at any time, and without notice to any surety, require the CONTRACTOR to stop all or any part of the performance called for by this Contract. This order shall be for a specified

period not exceeding sixty (60) days after the order is delivered to the CONTRACTOR, unless the parties agree to any further period. Any such order shall be identified specifically as a stop performance order issued pursuant to this section. Stop performance orders shall include, as appropriate: (1) A clear description of the work to be suspended; (2) Instructions as to the issuance of further orders by the CONTRACTOR for material or services; (3) Guidance as to action to be taken on subcontracts; and (4) Other instructions and suggestions to the CONTRACTOR for minimizing costs. Upon receipt of such an order, the CONTRACTOR shall forthwith comply with its terms and suspend all performance under this Contract at the time stated, provided, however, the CONTRACTOR shall take all reasonable steps to minimize the occurrence of costs allocable to the performance covered by the order during the period of performance stoppage. Before the stop performance order expires, or within any further period to which the parties shall have agreed, the Agency procurement officer shall either:

- (1) Cancel the stop performance order; or
 - (2) Terminate the performance covered by such order as provided in the termination for default provision or the termination for convenience provision of this Contract.
- b. Cancellation or expiration of the order. If a stop performance order issued under this section is cancelled at any time during the period specified in the order, or if the period of the order or any extension thereof expires, the CONTRACTOR shall have the right to resume performance. An appropriate adjustment shall be made in the delivery schedule or contract price, or both, and the Contract shall be modified in writing accordingly, if:
- (1) The stop performance order results in an increase in the time required for, or in the CONTRACTOR'S cost properly allocable to, the performance of any part of this Contract; and
 - (2) The CONTRACTOR asserts a claim for such an adjustment within thirty (30) days after the end of the period of performance stoppage; provided that, if the Agency procurement officer decides that the facts justify such action, any such claim asserted may be received and acted upon at any time prior to final payment under this Contract.
- c. Termination of stopped performance. If a stop performance order is not cancelled and the performance covered by such order is terminated for default or convenience, the reasonable costs resulting from the stop performance order shall be allowable by adjustment or otherwise.
- d. Adjustment of price. Any adjustment in contract price made pursuant to this paragraph shall be determined in accordance with the price adjustment provision of this Contract.

13. Termination for Default.

- a. Default. If the CONTRACTOR refuses or fails to perform any of the provisions of this Contract with such diligence as will ensure its completion within the time specified in this Contract, or any extension thereof, otherwise fails to timely satisfy the Contract provisions, or commits any other substantial breach of this Contract, the Agency procurement officer may notify the CONTRACTOR in writing of the delay or non-performance and if not cured in ten (10) days or any longer time specified in writing by the Agency procurement officer, such officer may terminate the CONTRACTOR'S right to proceed with the Contract or such part of the Contract as to which there has been delay or a failure to properly perform. In the event of termination in whole or in part, the Agency procurement officer may procure similar goods or services in a manner and upon the terms deemed appropriate by the Agency procurement officer. The CONTRACTOR shall continue performance of the Contract to the extent it is not terminated and shall be liable for excess costs incurred in procuring similar goods or services.
- b. CONTRACTOR'S duties. Notwithstanding termination of the Contract and subject to any directions from the Agency procurement officer, the CONTRACTOR shall take timely, reasonable, and

necessary action to protect and preserve property in the possession of the CONTRACTOR in which the STATE has an interest.

- c. Compensation. Payment for completed goods and services delivered and accepted by the STATE shall be at the price set forth in the Contract. Payment for the protection and preservation of property shall be in an amount agreed upon by the CONTRACTOR and the Agency procurement officer. If the parties fail to agree, the Agency procurement officer shall set an amount subject to the CONTRACTOR'S rights under chapter 3-126, HAR. The STATE may withhold from amounts due the CONTRACTOR such sums as the Agency procurement officer deems to be necessary to protect the STATE against loss because of outstanding liens or claims and to reimburse the STATE for the excess costs expected to be incurred by the STATE in procuring similar goods and services.
- d. Excuse for nonperformance or delayed performance. The CONTRACTOR shall not be in default by reason of any failure in performance of this Contract in accordance with its terms, including any failure by the CONTRACTOR to make progress in the prosecution of the performance hereunder which endangers such performance, if the CONTRACTOR has notified the Agency procurement officer within fifteen (15) days after the cause of the delay and the failure arises out of causes such as: acts of God; acts of a public enemy; acts of the State and any other governmental body in its sovereign or contractual capacity; fires; floods; epidemics; quarantine restrictions; strikes or other labor disputes; freight embargoes; or unusually severe weather. If the failure to perform is caused by the failure of a subcontractor to perform or to make progress, and if such failure arises out of causes similar to those set forth above, the CONTRACTOR shall not be deemed to be in default, unless the goods and services to be furnished by the subcontractor were reasonably obtainable from other sources in sufficient time to permit the CONTRACTOR to meet the requirements of the Contract. Upon request of the CONTRACTOR, the Agency procurement officer shall ascertain the facts and extent of such failure, and, if such officer determines that any failure to perform was occasioned by any one or more of the excusable causes, and that, but for the excusable cause, the CONTRACTOR'S progress and performance would have met the terms of the Contract, the delivery schedule shall be revised accordingly, subject to the rights of the STATE under this Contract. As used in this paragraph, the term "subcontractor" means subcontractor at any tier.
- e. Erroneous termination for default. If, after notice of termination of the CONTRACTOR'S right to proceed under this paragraph, it is determined for any reason that the CONTRACTOR was not in default under this paragraph, or that the delay was excusable under the provisions of subparagraph 13d, "Excuse for nonperformance or delayed performance," the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to paragraph 14.
- f. Additional rights and remedies. The rights and remedies provided in this paragraph are in addition to any other rights and remedies provided by law or under this Contract.

14. Termination for Convenience.

- a. Termination. The Agency procurement officer may, when the interests of the STATE so require, terminate this Contract in whole or in part, for the convenience of the STATE. The Agency procurement officer shall give written notice of the termination to the CONTRACTOR specifying the part of the Contract terminated and when termination becomes effective.
- b. CONTRACTOR'S obligations. The CONTRACTOR shall incur no further obligations in connection with the terminated performance and on the date(s) set in the notice of termination the CONTRACTOR will stop performance to the extent specified. The CONTRACTOR shall also terminate outstanding orders and subcontracts as they relate to the terminated performance. The CONTRACTOR shall settle the liabilities and claims arising out of the termination of subcontracts and orders connected with the terminated performance subject to the STATE'S approval. The Agency procurement officer may direct the CONTRACTOR to assign the CONTRACTOR'S right, title, and interest under terminated orders or subcontracts to the STATE. The CONTRACTOR must still complete the performance not terminated by the notice of termination and may incur obligations as necessary to do so.

- c. Right to goods and work product. The Agency procurement officer may require the CONTRACTOR to transfer title and deliver to the STATE in the manner and to the extent directed by the Agency procurement officer:

- (1) Any completed goods or work product; and
- (2) The partially completed goods and materials, parts, tools, dies, jigs, fixtures, plans, drawings, information, and contract rights (hereinafter called "manufacturing material") as the CONTRACTOR has specifically produced or specially acquired for the performance of the terminated part of this Contract.

The CONTRACTOR shall, upon direction of the Agency procurement officer, protect and preserve property in the possession of the CONTRACTOR in which the STATE has an interest. If the Agency procurement officer does not exercise this right, the CONTRACTOR shall use best efforts to sell such goods and manufacturing materials. Use of this paragraph in no way implies that the STATE has breached the Contract by exercise of the termination for convenience provision.

- d. Compensation.

- (1) The CONTRACTOR shall submit a termination claim specifying the amounts due because of the termination for convenience together with the cost or pricing data, submitted to the extent required by chapter 3-122, HAR, bearing on such claim. If the CONTRACTOR fails to file a termination claim within one year from the effective date of termination, the Agency procurement officer may pay the CONTRACTOR, if at all, an amount set in accordance with subparagraph 14d(3) below.
- (2) The Agency procurement officer and the CONTRACTOR may agree to a settlement provided the CONTRACTOR has filed a termination claim supported by cost or pricing data submitted as required and that the settlement does not exceed the total Contract price plus settlement costs reduced by payments previously made by the STATE, the proceeds of any sales of goods and manufacturing materials under subparagraph 14c, and the Contract price of the performance not terminated.
- (3) Absent complete agreement under subparagraph 14d(2) the Agency procurement officer shall pay the CONTRACTOR the following amounts, provided payments agreed to under subparagraph 14d(2) shall not duplicate payments under this subparagraph for the following:
 - (A) Contract prices for goods or services accepted under the Contract;
 - (B) Costs incurred in preparing to perform and performing the terminated portion of the performance plus a fair and reasonable profit on such portion of the performance, such profit shall not include anticipatory profit or consequential damages, less amounts paid or to be paid for accepted goods or services; provided, however, that if it appears that the CONTRACTOR would have sustained a loss if the entire Contract would have been completed, no profit shall be allowed or included and the amount of compensation shall be reduced to reflect the anticipated rate of loss;
 - (C) Costs of settling and paying claims arising out of the termination of subcontracts or orders pursuant to subparagraph 14b. These costs must not include costs paid in accordance with subparagraph 14d(3)(B);
 - (D) The reasonable settlement costs of the CONTRACTOR, including accounting, legal, clerical, and other expenses reasonably necessary for the preparation of settlement claims and supporting data with respect to the terminated portion of the Contract and for the termination of subcontracts thereunder, together with reasonable storage, transportation, and other costs incurred in connection with the protection or disposition of property allocable to the terminated portion of this Contract. The total sum to be paid the CONTRACTOR under this subparagraph shall not exceed the

total Contract price plus the reasonable settlement costs of the CONTRACTOR reduced by the amount of payments otherwise made, the proceeds of any sales of supplies and manufacturing materials under subparagraph 14d(2), and the contract price of performance not terminated.

- (4) Costs claimed, agreed to, or established under subparagraphs 14d(2) and 14d(3) shall be in accordance with Chapter 3-123 (Cost Principles) of the Procurement Rules.

15. Claims Based on the Agency Procurement Officer's Actions or Omissions.

- a. Changes in scope. If any action or omission on the part of the Agency procurement officer (which term includes the designee of such officer for purposes of this paragraph 15) requiring performance changes within the scope of the Contract constitutes the basis for a claim by the CONTRACTOR for additional compensation, damages, or an extension of time for completion, the CONTRACTOR shall continue with performance of the Contract in compliance with the directions or orders of such officials, but by so doing, the CONTRACTOR shall not be deemed to have prejudiced any claim for additional compensation, damages, or an extension of time for completion; provided:
- (1) Written notice required. The CONTRACTOR shall give written notice to the Agency procurement officer:
- (A) Prior to the commencement of the performance involved, if at that time the CONTRACTOR knows of the occurrence of such action or omission;
- (B) Within thirty (30) days after the CONTRACTOR knows of the occurrence of such action or omission, if the CONTRACTOR did not have such knowledge prior to the commencement of the performance; or
- (C) Within such further time as may be allowed by the Agency procurement officer in writing.
- (2) Notice content. This notice shall state that the CONTRACTOR regards the act or omission as a reason which may entitle the CONTRACTOR to additional compensation, damages, or an extension of time. The Agency procurement officer, upon receipt of such notice, may rescind such action, remedy such omission, or take such other steps as may be deemed advisable in the discretion of the Agency procurement officer;
- (3) Basis must be explained. The notice required by subparagraph 15a(1) describes as clearly as practicable at the time the reasons why the CONTRACTOR believes that additional compensation, damages, or an extension of time may be remedies to which the CONTRACTOR is entitled; and
- (4) Claim must be justified. The CONTRACTOR must maintain and, upon request, make available to the Agency procurement officer within a reasonable time, detailed records to the extent practicable, and other documentation and evidence satisfactory to the STATE, justifying the claimed additional costs or an extension of time in connection with such changes.
- b. CONTRACTOR not excused. Nothing herein contained, however, shall excuse the CONTRACTOR from compliance with any rules or laws precluding any state officers and CONTRACTOR from acting in collusion or bad faith in issuing or performing change orders which are clearly not within the scope of the Contract.
- c. Price adjustment. Any adjustment in the price made pursuant to this paragraph shall be determined in accordance with the price adjustment provision of this Contract.

16. Costs and Expenses. Any reimbursement due the CONTRACTOR for per diem and transportation expenses under this Contract shall be subject to chapter 3-123 (Cost Principles), HAR, and the following guidelines:

- a. Reimbursement for air transportation shall be for actual cost or coach class air fare, whichever is less.
- b. Reimbursement for ground transportation costs shall not exceed the actual cost of renting an intermediate-sized vehicle.
- c. Unless prior written approval of the HOPA is obtained, reimbursement for subsistence allowance (i.e., hotel and meals, etc.) shall not exceed the applicable daily authorized rates for inter-island or out-of-state travel that are set forth in the current Governor's Executive Order authorizing adjustments in salaries and benefits for state officers and employees in the executive branch who are excluded from collective bargaining coverage.

17. Payment Procedures: Final Payment; Tax Clearance.

- a. Original invoices required. All payments under this Contract shall be made only upon submission by the CONTRACTOR of original invoices specifying the amount due and certifying that services requested under the Contract have been performed by the CONTRACTOR according to the Contract.
- b. Subject to available funds. Such payments are subject to availability of funds and allotment by the Director of Finance in accordance with chapter 37, HRS. Further, all payments shall be made in accordance with and subject to chapter 40, HRS.
- c. Prompt payment.
 - (1) Any money, other than retainage, paid to the CONTRACTOR shall be disbursed to subcontractors within ten (10) days after receipt of the money in accordance with the terms of the subcontract; provided that the subcontractor has met all the terms and conditions of the subcontract and there are no bona fide disputes; and
 - (2) Upon final payment to the CONTRACTOR, full payment to the subcontractor, including retainage, shall be made within ten (10) days after receipt of the money; provided that there are no bona fide disputes over the subcontractor's performance under the subcontract.
- d. Final payment. Final payment under this Contract shall be subject to sections 103-53 and 103D-328, HRS, which require a tax clearance from the Director of Taxation, State of Hawaii, and the Internal Revenue Service, U.S. Department of Treasury, showing that all delinquent taxes, if any, levied or accrued under state law and the Internal Revenue Code of 1986, as amended, against the CONTRACTOR have been paid. Further, in accordance with section 3-122-112, HAR, CONTRACTOR shall provide a certificate affirming that the CONTRACTOR has remained in compliance with all applicable laws as required by this section.

18. Federal Funds. If this Contract is payable in whole or in part from federal funds, CONTRACTOR agrees that, as to the portion of the compensation under this Contract to be payable from federal funds, the CONTRACTOR shall be paid only from such funds received from the federal government, and shall not be paid from any other funds. Failure of the STATE to receive anticipated federal funds shall not be considered a breach by the STATE or an excuse for nonperformance by the CONTRACTOR.

19. Modifications of Contract.

- a. In writing. Any modification, alteration, amendment, change, or extension of any term, provision, or condition of this Contract permitted by this Contract shall be made by written amendment to this Contract, signed by the CONTRACTOR and the STATE, provided that change orders shall be made in accordance with paragraph 20 herein.
- b. No oral modification. No oral modification, alteration, amendment, change, or extension of any term, provision, or condition of this Contract shall be permitted.

- c. Agency procurement officer. By written order, at any time, and without notice to any surety, the Agency procurement officer may unilaterally order of the CONTRACTOR:
 - (A) Changes in the work within the scope of the Contract; and
 - (B) Changes in the time of performance of the Contract that do not alter the scope of the Contract work.
 - d. Adjustments of price or time for performance. If any modification increases or decreases the CONTRACTOR'S cost of, or the time required for, performance of any part of the work under this Contract, an adjustment shall be made and this Contract modified in writing accordingly. Any adjustment in contract price made pursuant to this clause shall be determined, where applicable, in accordance with the price adjustment clause of this Contract or as negotiated.
 - e. Claim barred after final payment. No claim by the CONTRACTOR for an adjustment hereunder shall be allowed if written modification of the Contract is not made prior to final payment under this Contract.
 - f. Claims not barred. In the absence of a written contract modification, nothing in this clause shall be deemed to restrict the CONTRACTOR'S right to pursue a claim under this Contract or for a breach of contract.
 - g. CPO approval. If this is a professional services contract awarded pursuant to section 103D-303 or 103D-304, HRS, any modification, alteration, amendment, change, or extension of any term, provision, or condition of this Contract which increases the amount payable to the CONTRACTOR by at least \$25,000.00 or ten per cent (10%) of the initial contract price, whichever increase is higher, must receive the prior approval of the CPO.
 - h. Tax clearance. The STATE may, at its discretion, require the CONTRACTOR to submit to the STATE, prior to the STATE'S approval of any modification, alteration, amendment, change, or extension of any term, provision, or condition of this Contract, a tax clearance from the Director of Taxation, State of Hawaii, and the Internal Revenue Service, U.S. Department of Treasury, showing that all delinquent taxes, if any, levied or accrued under state law and the Internal Revenue Code of 1986, as amended, against the CONTRACTOR have been paid.
 - i. Sole source contracts. Amendments to sole source contracts that would change the original scope of the Contract may only be made with the approval of the CPO. Annual renewal of a sole source contract for services should not be submitted as an amendment.
20. Change Order. The Agency procurement officer may, by a written order signed only by the STATE, at any time, and without notice to any surety, and subject to all appropriate adjustments, make changes within the general scope of this Contract in any one or more of the following:
- (1) Drawings, designs, or specifications, if the goods or services to be furnished are to be specially provided to the STATE in accordance therewith;
 - (2) Method of delivery; or
 - (3) Place of delivery.
- a. Adjustments of price or time for performance. If any change order increases or decreases the CONTRACTOR'S cost of, or the time required for, performance of any part of the work under this Contract, whether or not changed by the order, an adjustment shall be made and the Contract modified in writing accordingly. Any adjustment in the Contract price made pursuant to this provision shall be determined in accordance with the price adjustment provision of this Contract. Failure of the parties to agree to an adjustment shall not excuse the CONTRACTOR from proceeding with the Contract as changed, provided that the Agency procurement officer promptly and duly makes the provisional adjustments in payment or time for performance as may be reasonable. By

proceeding with the work, the CONTRACTOR shall not be deemed to have prejudiced any claim for additional compensation, or any extension of time for completion.

- b. Time period for claim. Within ten (10) days after receipt of a written change order under subparagraph 20a, unless the period is extended by the Agency procurement officer in writing, the CONTRACTOR shall respond with a claim for an adjustment. The requirement for a timely written response by CONTRACTOR cannot be waived and shall be a condition precedent to the assertion of a claim.
- c. Claim barred after final payment. No claim by the CONTRACTOR for an adjustment hereunder shall be allowed if a written response is not given prior to final payment under this Contract.
- d. Other claims not barred. In the absence of a change order, nothing in this paragraph 20 shall be deemed to restrict the CONTRACTOR'S right to pursue a claim under the Contract or for breach of contract.

21. Price Adjustment.

- a. Price adjustment. Any adjustment in the contract price pursuant to a provision in this Contract shall be made in one or more of the following ways:
 - (1) By agreement on a fixed price adjustment before commencement of the pertinent performance or as soon thereafter as practicable;
 - (2) By unit prices specified in the Contract or subsequently agreed upon;
 - (3) By the costs attributable to the event or situation covered by the provision, plus appropriate profit or fee, all as specified in the Contract or subsequently agreed upon;
 - (4) In such other manner as the parties may mutually agree; or
 - (5) In the absence of agreement between the parties, by a unilateral determination by the Agency procurement officer of the costs attributable to the event or situation covered by the provision, plus appropriate profit or fee, all as computed by the Agency procurement officer in accordance with generally accepted accounting principles and applicable sections of chapters 3-123 and 3-126, HAR.
- b. Submission of cost or pricing data. The CONTRACTOR shall provide cost or pricing data for any price adjustments subject to the provisions of chapter 3-122, HAR.

22. Variation in Quantity for Definite Quantity Contracts. Upon the agreement of the STATE and the CONTRACTOR, the quantity of goods or services, or both, if a definite quantity is specified in this Contract, may be increased by a maximum of ten per cent (10%); provided the unit prices will remain the same except for any price adjustments otherwise applicable; and the Agency procurement officer makes a written determination that such an increase will either be more economical than awarding another contract or that it would not be practical to award another contract.

23. Changes in Cost-Reimbursement Contract. If this Contract is a cost-reimbursement contract, the following provisions shall apply:

- a. The Agency procurement officer may at any time by written order, and without notice to the sureties, if any, make changes within the general scope of the Contract in any one or more of the following:
 - (1) Description of performance (Attachment 1);
 - (2) Time of performance (i.e., hours of the day, days of the week, etc.);
 - (3) Place of performance of services;

- (4) Drawings, designs, or specifications when the supplies to be furnished are to be specially manufactured for the STATE in accordance with the drawings, designs, or specifications;
 - (5) Method of shipment or packing of supplies; or
 - (6) Place of delivery.
 - b. If any change causes an increase or decrease in the estimated cost of, or the time required for performance of, any part of the performance under this Contract, whether or not changed by the order, or otherwise affects any other terms and conditions of this Contract, the Agency procurement officer shall make an equitable adjustment in the (1) estimated cost, delivery or completion schedule, or both; (2) amount of any fixed fee; and (3) other affected terms and shall modify the Contract accordingly.
 - c. The CONTRACTOR must assert the CONTRACTOR'S rights to an adjustment under this provision within thirty (30) days from the day of receipt of the written order. However, if the Agency procurement officer decides that the facts justify it, the Agency procurement officer may receive and act upon a proposal submitted before final payment under the Contract.
 - d. Failure to agree to any adjustment shall be a dispute under paragraph 11 of this Contract. However, nothing in this provision shall excuse the CONTRACTOR from proceeding with the Contract as changed.
 - e. Notwithstanding the terms and conditions of subparagraphs 23a and 23b, the estimated cost of this Contract and, if this Contract is incrementally funded, the funds allotted for the performance of this Contract, shall not be increased or considered to be increased except by specific written modification of the Contract indicating the new contract estimated cost and, if this contract is incrementally funded, the new amount allotted to the contract.
24. Confidentiality of Material.
- a. All material given to or made available to the CONTRACTOR by virtue of this Contract, which is identified as proprietary or confidential information, will be safeguarded by the CONTRACTOR and shall not be disclosed to any individual or organization without the prior written approval of the STATE.
 - b. All information, data, or other material provided by the CONTRACTOR to the STATE shall be subject to the Uniform Information Practices Act, chapter 92F, HRS.
25. Publicity. The CONTRACTOR shall not refer to the STATE, or any office, agency, or officer thereof, or any state employee, including the HOPA, the CPO, the Agency procurement officer, or to the services or goods, or both, provided under this Contract, in any of the CONTRACTOR'S brochures, advertisements, or other publicity of the CONTRACTOR. All media contacts with the CONTRACTOR about the subject matter of this Contract shall be referred to the Agency procurement officer.
26. Ownership Rights and Copyright. The STATE shall have complete ownership of all material, both finished and unfinished, which is developed, prepared, assembled, or conceived by the CONTRACTOR pursuant to this Contract, and all such material shall be considered "works made for hire." All such material shall be delivered to the STATE upon expiration or termination of this Contract. The STATE, in its sole discretion, shall have the exclusive right to copyright any product, concept, or material developed, prepared, assembled, or conceived by the CONTRACTOR pursuant to this Contract.
27. Liens and Warranties. Goods provided under this Contract shall be provided free of all liens and provided together with all applicable warranties, or with the warranties described in the Contract documents, whichever are greater.

28. Audit of Books and Records of the CONTRACTOR. The STATE may, at reasonable times and places, audit the books and records of the CONTRACTOR, prospective contractor, subcontractor, or prospective subcontractor which are related to:
- a. The cost or pricing data, and
 - b. A state contract, including subcontracts, other than a firm fixed-price contract.
29. Cost or Pricing Data. Cost or pricing data must be submitted to the Agency procurement officer and timely certified as accurate for contracts over \$100,000 unless the contract is for a multiple-term or as otherwise specified by the Agency procurement officer. Unless otherwise required by the Agency procurement officer, cost or pricing data submission is not required for contracts awarded pursuant to competitive sealed bid procedures.
- If certified cost or pricing data are subsequently found to have been inaccurate, incomplete, or noncurrent as of the date stated in the certificate, the STATE is entitled to an adjustment of the contract price, including profit or fee, to exclude any significant sum by which the price, including profit or fee, was increased because of the defective data. It is presumed that overstated cost or pricing data increased the contract price in the amount of the defect plus related overhead and profit or fee. Therefore, unless there is a clear indication that the defective data was not used or relied upon, the price will be reduced in such amount.
30. Audit of Cost or Pricing Data. When cost or pricing principles are applicable, the STATE may require an audit of cost or pricing data.
31. Records Retention.
- (1) Upon any termination of this Contract or as otherwise required by applicable law, CONTRACTOR shall, pursuant to chapter 487R, HRS, destroy all copies (paper or electronic form) of personal information received from the STATE.
 - (2) The CONTRACTOR and any subcontractors shall maintain the files, books, and records that relate to the Contract, including any personal information created or received by the CONTRACTOR on behalf of the STATE, and any cost or pricing data, for at least three (3) years after the date of final payment under the Contract. The personal information shall continue to be confidential and shall only be disclosed as permitted or required by law. After the three (3) year, or longer retention period as required by law has ended, the files, books, and records that contain personal information shall be destroyed pursuant to chapter 487R, HRS or returned to the STATE at the request of the STATE.
32. Antitrust Claims. The STATE and the CONTRACTOR recognize that in actual economic practice, overcharges resulting from antitrust violations are in fact usually borne by the purchaser. Therefore, the CONTRACTOR hereby assigns to STATE any and all claims for overcharges as to goods and materials purchased in connection with this Contract, except as to overcharges which result from violations commencing after the price is established under this Contract and which are not passed on to the STATE under an escalation clause.
33. Patented Articles. The CONTRACTOR shall defend, indemnify, and hold harmless the STATE, and its officers, employees, and agents from and against all liability, loss, damage, cost, and expense, including all attorneys fees, and all claims, suits, and demands arising out of or resulting from any claims, demands, or actions by the patent holder for infringement or other improper or unauthorized use of any patented article, patented process, or patented appliance in connection with this Contract. The CONTRACTOR shall be solely responsible for correcting or curing to the satisfaction of the STATE any such infringement or improper or unauthorized use, including, without limitation: (a) furnishing at no cost to the STATE a substitute article, process, or appliance acceptable to the STATE, (b) paying royalties or other required payments to the patent holder, (c) obtaining proper authorizations or releases from the patent holder, and (d) furnishing such security to or making such arrangements with the patent holder as may be necessary to correct or cure any such infringement or improper or unauthorized use.

34. Governing Law. The validity of this Contract and any of its terms or provisions, as well as the rights and duties of the parties to this Contract, shall be governed by the laws of the State of Hawaii. Any action at law or in equity to enforce or interpret the provisions of this Contract shall be brought in a state court of competent jurisdiction in Honolulu, Hawaii.
35. Compliance with Laws. The CONTRACTOR shall comply with all federal, state, and county laws, ordinances, codes, rules, and regulations, as the same may be amended from time to time, that in any way affect the CONTRACTOR'S performance of this Contract.
36. Conflict Between General Conditions and Procurement Rules. In the event of a conflict between the General Conditions and the procurement rules, the procurement rules in effect on the date this Contract became effective shall control and are hereby incorporated by reference.
37. Entire Contract. This Contract sets forth all of the agreements, conditions, understandings, promises, warranties, and representations between the STATE and the CONTRACTOR relative to this Contract. This Contract supersedes all prior agreements, conditions, understandings, promises, warranties, and representations, which shall have no further force or effect. There are no agreements, conditions, understandings, promises, warranties, or representations, oral or written, express or implied, between the STATE and the CONTRACTOR other than as set forth or as referred to herein.
38. Severability. In the event that any provision of this Contract is declared invalid or unenforceable by a court, such invalidity or unenforceability shall not affect the validity or enforceability of the remaining terms of this Contract.
39. Waiver. The failure of the STATE to insist upon the strict compliance with any term, provision, or condition of this Contract shall not constitute or be deemed to constitute a waiver or relinquishment of the STATE'S right to enforce the same in accordance with this Contract. The fact that the STATE specifically refers to one provision of the procurement rules or one section of the Hawaii Revised Statutes, and does not include other provisions or statutory sections in this Contract shall not constitute a waiver or relinquishment of the STATE'S rights or the CONTRACTOR'S obligations under the procurement rules or statutes.
40. Pollution Control. If during the performance of this Contract, the CONTRACTOR encounters a "release" or a "threatened release" of a reportable quantity of a "hazardous substance," "pollutant," or "contaminant" as those terms are defined in section 128D-1, HRS, the CONTRACTOR shall immediately notify the STATE and all other appropriate state, county, or federal agencies as required by law. The Contractor shall take all necessary actions, including stopping work, to avoid causing, contributing to, or making worse a release of a hazardous substance, pollutant, or contaminant, and shall promptly obey any orders the Environmental Protection Agency or the state Department of Health issues in response to the release. In the event there is an ensuing cease-work period, and the STATE determines that this Contract requires an adjustment of the time for performance, the Contract shall be modified in writing accordingly.
41. Campaign Contributions. The CONTRACTOR is hereby notified of the applicability of 11-355, HRS, which states that campaign contributions are prohibited from specified state or county government contractors during the terms of their contracts if the contractors are paid with funds appropriated by a legislative body.
42. Confidentiality of Personal Information.
- a. Definitions.
- "Personal information" means an individual's first name or first initial and last name in combination with any one or more of the following data elements, when either name or data elements are not encrypted:
- (1) Social security number;
 - (2) Driver's license number or Hawaii identification card number; or

- (3) Account number, credit or debit card number, access code, or password that would permit access to an individual's financial information.

Personal information does not include publicly available information that is lawfully made available to the general public from federal, state, or local government records.

"Technological safeguards" means the technology and the policy and procedures for use of the technology to protect and control access to personal information.

b. Confidentiality of Material.

- (1) All material given to or made available to the CONTRACTOR by the STATE by virtue of this Contract which is identified as personal information, shall be safeguarded by the CONTRACTOR and shall not be disclosed without the prior written approval of the STATE.
- (2) CONTRACTOR agrees not to retain, use, or disclose personal information for any purpose other than as permitted or required by this Contract.
- (3) CONTRACTOR agrees to implement appropriate "technological safeguards" that are acceptable to the STATE to reduce the risk of unauthorized access to personal information.
- (4) CONTRACTOR shall report to the STATE in a prompt and complete manner any security breaches involving personal information.
- (5) CONTRACTOR agrees to mitigate, to the extent practicable, any harmful effect that is known to CONTRACTOR because of a use or disclosure of personal information by CONTRACTOR in violation of the requirements of this paragraph.
- (6) CONTRACTOR shall complete and retain a log of all disclosures made of personal information received from the STATE, or personal information created or received by CONTRACTOR on behalf of the STATE.

c. Security Awareness Training and Confidentiality Agreements.

- (1) CONTRACTOR certifies that all of its employees who will have access to the personal information have completed training on security awareness topics relating to protecting personal information.
- (2) CONTRACTOR certifies that confidentiality agreements have been signed by all of its employees who will have access to the personal information acknowledging that:
 - (A) The personal information collected, used, or maintained by the CONTRACTOR will be treated as confidential;
 - (B) Access to the personal information will be allowed only as necessary to perform the Contract; and
 - (C) Use of the personal information will be restricted to uses consistent with the services subject to this Contract.

d. Termination for Cause. In addition to any other remedies provided for by this Contract, if the STATE learns of a material breach by CONTRACTOR of this paragraph by CONTRACTOR, the STATE may at its sole discretion:

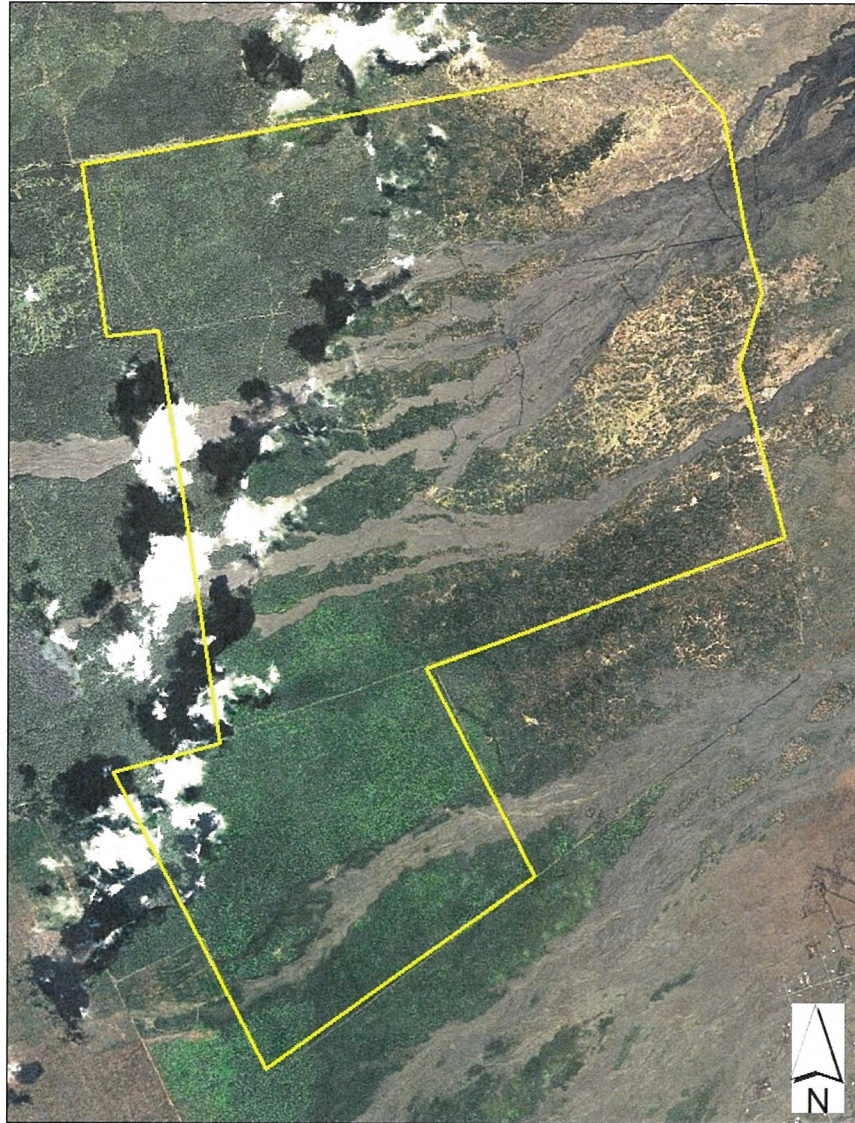
- (1) Provide an opportunity for the CONTRACTOR to cure the breach or end the violation; or
- (2) Immediately terminate this Contract.

In either instance, the CONTRACTOR and the STATE shall follow chapter 487N, HRS, with respect to notification of a security breach of personal information.

e. Records Retention.

- (1) Upon any termination of this Contract or as otherwise required by applicable law, CONTRACTOR shall, pursuant to chapter 487R, HRS, destroy all copies (paper or electronic form) of personal information received from the STATE.
- (2) The CONTRACTOR and any subcontractors shall maintain the files, books, and records that relate to the Contract, including any personal information created or received by the CONTRACTOR on behalf of the STATE, and any cost or pricing data, for at least three (3) years after the date of final payment under the Contract. The personal information shall continue to be confidential and shall only be disclosed as permitted or required by law. After the three (3) year, or longer retention period as required by law has ended, the files, books, and records that contain personal information shall be destroyed pursuant to chapter 487R, HRS or returned to the STATE at the request of the STATE.

Forest Stewardship Management Plan for The Kona Hema Preserve



Prepared by:
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May 22, 2017

Cover Sheet

Applicant: The Nature Conservancy of Hawai‘i

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Tax Map Keys:

Pāpā parcel:	(3)8-8-01: <u>01</u> (2,248.8 acres)
Honomalino parcel:	(3)8-9-01: <u>01</u> (4,021.6 acres)
Kapu‘a parcels:	(3)8-9-06: <u>30</u> (628.5 acres)
	(3)8-9-06: <u>31</u> (583.7 acres)
	(3)8-9-06: <u>33</u> (593.1 acres)

State Land Use Designation: Agriculture

County Zoning: Agriculture/A-5a

Property Acreage: 8,072.7 acres

Stewardship Management Area: 8,072.7 acres

Approximate Elevation: 2,880 to 5,720 feet

Slope: 2 to 20 %

Perennial or intermittent stream courses: None

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Plan Completion Date: May 22, 2017

Signature Page

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

Prepared by: _____

Jon G. Griffin

Natural Resources Consultant

Date: _____

2/16/2018

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

Prepared for: _____

The Nature Conservancy of Hawai'i

Date: _____

3/15/2018

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

Approved by: _____

Administrator

Division of Forestry and Wildlife

Date: _____

5/2/18

Forest Stewardship Advisory Committee Approval: This plan was reviewed and approved by the Forest Stewardship Advisory Committee

on September 8, 2017

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Forest Stewardship Management Plan Preface

The Nature Conservancy of Hawai'i (TNC) is an international non-profit organization dedicated to the protection of native Hawaiian ecosystems. The Conservancy owns and manages Kona Hema Preserve on the Island of Hawai'i. A management plan for the preserve was prepared in 2005 by TNC. Since that time, many of the proposed management objectives have been met and new resource information has become available. This revised Forest Stewardship Management Plan describes existing natural resources at Kona Hema Preserve and provides sound, integrated strategies and actions for managing resources on the property. It also reviews accomplishments under the previous plan and sets forth new management objectives, strategies, and practices for the next 10-year period. The plan draws on information provided by Conservancy scientists, resource managers, and private planners. It reflects the desires of the applicant to protect and enhance all resources on the property.

This Forest Stewardship Management Plan is being submitted for approval by the Hawai'i Forest Stewardship Advisory Committee and authorization for reimbursement of the negotiated cost-share amounts by the Hawai'i Forest Stewardship Program (FSP). Further, the document is intended to meet plan revision requirements in accordance with existing conservation easements granted to the U. S. Department of Agriculture (USDA) Forest Legacy Program (FLP).

Introduction

The 1.5 million acres of native-dominated landscapes on the Island of Hawai'i is representative of seventy-five percent of similar lands in the state. Sixty-seven percent of all the recently recorded Hawai'i Island rare plants and vertebrates are included within these landscapes, a significant portion of whose habitat lies in the Kona region. Rare plants, natural communities, rare forest birds, and other unique elements occur throughout the Kona region and represent an important but poorly protected resource. While most of the forested land in the state is zoned "Conservation", virtually the entire forest on the Kona flank of Mauna Loa is zoned "Agriculture." This zoning allows many uses that are incompatible with environmental protection.

TNC has implemented a dual-pronged strategy to enhance conservation of Kona forests by facilitating federal land acquisition and by establishing preserves. In 1997, with the help of TNC, the U.S. Fish and Wildlife Service (USFWS) established the 5,600 acre Kona Forest Unit of the Hakalau Forest National Wildlife Refuge. In 2003, TNC facilitated the purchase of the 116,000 acre Kahuku Ranch by the National Park Service.

TNC has also contributed to the protection of Kona forests through land acquisition and management.

Kona Hema Preserve was established in June 1999 when TNC purchased the Honomalino parcel (4,021.6 acres) in South Kona, Island of Hawai'i. Three more parcels at Kapu'a (1,805.3 acres) were added to the preserve in 2002. These Kapu'a lands are adjacent to the southern border of the Honomalino unit. The Pāpā parcel (2,248.5 acres) was added in 2003. The Pāpā parcel is adjacent to the northern border of the Honomalino unit. Together, these land units make up the 8,075.7 acre Kona Hema Preserve.

Kona Hema Preserve protects part of an ancient koa/'ōhi'a (*Acacia koa*/*Metrosideros polymorpha*) forest along the southwest flank of Mauna Loa. The preserve forms a core of critically important conservation areas that include private lands, state Natural Area and Forest Reserves, and Hawai'i Volcanoes National Park. TNC has been actively managing the area since 2000 with emphasis on fencing, ungulate removal, and alien plant control.

The lands of Honomalino and Pāpā have been severely impacted over the past century by cattle grazing, logging, and feral animal damage. Kapu'a lands have been relatively undisturbed by human activities but were heavily impacted by feral animals. TNC's primary objectives at the Kona Hema Preserve are to (1) protect watershed values; (2) promote the recovery of native plants, animals, and natural communities; and (3) explore and demonstrate the potential of these lands to support compatible economic activities such as sustainable forestry. The Conservancy strongly believes that by removing and mitigating conservation threats and by expanding its knowledge of sustainable land management, it can also influence the conservation and management of other public and privately-owned forests.

Native plant communities at Kona Hema Preserve are representative of the general pattern of vegetation at middle elevations along the Kona flank of Mauna Loa. Koa/'ōhi'a montane mesic forest occupies a significant portion of the preserve. This vegetation type lies between subalpine dry shrub lands above and 'ōhi'a-dominated wet and mesic forest below. Forest cover is interrupted by sparsely vegetated lava flows running down through older vegetation. These more recent flows support pioneer plants in varying stages of successional development.

Preserve lands provide important habitats for native plant and wildlife species. Koa is especially important as it is a favored host of endangered birds. Hawaiian birds use koa trees for nesting, feeding, roosting, and other requirements of their life cycle. 'Alalā or Hawaiian crows (*Corvus hawaiiensis*), Hawai'i 'ākepa (*Loxops coccineus coccineus*), 'akiapōlā'au (*Hemignathus munroi*), and 'alawī or Hawai'i creeper (*Oreomystis mana*)

all exhibit a strong preference for koa, foraging on wood boring beetles (Cerambycidae) and other invertebrates that live under the bark and on the leaves of trees. The existence of most native wildlife species in the preserve is dependent upon the continued presence of koa and 'ōhi'a as forest dominants. Koa is also important for sustaining Hawaii's forestry industry. Thus, koa provides not only an economic incentive for sustainability but is itself a conservation target that TNC would like to see thrive in the landscape.

Description of the Property

Environmental Setting

Kona Hema Preserve occupies a central region in the South Kona District, Island of Hawai'i. It is situated between two State of Hawai'i Natural Area Reserves (NAR); Manukā to the south and Kipahoe to the north. A mix of state forest reserves and private lands are interspersed between. Hawaii Volcanoes National Park (Kahuku unit) extends above the preserve (fig. 1). These combined lands comprise the majority of the region and contribute to the long-term conservation of native plants and animals in the landscape.

The preserve includes 8,075.7 acres of wet and mesic forest. It is situated on the western (leeward) flank of Mauna Loa Volcano, north of the volcano's southwest rift zone. Property boundaries extend from 2,880 to 5,720 feet elevation and fall within four Hawaiian land divisions or *ahupua'a*. From north to south they are Pāpā 1, Pāpā 2, Ho'opuloa, and Kapu'a (USGS Pāpā quadrangle). Topography is moderately steep (2 - 20% slope), increasing in elevation at a rate of about 1,000 feet per linear mile. The preserve is divided into three adjacent management units: Pāpā (2,248.8 acres), Honomalino (4,021.6 acres), and Kapu'a (1,805.3 acres). The management units incorporate five tax map key (TMK) parcels:

Pāpā:	(3)8-8-01: <u>01</u> (2,248.8 acres)
Homalino:	(3)8-9-01: <u>01</u> (4,021.6 acres)
Kapu'a:	(3)8-9-06: <u>30</u> (628.5 acres)
	(3)8-9-06: <u>31</u> (583.7 acres)
	(3)8-9-06: <u>33</u> (593.1 acres)

Access Routes

There are three controlled roads that access preserve lands from the Hawai'i Belt Road (Highway 11). The Honomalino and Pāpā units can be reached from Honomalino Road. This route begins on Highway 11, a few hundred yards south of mile marker 89. The access route continues upslope through Honomalino Estates Subdivision to a locked gate. An unimproved road begins at the end of the subdivision and passes through private land on an easement. There is a second locked gate at the Honomalino Section of the South

Kona Forest Reserve boundary and a third locked gate at the lower boundary of the preserve (Honomalino unit). The Honomalino and Pāpā units may also be accessed from an unimproved road off the Old Mamalahoa Highway. This route passes some residences on a private easement and is also controlled by a locked gate. The Kapu‘a unit is accessed via an unimproved road extending through the 4,000-acre macadamia nut orchard managed by MacFarms (fig. 2).

Conservation Easements

The USDA Forest Legacy Program (FLP) is designed to encourage the protection of privately owned forest lands by conveying conservation easements to the federal government. It is administered by the U. S. Forest Service (USFS) in partnership with states and is entirely voluntary. TNC has encumbered all five parcels at Kona Hema Preserve with conservation easements under the FLP. Easements were granted to the United States of America by and through the Secretary of Agriculture. Grants were made over a period of several years: Kapu‘a in 2003, Pāpā in 2004, and Honomalino in 2007. The easements were granted for the purpose of (1) preserving and conserving biodiversity, scientific values, open space, and scenic values for the benefit of the general public; (2) preserving and conserving wildlife habitat, natural communities, and cultural resources on the property; (3) linking more than 30,000 acres of protected natural land in the South Kona koa/‘ōhi‘a forest belt; and (4) retaining the property in perpetuity as an ecologically viable tract of land for other forest and natural values.

TNC retained some limited development rights under the Honomalino conservation easement. These included the right to construct or place new buildings, structures, and infrastructure on 20 pre-approved five-acre development sites (fig. 3). Footprints of the aggregate sites may not exceed 50 acres (“development cap”). No additional development sites were retained by TNC on the Pāpā and Kapu‘a parcels.

The FLP required that TNC develop a forest management plan for the encumbered properties and have it approved by the State Forester before conducting any management activities. An initial plan was completed in 2005. The easement documents further state that the Grantee shall revise the Forest Management Plan, “not less frequently than every ten years” and shall “submit the revision simultaneously to the Grantee and the State Forester.” This first revision of the Kona Hema Forest Stewardship Management Plan is intended to meet that requirement.

Property Zoning

State and County zoning regulations dictate what kinds of uses and projects are acceptable on any given land parcel in Hawai‘i. Chapter 205, Hawai‘i Revised Statutes (HRS), grants power to the State Land Use Commission to designate all land in Hawai‘i as one of four district types: Agriculture, Conservation, Urban, or Rural. Kona Hema Preserve is designated Agriculture District. This designation permits livestock grazing, cultivation of crops, forest clearing for pasture improvement, timber harvesting, and

development of wind energy facilities. County zoning reaffirms or further refines state land use classifications. Hawai'i County zoning for parcels at Kona Hema Preserve is A-5a. This designation sets a minimum lot size of five acres for agricultural uses as defined by the Hawai'i County Zoning Code. The code also sets forth requirements for subdivision.

Ownership/Land Use

Land parcels, comprising Kona Hema Preserve, have changed hands many times since the late 1800's. J. M. Monsarrat obtained the original Pāpā Land Patent Grant (#3723) from the Hawaiian government in 1894 (3,300 acres). William C. Achi acquired the Honomalino Land Patent Grant (#4731) from the same source in 1903 (4,166 acres). Bishop Estate owned the Kapu'a *ahupua'a*. Very little information is available about land use practices in those early years. Robinson A. McWayne established the McWayne Ranch on the Honomalino parcel in 1907 and began grazing cattle there. Unfortunately, the 1926 Ho'opuloa lava flow "ruined some 2,000 acres, including some of the best pastures in the ranch where many imported grasses had been introduced. Some cattle were also lost in this recent flow." Grasses growing on the ranch at that time included "some of the Paspalums, Rhodes grass (*Chloris gayana*) Redtop (*Tricholaena rosea*) and others." (Henke (1929). Robert Hind Ltd. purchased the McWayne Ranch in 1950 and continued running cattle on the land. It was then called Honomalino Ranch. Robert Hind Ltd. also owned Pu'uwa'awa'a Ranch in North Kona and the Captain Cook Coffee Company in South Kona. Dillingham Investment Company acquired the land from Robert Hind Ltd. in 1958 and operated it as Dillingham Ranch. Wild cattle were present on the property and on the adjacent state forest reserve when Dillingham took control. These animals were removed by 1967 or 1968 and replaced with a domestic herd. The ranch also pastured domestic cattle on the adjacent Pāpā parcel. Cattle remained on the Honomalino parcel until 1997 when the parcel was deeded to First Hawaiian Bank in lieu of foreclosure (D. Carlsmith, 1999). The Kapu'a parcels and additional forested land in the lower section of the Honomalino parcel were not heavily grazed because of their dense vegetation and rugged terrain (M. Johansen, pers. comm., 2/16/2017).

The Honomalino parcel was first logged by Robert Hind Ltd. in 1950. Dillingham Investment Company logged the area again in 1958 and 1959 (D. Carlsmith, 1999). Sporadic removal of koa continued at Honomalino until 1997, when the owner deeded this parcel to First Hawaiian Bank. The bank allowed loggers to remove more koa from the parcel until 1999, when it was purchased by TNC (M. Johansen, pers. comm., 4/27/2017). Commercial logging continued at Pāpā until 2003 when TNC purchased that parcel and logging ceased. Old milling and log landing sites are still apparent at various locations in both parcels. Rotting lumber, slash, and sawn koa logs litter the ground at some of these sites. There are no records or evidence of commercial timber harvesting activities at Kapu'a.

Land use practices abruptly changed in 1999 when TNC became the land owner of the Honomalino parcel. Ranching and logging operations ended and forest restoration

activities began. An ungulate-proof fence (6 feet high) was constructed around the perimeter of the Honomalino parcel the following year (2000). TNC staff and contractors then began aggressively removing feral pigs (*Sus scrofa*), feral goats (*Capra aegagrus hircus*), and mouflon sheep (*Ovis gmelini musimon*). Pigs were baited and captured in portable metal traps while goats and sheep were tracked and shot by staff hunters. Ungulates (hoofed animals) were totally eliminated from this unit in 2005.

The Kapu‘a parcel was fenced in 2003 using funds received from the USDA, Natural Resources Conservation Service (NRCS), and private donors. Most sheep and all goats were driven out of the unit prior to fence completion. All remaining ungulates were removed by trapping and shooting in 2005.

Soon after acquiring the Pāpā parcel, TNC applied for NRCS funding to partially fence the unit. Funds were awarded in May 2004 and a contractor was hired to construct new fences along the northern and western boundaries. This work was completed in December 2004. No fencing was needed along the eastern boundary of the parcel because Hawaii Volcanoes National Park (HAVO) had previously (2004) completed a new ungulate-proof fence to protect their Kahuku unit. The southern boundary of the Pāpā parcel borders TNC’s Honomalino unit which was already fenced. Most sheep and goats were driven from the Pāpā unit immediately after fencing and the remainder were trapped or shot. All ungulates were removed by 2006.

Since the year 2000, over 1,000 feral pigs, mouflon sheep, and feral goats have been removed from Kona Hema Preserve (M. Johansen, pers. comm., 2/16/2017). Partial funding for this work was received under a federal grant (PSGP Agreement No. 122005G024). The few ungulates that continue to gain access to the preserve are actively pursued by TNC staff and removed. Innovative technologies such as forward-looking infrared systems (FLIR), wireless remote game cameras, Judas animals, and aerial tracking from helicopters have been employed to locate any remnant populations of ungulates.

Land and Resource Description

Climate

Kona’s climate is characterized by a unique diurnal rain cycle. Mornings are generally clear and sunny. During the day, the surface of Mauna Loa volcano absorbs large amounts of solar radiation, heating air over the mountain and creating updrafts. Rising air masses draw in moist marine air that condenses as it moves upslope. This results in afternoon cloud cover and/or rain. The cycle reverses in the evening. Cold air descends from the mountain summit and drives clouds out to sea. Increased surface heating in the

summer intensifies this process, producing the only summer rainfall maximum in the state (Giambelluca and Schroeder, 1998).

Climate maps developed by Price et al. (2007) and Price et al. (2012) depict seven discrete zones of moisture availability in Hawai'i as pertaining to plant species ranges and distribution. Moisture zones are based not only on precipitation but include rainfall and fog, minus potential evapotranspiration (moisture demand from the atmosphere). These maps delineate critical moisture thresholds that have several potential applications including facilitating field surveys for rare plants, expediting restoration efforts, investigating plant range size and rarity, studying biodiversity, managing invasive species, and planning of conservation efforts (Price et. al., 2012). The project area includes three moisture zones as mapped by Price et al. From lowest to highest elevation, they are moderately wet, moist mesic, and seasonal mesic. A moisture gradient also extends from south to north, with Manukā, Kaulanamauna, and Kapu'a *ahupua'a* being a bit drier than the Pāpā and Ho'opuloa lands. The ancient lava flow in the Kapu'a management unit generally delineates the boundary of the south to north moisture shift (fig. 4). Lands south of the lava flow are drier (moist mesic) than those north of the flow (moderately wet). Forest vegetation types in the Kapu'a unit also reflect this change in moisture conditions.

Rainfall

A map of median annual precipitation, consisting of isohyet lines, is available in digital form from the State of Hawai'i (Giambelluca et al., 2013). This data indicates that precipitation in the preserve tracks elevation, being wettest near the lower boundary and decreasing upslope. During the climatological base period (1978-2007), annual rainfall averaged 59.0 inches in the lower third of the preserve but decreased to 39.3 inches in the upper regions. No rainfall records are available from local rain gauges. Kona storms can create large annual fluctuations in rainfall. These weather systems develop west of Hawai'i, bringing moist southerly winds and rain which can persist for a week or more (Giambelluca and Schroeder, 1998). Kona had a particularly wet year in 2015 due to an El Nino event.

Geology

Preserve substrates consist of Ka'u basalt that erupted from the southwest rift of Mauna Loa, an active shield volcano. These lavas are composed primarily of 'a'ā (loose, cobbled lava) flows with lesser amounts of pāhoehoe (smooth, relatively unbroken material). Lava substrates include both ancient (Holocene and Pleistocene) and historic flows. They range in age from 1,500-3,000 years old (Wolf and Morris, 1996). Two historic lava flows, from the 1916 and 1926 eruptions, intersect older substrates within mature native forests. These younger flows cover approximately 1,798 acres or 22% of the preserve. The 1926 Ho'opuloa lava flow supports a community of pristine early successional native

plants (fig. 5).

A number of deep lava channels and a few lava tube systems are distributed throughout the preserve. Lava tubes represent vacated channels of molten lava that formed within lava flows. They are generally restricted to pāhoehoe substrates. Lava tube systems in the preserve are highly segmented due to blockages caused by piles of breakdown and lava barriers. Passage openings or skylights occur at some locations, creating holes up to 30 feet deep. These openings make foot travel extremely hazardous in heavily vegetated areas. Maps developed by the U.S. Geological Survey place Kona Hema Preserve in lava flow hazard zone 2, along with much of South Kona. This zone is adjacent to and downslope of active rift zones and has a high degree of risk from lava flows. Appendix 1 provides descriptions of known lava tube skylights in the preserve.

Soils

Moist climate zones and relatively old lava flows have created a fertile assemblage of soils in the preserve. However, most soils have some level of compaction, disturbance, and erosion associated with past logging and cattle ranching activities. Kona Hema soils are classified as Histosols by the USDA. This taxonomic order consists of soils with more than 50 percent organic matter in the surface horizons (soil layers). In Kona, they formed on recent lava flows where organic matter from decaying vegetation accumulated. If soils formed on ‘a‘ā lava, the organic matter is mixed with ‘a‘ā fragments, making the soils very stony. If soils formed on pāhoehoe lava flows, the organic matter accumulated above pāhoehoe bedrock.

Soil series further define characteristics of soils. These assemblages are typically delineated by parent material, rainfall, soil depth, slope, drainage, and permeability. In Hawai‘i, soil series are generally given geographic place names, but written without diacritical marks.

The most recent comprehensive soil survey of Hawai‘i Island was completed in 2013 (USDA, 2013). Soil maps (NRCS, 2017) show five different soil series at Kona Hema Preserve (fig. 6). Soils classified as “Mawae very cobbly highly decomposed plant material” cover the greatest area (2,854 acres). They occur at upper elevations, generally above 4,000 feet. The Mawae series consist of moderately deep, well drained soils that formed in organic material mixed with minor amounts of basic volcanic ash in ‘a‘ā lava (2-20% slopes). Depth to bedrock is 20-40 inches. The mean annual rainfall is 35 inches. Natural vegetation consists of ‘ōhi‘a, tree fern (*Cibotium chamissoi*), ‘ama‘u fern (*Sadleria cyatheoides*), ‘ie‘ie vine (*Freycinetia arborea*), and māmaki (*Pipturus albidus*).

A band of soil classified as “Puna and haplic udarents” occurs below 4,000 feet elevation (2,500 acres). This series consists of moderately deep, well drained soils that formed in

organic material mixed with minor amounts of basic volcanic ash in 'a'a lava (10-20% slopes). Depth to bedrock is 20 to 40 inches. The mean annual rainfall is about 65 inches. Natural vegetation consists of 'ōhi'a and hāpu'u tree ferns (*Cibotium* spp.).

'Ā'ā lava flows (1,735 acres) intersect all three management units (2-20% slopes). They are excessively drained and not considered prime farm land.

Soils in the remaining two soil series are restricted to smaller acreages. The "Puna-lava flows complex" (439 ac.) is scattered at lower elevations. "Kekake gravelly highly decomposed plant material" (263 ac.) is found in the southeastern corner of the Honomalino unit. A custom soil resources report, generated by Natural Resources Conservation Service (NRCS), is available under separate cover.

Water Resources

Kona Hema Preserve sits entirely within the 209,141 acre Ki'ilae watershed. This drainage system extends from the summit of Mauna Loa all the way to the coast. The Hawai'i Water Plan (2008) depicts preserve lands within the Ka'apuna ground water hydrologic unit (code 80601). The aquifer in this unit has a predicted sustainable yield of 51 million gallons/day, but is not part of a ground water management area. All ground water sources in Kona ultimately depend upon recharge that primarily occurs in a band between 1,500 and 5,500 feet elevation (Three Mountain Alliance, 2007). The preserve area is identified as Priority 1 watershed in the State of Hawai'i initiative entitled, "Rain Follows the Forest, a Plan to Replenish Hawaii's Source of Water." (Hawai'i DLNR, 2011).

Watershed conditions in the preserve are generally good with vegetation layers composed primarily of native trees and shrubs, along with non-native pasture grasses. There are no perennial streams, naturally occurring surface waters, major drainages, or wetland plant communities on the property. This is due to the geologically-young and extremely porous nature of the lava substrate.

The North and South Kona Districts are prone to frequent flooding due to intensive land use practices, steep slopes, shallow soils, frequent high intensity rains, and the lack of well-defined drainage-ways. The preserve is located within Zone X of the Hawai'i Flood Insurance Rate Map. This zone is outside the 500 year flood plain.

Natural Communities

Upland plant communities in Hawai'i were mapped by Jacobi (1989) during the period 1976-1981. Vegetation boundaries were initially delineated on aerial photographs and then overlaid on 1:24,000-scale orthophoto quad sheets. Resulting vegetation units were then verified in the field and by aerial reconnaissance. The final products delineate

vegetation types and describe tree canopy crown cover, tree height, tree species composition, and understory species composition. Jacobi's maps show at least nine different vegetation types at Kona Hema Preserve (fig. 7). Appendix 2 provides descriptions for each of these types.

A classification system for Hawaiian plant communities was developed by Gagne and Cuddihy (1999). Unique forest types within each principal community were named and described. Based on this system, two native plant communities, occupying different elevations and substrates, were recognized within Kona Hema Preserve. They are koa/'ōhi'a montane mesic forest and 'ōhi'a montane wet forest. Each of these natural communities is described in some detail below.

Koa/'ōhi'a Montane Mesic Forest

Montane mesic forests dominated by koa and 'ōhi'a are known from the islands of Kaua'i, Maui, and Hawai'i. This community type has an open-to-closed canopy of tall koa emergent above tall 'ōhi'a. The understory is rich in native tree and shrub species. Ground cover often consists of native ferns (Gagne and Cuddihy, 1999). Koa forests have historically been targeted for timber harvesting and are considered rare and imperiled. Koa/'ōhi'a montane mesic forests are important habitat for native forest birds and often contain rare plants.

A koa/'ōhi'a forest community covers the upper portion of the Kona Hema Preserve (Pāpā and Honomalino units only) and encompasses an area of 2,968 acres. It begins at about 3,800 feet elevation and extends upslope to the preserve boundary. Koa and 'ōhi'a are the dominant tree species in the overstory. A secondary tree layer consists primarily of pilo (*Coprosma rhynchocarpa*), naio (*Myoporum sandwicense*), and kōlea lau nui (*Myrsine lessertiana*). Pūkiawe (*Styphelia tameiameia*), and 'ākala (*Rubus hawaiiensis*) are common shrubs in the understory. The presence of several shrub species along with lack of epiphytic mosses characterizes this forest community as mesic. Native ferns are not particularly well represented, but *Dryopteris* spp., palapalai (*Microlepia strigosa*), and 'owali (*Pteris cretica*) are present. Hāpu'u pulu (*Cibotium glaucum*) occur only in patches.

Meadow ricegrass (*Ehrharta stipoides*) is the most prevalent non-native ground cover in these heavily wooded areas. This grass often creates a dense mat under the trees. Kikuyu (*Pennisetum clandestinum*) and other pasture grasses carpet the ground in open to sparsely wooded areas. These grasses are especially prevalent where past cattle ranching and koa logging operations have removed forest canopy. Open pastures, as well as heavily degraded forest areas, serve as the primary focus for koa regeneration studies and sustainable forestry actions described in this plan.

‘Ōhi‘a Montane Wet Forest

‘Ōhi‘a montane wet forests are one of the most widespread forest communities in the Hawaiian Islands. Examples on wet slopes above 3,000 feet elevation are known from the islands of Kauai, Molokai, Maui and Hawai‘i. The upper layers of this forest type consist of pure stands of ‘ōhi‘a with an occasional ‘ōlapa (*Cheirodendron trigynum*) in the canopy. Tree branches are often covered with epiphytic bryophytes and lichens. Native shrubs are prominent in the understory, especially pilo. Hāpu‘u, laukahi (*Dryopteris wallichiana*), and ‘ama‘u are common native ferns (Gagne and Cuddihy, 1999). This community type is known to support rare plants, birds, and invertebrates and is often important habitat for endangered species.

An ‘ōhi‘a montane wet forest community occurs in the lower portion of Kona Hema Preserve. This community occupies all three management units and covers an area of approximately 2,423 acres. It generally begins below 4,000 feet elevation and extends downslope to the lower boundary of the preserve. The overstory is dominated by medium to tall ‘ōhi‘a, some in excess of 90 feet in height. The subcanopy tree layer includes such species as pilo, kōpiko (*Psychotria hawaiiensis*), kōlea (*Myrsine lessertiana*), kāwa‘u (*Ilex anomala*), and tree ferns. Matted uluhe (*Dicranopteris linearis*) ferns occur in some areas. Vines climbing into the subcanopy include maile (*Alyxia oliviformis*), ‘ie‘ie, and hoi kuahiwi (*Smilax melastomifolia*). Groundcover shows a well-developed fern component, including laukahi, ‘owali, waimakanui (*Pteris excelsa*), hō‘i‘o (*Diplazium sandwichianum*), palapalai and ‘okupukupu (*Nephrolepis cordifolia*). Native herbs, grasses, and sedges are sparse.

Invasive weeds from adjacent ranchlands have invaded this ‘ōhi‘a community in some places. These weeds are most common near the lower edge of the preserve. Weed species include a variety of grasses (especially Kikuyu) and shrubs. Strawberry guava (*Psidium cattleianum*) and thimbleberry (*Rubus rosifolius*) occur in patches. Japanese anemone (*Anemone hupehensis*) is also a serious problem in some areas.

Pioneer Vegetation on Lava Flows.

On the geologically younger islands of Maui and Hawai‘i, relatively recent lava flows and cinder beds are occupied by pioneer vegetation in various successional stages. Plant cover may be limited to a few cryptogams (lichens, liverworts, and mosses), hardy ferns, or low-stature ‘ōhi‘a; depending on substrate age, moisture, and elevation. Pioneer vegetation is not generally known as rare plant habitat, but in coastal areas species such as maiapilo (*Capparis sandwichiana*) are known to occur on sparsely-vegetated flows.

Pioneer vegetation occurs on the 1916 and 1926 lava flows that intersect the preserve. Scattered plants are growing in cinder beds or on unweathered lava. Sparse stands of

‘ōhi‘a, composed of short stature trees, dominate these young volcanic substrates. Ground cover includes na‘ena‘e (*Dubautia scabra* spp. *scabra*), *Luzula hawaiiensis* var. *hawaiiensis*, ‘uki (*Machaerina angustifolia*), and *Hedyotis centranthoides*. Shrubs typical of drier environments may also be present. These include pūkiawe (*Styphelia tameiameia*) and ‘ohelo (*Vaccinium reticulatum*).

Non-native weeds are uncommon or altogether lacking on the 2016 and 2026 lava flows. However, shrubs such as sourbush (*Pluchea symphytifolia*), dogatail (*Buddleia asiatica*), and pamakani (*Ageratina riparia*) are present.

Existing Plant Species

Historic Records

The Hawai‘i Biodiversity and Mapping Program (HBMP), located at the University of Hawai‘i at Mānoa, collects information on the location and condition of Hawai‘i’s natural communities (ecosystems), rare plants, and animals. The HBMP natural diversity database and GIS records span a period from the 1800s to present. Taxa (plant or animal species) are defined as rare, “if available records indicate that its current distribution or abundance is limited, i.e. it is known from 20 or fewer location OR fewer than 3,000 individuals have been observed in the wild.”

A query of the HBMP database did not return any historical records of rare plant occurrences in the preserve area. However, occurrences of the critically endangered loulu (*Pritchardia schattaueri*) palm were recorded just below the preserve in nearby Honomalino Forest Reserve and on Ho‘omau Ranch (1990).

Botanical Surveys

Botanists affiliated with the Hawai‘i Natural Heritage Program conducted a plant survey at Kona Hema Preserve in 2005. The purpose of the survey was to develop a baseline inventory of all plant species found in the management units and to document the presence of threatened or endangered species. A total of 92 endemic and indigenous species were recorded during the survey (appendix 3). At least 17 additional plant species have been discovered in the preserve since 2005. These plants were reported by TNC staff members and knowledgeable visitors (table 1).

The American Forests Organization maintains a national register for champion trees. This registry lists an exceptionally large koa growing in the Honomalino unit as a champion for that species. The following measurements were given (2012) for the tree: height, 115 feet; crown spread, 93.3 feet; and trunk circumference, 343 inches.

Native Plant Restoration

In FY 2010 and FY 2011, more than 3,422 native plants, comprising 17 species, were outplanted in the forest understory at Kona Hema Preserve. The objective of this project was to improve wildlife habitat by planting trees, shrubs, and vines that produce food for the endangered ‘alalā. ‘Ohawai (*Clermontia hawaiiensis*) was previously reported as outplanted in the preserve, but that record was in error. The only outplanted lobelioid was *Clermontia clermontioides* (L. Nelson, pers. comm., 2/21/2017). Partial funding for this project was provided by a USFWS grant (Partners Agreement No. #F09AC00013). Survival of outplanted ‘alalā food species was mixed. Those planted at lower elevations in the wet ‘ōhi‘a forest zone experienced high survival rates, while those placed in the drier koa/‘ōhi‘a mesic forest zone often failed to survive.

Threatened and Endangered Plant Species

There are a number of rare plants growing naturally at Kona Hema Preserve (table 2). A‘e (*Zanthoxylum hawaiiensis*) and *Phylostegia floribunda* are both listed as endangered by the USFWS. Other rare plants include lovegrass (*Eragrostis deflexa*), alani (*Melicope hawaiiensis*), ‘ākala (*Rubus macraei*), mau‘u lā‘ili (*Sisyrinchium acre*), and *Stenogyne macrantha*. Three other endangered species occur in the vicinity of the preserve at either Kipahoe NAR, Manukā NAR, or on private lands nearby. Some of these may be suitable for introduction into the preserve. Among this group are loulou palms (*Pritchardia schattaueri*), mēhamehame (*Fluggea neowawraea*), ‘akahea (*Bohea timonioides*), and halapepe (*Pleomele hawaiiensis*). Additionally, *Clermontia lindseyana* was historically collected in south Kona at “Kapu‘a mauka” according to Lammers (1991). No collection date or elevation was given for this record. Ko‘oko‘olau (*Bidens campylotheca* ssp. *campylotheca*) was last observed in Honomalino Forest Reserve in 1911.

A single a‘e tree was discovered in the Honomalino unit at 4,766 feet elevation in 2008 (photo1). It was found by J. B. Friday, Extension Forester with the University of Hawai‘i. Laura Nelson, a TNC botanist, later confirmed the identification. The tree was not visited after 2009 because preserve staff were unable to find it again. Mel Johansen and Jon Giffin relocated the tree on February 28, 2017 and mapped its location. It was growing in the understory of a regenerating stand of koa. The tree was in good condition, but was not flowering or producing fruit. Trunk circumference was measured at 12 inches. The base of the tree exhibited several very old scars, apparently caused by pig tusks. These injuries had clearly healed years earlier, consistent with the timing of pig removal from the management unit. A quick search of the adjacent area failed to produce any additional a‘e trees.

The palm family (Arecaceae) is well known in Hawai‘i. The genus *Pritchardia* is represented by 27 species, of which 24 are endemic to the Hawaiian islands. The other

three species are restricted to tropical Pacific islands. *Loulu*, *noulu*, *hāwane*, and *wāhane* are some of the Hawaiian vernacular names applied to palms in this genus (Hodel, 2012; Wagner et al., 1999). *Pritchardia schattaueri* is one of the rarest palms in the genus. It was first discovered on Ho‘omau Ranch in 1960 by George Schattauer. This species is only known from 12 individuals in the wild (Wagner et al., 1999). *P. schattaueri* presently occurs from about 2,500-2,750 feet elevation (possibly just part of the unknown original elevation range). This relict population occurs on intermediate and older lava flows in ‘ōhi‘a dominated mesic forest along with other native tree species. The U.S. Fish and Wildlife Service listed *P. schattaueri* as endangered in 1996, but this designation alone does little to ensure its survival.

Kona Hema Preserve was selected by the USFWS as an outplanting site for *P. schattaueri* because the preserve is one of the few ungulate-free sites in South Kona. The recovery plan for this species states the need to establish several large, new populations near the 12 individuals that comprise the remaining wild population. To help meet this objective, palm seeds were collected from wild trees located on Ho‘omau Ranch, approximately two miles downslope from the preserve. Seeds were germinated and seedlings planted in seven discrete populations in the preserve. Four planting plots occur in the Honomalino unit and three in the Kapu‘a unit. Each plot is approximately three acres in size. Over 660 palms from four different founders were outplanted in the preserve between 2003 and 2009. TNC staff, community volunteers, and the Hawai‘i Youth Conservation Corps (HYCC) provided the labor for this work (photo 2). Survival rates of outplanted loulu have been extremely high (> 90%) and some individuals have reached a height of 15 feet (M. Johansen, pers. comm., 3/29/2017). Botanists with the Hawai‘i Plant Extinction Prevention Program (PEPP) are currently in the process of collecting and germinating seeds from all remaining wild palms. These seedlings will be outplanted in the preserve to diversify the genetics of the entire outplanted population. Palm restoration activities are being conducted in a systematic and genetically balanced manner.

Wild populations of the endangered hāhā (*Cyanea stictophylla*) exist north of the Pāpā unit in the Kukuiopa‘e and Ka‘ohe *ahupua‘a*. Seeds from these unusual lobelioids were collected by PEPP botanists and germinated in a nursery. These seedlings (123 individuals) were then outplanted in the Pāpā unit in February 2017. Seeds of the endangered haha (*Cyanea marksii*) were also collected from wild plants at Ka‘ohe gulch and Ka‘ohe pit crater. At least 35 of these seedlings were planted in the Pāpā unit on the same date.

Special Management Areas

TNC has designated three different areas in the Kona Hema Preserve as biodiversity sub-units. These areas support the highest quality and most botanically diverse forests in the

preserve. The sub-units lie along the lower boundary of the preserve, between 3,000 and 4,000 feet elevation. All three units are within the 'ōhi'a montane wet forest zone and are separated from each other by historic lava flows (fig. 7). Endangered plants are generally outplanted within these special management areas.

Critical Habitat Designation

“Critical habitat” is a term used in the U.S. Endangered Species Act to identify geographic areas that are essential for the conservation of threatened or endangered species. This designation is used by the USFWS for both public and private lands considered essential for the conservation of threatened or endangered plant or animal species. Designation of land as critical habitat does not require the landowner to implement recovery actions or to manage the land in any certain way. However, the Service does require landowners to consult with the USFWS if undertaking projects that entail federal funding or permitting.

Critical habitat has not been designated for any plant species at Kona Hema Preserve. However, there are three plant critical habitat areas nearby. Critical habitat for *Colubrina oppositifolia*, *Diellia erecta*, *Gouania vitifolia*, and *Pleomele hawaiiensis* occurs southwest and adjacent to the Kapu'a unit. Critical habitat for *Diellia erecta* and *Flueggea neowawraea* occurs west of the preserve. *Cyanea stictophylla* critical habitat occurs approximately one mile north of the Pāpā unit.

Existing Wildlife Species

Native Hawaiian animals are generally threatened throughout much of their range by habitat loss, competition from introduced species, and exposure to infectious diseases. Global climate change may also have long-term effects on the survival of many of these species. Native forests provide habitat required for Hawaii's unique fauna. Protection of forest lands at Kona Hema Preserve will provide improved foraging, roosting, and breeding habitat for native birds, mammals, and arthropods.

Avifauna

Hawaii's native avifauna originally consisted of more than 140 species of birds. At least 70 of these are now extinct and 30 more are endangered. Many of the endangered species are close to extinction. The progenitors of Hawaiian birds evolved and adapted to successfully occupy a variety of niches from mountaintop to coastline. The Hawaiian honeycreepers, a group in the finch family (Fringillidae, subfamily Drepanidini), underwent extensive adaptive radiation, producing more than 50 species with varied bill shapes and specialized food habits. Montane rain forests support the bulk of Hawaii's endemic bird life. Forest birds are the dominant form of native wildlife found at Kona Hema Preserve today.

Subfossil Records

Lava tubes offer a hidden record of birds that formerly inhabited the islands. Passage openings or skylights acted as pitfall traps, collecting both flightless and volant species. Trapped birds wandered down underground passageways, died, and their bones were preserved in the perpetual darkness. Small deposits of subfossil bird remains have been located in two different lava tubes systems at Kona Hema. Species identified so far are giant flightless geese (*Geochen rhuax*) and dark-rumped petrels (*Pterodroma phaeopygia sandwichensis*). Flightless geese were the largest terrestrial vertebrate to have inhabited the Island of Hawai‘i. Adults were over twice the size of a modern nene (*Branta sandvicensis*). These birds had massive skulls, heavy bodies, stocky legs, and wings too short for sustained flight. Flightless geese became extinct shortly after Hawaiians settled the islands, likely due to hunting and introduction of rats. Dark-rumped petrels have historically been observed upslope from the preserve in the Kahuku unit of Hawaii Volcanoes National Park, and continue to inhabit that area today. Fossil bird sites in the preserve deserve protection and future scientific study.

Historic Records

A query of the HBMP database returned multiple records of endangered bird sightings on lands now included in the preserve. ‘Alalā or Hawaiian crows (*Corvus hawaiiensis*) and ‘io or Hawaiian hawks (*Buteo solitarius*) were recorded at various locations over the years. A single Hawai‘i ‘ākepa (*Loxops coccineus coccineus*) was recorded on the lower boundary of the Honomalino unit (3,400 feet elevation) in 1982. Two ‘akiapōlā‘au (*Hemignathus monroi*) were observed in 1978 just 300 feet north of the Pāpā unit (5,100 & 5,200 feet elevation). A Hawai‘i creeper (*Oreomystis mana*) was recorded in 1978 in the Pāpā unit (5,500 feet elevation).

‘Alalā were last seen in the preserve in the late 1980’s and at least one pair nested at Honomalino (3,440 ft. elev.) in 1981. This species is now extirpated in the wild, but the USFWS has recently re-introducing crows into suitable habitat at Kulani (above upper Waiākea Forest Reserve). More releases are planned in the near future. There are no recent sightings of Hawai‘i ‘ākepa or ‘akiapōlā‘au in the preserve.

Forest Bird Surveys

The Hawaiian Forest Bird Survey (HFBS) was the most extensive effort to inventory Hawaiian birds in modern times. This project was sponsored by the USFWS and covered a seven-year period from 1976 to 1983. It focused on native forests above 3,200 feet elevation on all the main islands except Oahu. Biologists sampled and recorded the occurrence of all bird species detected along transects using the Variable Circular-plot Method (Scott et al., 1986).

Three HFBS transects were established in the vicinity of Kona Hema Preserve in 1978. Transect 69 ran along the upper northern edge of the Pāpā unit. Only 18 sampling stations extended into that area. Transect 70 had the greatest coverage with 39 stations extending from the upper to lower boundary of the Honomalino unit. Transect 71 extended from the upper to lower boundary of the Kapu‘a unit, and had 22 stations (fig. 8).

A baseline survey of Kona Hema forest birds was conducted by the HFBS project in June 1978. Additional surveys were carried out by other government agencies in subsequent years. DOFAW counted birds on transects 70 and 71 in 2003 and again in 2009. In 2005, HAVO established four new bird survey transects in the Honomalino and Pāpā units (transects 1, 6, 36, and 38). HAVO conducted bird counts on these routes in 2005 and 2010. HAVO also conducted a bird survey at the preserve in 2016, but that data is not currently available. Field data and reports for the 2016 survey are expected to be released by the summer of 2017 (R. Camp, pers. comm., 1/4/2017).

Forest bird surveys are scheduled every five years at Kona Hema Preserve. DOFAW and HAVO biologists conduct the counts in cooperation with TNC staff. The next survey cycle is scheduled for 2020.

Recent Observations

Forest bird survey results for Kona Hema Preserve were obtained from the Pacific Island Ecosystems Research Center, U.S. Geological Survey (PIERC). These records were reviewed and pertinent data on bird abundance and distribution extracted. A total of 18 native and non-native bird species have been detected in the preserve at sampling stations (Tweed et al., 2007; Judge et al, 2011). Another four species were reported by TNC staff. Endemic bird species consisted of four honeycreepers, one monarchine flycatcher, and one raptor (table 3). The honeycreepers, listed in order of abundance, were Hawai‘i ‘amakihi (*Hemignathus virens virens*), ‘apāpāne (*Himatione sanguinea*), i‘iwi (*Vestiaria coccinea*), and Hawai‘i creeper (*Oreomystis mana*).

The Hawai‘i ‘amakihi is a subspecies found only on Hawai‘i Island, Moloka‘i and Maui. It is one of the most common native forest birds. ‘Amakihi often congregate in small flocks, feeding on fruit, nectar, insects, and other invertebrates. They have a wide distribution in the preserve.

‘Apāpāne are found in ‘ōhi‘a forests on all of the main Hawaiian Islands. ‘Apāpāne feed primarily on ‘ōhi‘a flower nectar and foliage insects. They are gregarious birds, often feeding and flying in small flocks. ‘Apāpāne are commonly seen in the preserve.

‘I‘iwi are widely distributed on the Island of Hawai‘i. They were formerly common, but are now infrequently seen. ‘I‘iwi have vermilion plumage and a sharply decurved orange

bill. These birds feed primarily on flower nectar and foliage insects. They are considered scarce in the preserve, and were listed Threatened by USFWS in 2017.

Hawai'i creepers exist on all Big Island volcanoes except Kohala Mountain. They are most common in mesic and wet forests above 4,900 feet elevation. These small green birds feed on insects, spiders, and other invertebrates. They generally glean arthropods from the trunk and larger branches of 'ōhi'a and koa trees. Hawai'i creepers are rarely observed in the preserve.

The Hawaii 'elepaio (*Chasiempis sandwichensis sandwichensis*) is a Hawai'i Island subspecies that occupies a variety of forest types. These birds feed on insects and other invertebrates, often capturing them in the air (Scott et al., 1986). 'Elepaio are frequently seen in the preserve and are especially abundant in regenerating koa stands.

Forest bird population trend data are available from the 2010 forest bird survey. These data indicate that Hawai'i 'amakihi and 'apāpāne are increasing at Kona Hema Preserve. 'I'iwi exhibited relatively high population densities in the preserve, but population trend data are inconclusive. Population trends for creepers and 'elepaio are also inconclusive (Judge et al., 2011).

Hawaiian thrush or 'ōma'o (*Myadestes obscurus*) are a new addition to the avifauna at Kona Hema Preserve. This solitaire had a much wider distribution in the past than it does today. 'Ōma'o are common in windward Hawai'i forests, but are absent from Kohala, and most of Kona. They feed on fruit and, to a lesser extent, on insects (Scott et. al, 1986).

In 2010, 'ōma'o were detected in the leeward section of HVNP where the species was considered extirpated since 1978. The reappearance of 'ōma'o is perhaps the most significant finding of the 2010 forest bird survey (Judge et al., 2011). 'Ōma'o were not detected in the preserve in 2010, but were found upslope in the Kahuku unit of Hawai'i Volcanoes National Park. In 2014, a single 'ōma'o was heard singing in the Pāpā unit, near the upper boundary. Another bird was heard at the same location on February 16, 2017 (M. Johansen, pers. comm., 3/29/2017). This species appears to be expanding its range downslope into the preserve.

Marine birds do not nest in the preserve, but there is evidence that these birds transit the area on a regular basis. A single seabird has repeatedly been observed flying down the sparsely vegetated 1926 lava flow in the early morning hours. The latest observation was recorded in February 2017 (M. Johansen, pers. comm., 3/29/2017). More observations are needed to confirm the species identification.

Threatened and Endangered Bird Species

Hawai'i creepers and Hawaiian hawks were the only endangered birds detected in the preserve during the 2010 HAVO bird survey. HAVO counters recorded three creepers in the Honomalino unit and a single bird in the Pāpā unit. All were located near the upper boundary, above 5,240 feet elevation (Judge et al., 2011). Creepers had not been observed in the preserve since 1978, so these sightings were a significant finding and mark an expansion of this species range.

Hawaiian hawks are routinely seen in all parts of the preserve. These raptors are restricted to the Big Island but utilize many different habitat types. They generally hunt prey from a perch, feeding on native and non-native song birds, game birds, rats, mice and insects. However, the bulk of their diet is composed of rodents (Klavitter, 2000). On February 12, 2014, the USFWS opened a public comment period on a proposal to remove hawks from the endangered species list. Agency biologists believe that the population is secure and no longer requires federal protection. The deadline for submitting comments on this proposal was April 14, 2014, but a decision is still pending.

'I'iwi are of special concern to the USFWS. That agency has determined that the species warrants listing as "Threatened" under the Endangered Species Act of 1973. On September 19, 2016, the Service requested public comments on the proposed listing action, and in 2017 listed the species as "Threatened."

Forest Bird Recovery Areas

The USFWS has identified a number of "Forest Bird Recovery Areas" on Hawaii Island. The Service considers these areas of high importance for endangered forest bird species. Identification of recovery areas does not create or imply any legal requirement of the property owner to implement recovery actions, nor does it impose any limitation on the types of activities that the landowner may choose to engage in. Recovery areas are those that, from a purely biological standpoint, have the greatest potential to provide habitats important to the recovery of endangered forest birds. The "Revised Recovery Plan for Hawaiian Forest Birds" presents maps showing the location of "Forest Bird Recovery Areas" in Hawai'i. This plan was reviewed to determine if any designated areas fall within the Kona Hema Preserve. Maps indicate that recovery areas are designated for four bird species at Kona Hema Preserve. 'Ākepa, Hawaii creeper, and 'akiapōlā'au recovery habitat is found above 4,000 feet elevation while 'alalā recovery habitat occurs above 3,000 feet elevation (USFWS, 2006).

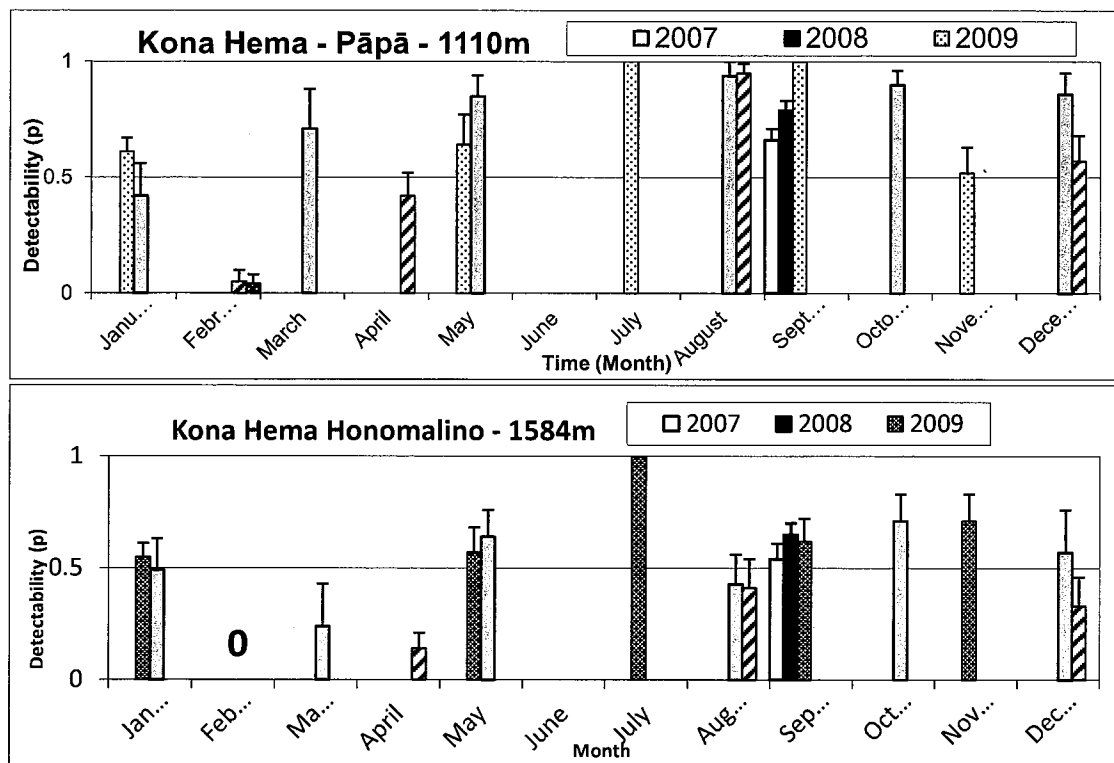
Mammals

Native Species

The 'ōpe'ape'a or Hawaiian hoary bat (*Lasiurus cinereus semotus*) is Hawaii's only native land mammal. This cryptic foliage-roosting creature was originally considered

to be a distinct species, but is now classified as a subspecies of the U. S. mainland hoary bat. Hawaiian bats are officially listed as an endangered by the USFWS. They occur from sea level to the highest volcanic peaks on Hawai‘i Island. Sightings of native bats are common in the Kona region. Local bats appear to concentrate in the coastal lowlands during the breeding season (May through October) and migrate to interior highlands during the winter non-breeding season. There is a significant association between bat occupancy and prevalence of mature forest cover (Gorresen et al., 2013).

Bat surveys were conducted at Kona Hema Preserve over a six-year period (2007–2012) by biologists affiliated with the U. S. Geological Survey and Hawai‘i Cooperative Studies Unit. Acoustic recording of bat echolocation calls were sampled using Anabat SD1 or Anabat II detectors and recorded with associated date and time data. Survey stations were established in the Pāpā (3,552 feet elevation) and Honomalino (5,069 feet elevation) management units. High levels of bat occupancy/use were recorded at stations in both areas (Pāpā, 0.94; Honomalino, 0.84). Values of zero indicate no bat use, while values nearing 1.0 indicate steady, consistent bat occupancy and use within a surveyed area. Bats were present at Pāpā survey stations during all months of the year. They were also detected each month in the Honomalino unit except during the February surveys in 2011 and 2012 (C. Pinzari, pers. comm., 2/21/2017). The charts below review bat occupancy/use by month at Kona Hema Preserve.



Source: Corinna Pinzari

Introduced species

Historically, lands which now encompass Kona Hema Preserve supported a variety of non-native mammals. Domestic cattle were grazed on the property for several decades. Feral pigs, mouflon sheep, and feral goats were also present in large numbers. Feral cats (*Felix domesticus*), mongooses (*Herpestes auropunctatus*), mice (*Mus musculus*) and rats (*Rattus rattus*) continue to be present in the preserve, but these present a lesser threat to endemic species than do ungulates.

Invertebrates

Native invertebrates are an important component of the fauna at Kona Hema Preserve. These little-known creatures occupy a variety of forest types (dry, mesic, and wet) and occur across a wide elevational gradient. No endangered invertebrates have been found in the preserve, but several rare native species are present. These include stink bugs (*Oechalia patruelis*), pomace flies (*Drosophila conspicua*), and a geometrid moth (*Progonostola* n.sp.). A few species of cave-adapted insects may be present in lava tubes. However, most subterranean passages in the preserve provide only marginal habitat for cave arthropods. Preserve lava tubes are generally deep and devoid of the tree roots necessary for arthropod survival. Such passages also tend to be dry and drafty, conditions unsuitable for these sensitive species. Appendix 4 lists all invertebrates identified at the preserve to date.

Forest Health

Forest Diseases

‘Ōhi‘a wilt (aka “rapid ‘ōhi‘a death”) and koa wilt are serious diseases that threaten native forest health in Hawai‘i. Vascular wilt fungi identified as *Ceratocystis fimbriata* and *Fusarium oxysporum*, respectively, are the causal agents of these diseases. To date, no evidence of either disease has been detected at the preserve. U. S. Geological Survey (USGS) personnel have placed spore traps at various locations in the preserve to monitor air currents for the existence of ‘ōhi‘a wilt (*Ceratocystis*) spores. None have been found to date.

The presence of rapid ‘ōhi‘a death (ROD) on the Island of Hawai‘i poses a serious concern when utilizing ‘ōhi‘a resources for commercial or personal use. In particular, it’s critical to prevent the disease from being transferred to unaffected regions, such as the Kohala region. Salvaged ‘ōhi‘a trees should not be removed from the property until TNC can ensure that the wood is disease free. It may be possible to kill the disease through heat treatment of the wood. However, ROD researchers have not yet identified the temperatures necessary to kill disease in a tree. ‘Ōhi‘a firewood can be utilized on the preserve with no limitations, but it would be best to heat treat any ‘ōhi‘a poles destined for fencing or other purposes to avoid spreading the disease. TNC is willing to cooperate with the ROD Working Group to determine protocols for utilizing ‘ōhi‘a while reducing

the potential for spreading the disease. Further, TNC will work with ROD Working Group/researchers to determine the correct post-harvest treatment methods to kill the disease within harvested trees. TNC has developed and implemented an internal protocol to prevent the introduction and spread of ROD at Kona Hema Preserve. A copy of TNC's ROD prevention and sanitation protocol is available upon request.

Invasive Alien Plants

Compared to other forested areas on the Island of Hawai'i, Kona Hema Preserve lacks many of the most aggressive, habitat-modifying weed species. These weed species have demonstrated the ability to displace or negatively affect native vegetation over large areas. For example, *Miconia calvescens*, banana poka (*Passiflora mollissima*), gorse (*Ulex europaeus*), Himalayan raspberry (*Rubus ellipticus*), fountain grass (*Pennisetum setaceum*), and kahili ginger (*Hedychium gardnerianum*) are not yet established at the preserve. Therefore, weed control activities at Kona Hema Preserve will focus on preventing these habitat-modifying weeds from becoming established. A stand of strawberry guava (*Psidium cattleianum*) occurs near the lower boundary of the Pāpā unit and Japanese anemone (*Anemone hupehensis*) has recently invaded portions of the Honomalino unit. Both of these invasive species are concentrated below 4,000 feet elevation, and efforts to control them are ongoing. Other more common weeds, notably alien grasses, will not be targeted for control except to prevent fire or to optimize native vegetation recruitment.

Invasive Alien Animals

Invasive alien animals are by far the greatest threat to Hawai'i's biodiversity in all native-dominated landscapes. Ungulates destroy native vegetation and prevent regeneration, accelerate the invasion of noxious weeds through direct dispersal of seeds, and can cause extensive soil erosion. In addition, pig wallows provide mosquito-breeding habitat that promotes the spread of avian disease, severely impacting populations of Hawai'i's native birds. Mouflon sheep and goats routinely browse on young trees, permanently damaging or killing saplings.

Rodents are seed predators and potential dispersers of both native and alien seeds. They may significantly reduce the likelihood or rate of regeneration in native plants. Rodents also eat the eggs of native birds and prey on land snails. This is especially a problem for species that are conservation targets. It is becoming increasingly apparent that rodents depress populations of arthropods which play important ecological roles. In the Kona region, rodents are present and likely abundant from sea level to summit.

Non-native insects and diseases have great potential to disrupt ecological processes and change the structure of native vegetation. Western yellowjackets (*Vespula pensylvanica*) are a dominant predator of native insects, often feeding on their larvae. These wasps have

contributed to the decline of various arthropod species and are hazardous to humans who encounter them. Exceptionally high populations of *Vespula* have been noted in the preserve, especially in the fall when dry weather conditions allow colonies to rapidly expand. Insect pests such as the black twig borer (*Xylosandrus* sp.) are known to be a major factor in the decline of certain native tree taxa. Recently, the introduced two-spotted leafhopper (*Sophonia* sp.) has been implicated in the decline of a wide variety of native fern, shrub and tree species via a yellowing disease. When leafhopper infestations are accompanied by other stress factors such as drought, affected native plants are more likely to succumb, potentially accelerating their replacement by alien components. Insect pests and diseases, therefore, may be contributing factors in the general decline of native species.

An outbreak of the native koa moth (*Scotorythra paludicola*) erupted on the Island of Hawai'i in 2013. During that time, moth larvae defoliated countless koa trees in the preserve. Most of the affected trees were recovering from this attack and flushing new leaves by 2014. Very little tree mortality was noted due to the moth outbreak (M. Johansen, pers. comm., 3/29/2017).

Timber Resources

Koa is the premiere Hawaiian wood and is one of the most valuable native trees grown in Hawai'i. Its wood was historically used by ancient Hawaiians to build dugout outrigger canoes, surfboards, and other items. Modern uses include wood carving, furniture construction, and the production of musical instruments. Koa is abundant in the Pāpā and Honomalino units, primarily above 4,000 feet elevation (mesic forest zone). Much of the preserve lies within the prime koa growing zone. However, koa resources in the preserve have been significantly diminished due to a long history of logging and cattle grazing. Almost all large trees were harvested in the past, but some regrowth is already reaching merchantable size. TNC's primary goal is to restore a biologically and economically viable forest system that can serve as a model for forest restoration throughout the Kona district.

‘Ōhi‘a is the most prevalent native tree growing in Hawaiian forests. Its wood was historically used by ancient Hawaiians for making weapons and tools, carving statues and idols, and for temple (*heiau*) construction. Modern uses include structural supports for buildings, flooring material, fence posts, and firewood. ‘Ōhi‘a occurs throughout the preserve with the largest and tallest trees found in the wet forest zone. Tree diameter and stature decrease markedly with increasing elevation.

A small number of ‘iliahi or sandalwood (*Santalum paniculatum*) are found at Kapu‘a, representing what was once a significant timber resource for the region. Although TNC

has no plans for ‘iliahi harvest, protection of these remaining individuals can support future restoration efforts.

An inventory of native timber resources in the Honomalino and Pāpā units was conducted by the Hawai‘i Division of Forestry and Wildlife (DOFAW) in 1999. No forest inventory was conducted in the Kapu‘a unit, so those acreage numbers were generated using GIS in lieu of a survey (table 4). Detailed descriptions of cover types and a map showing their location was presented in the 2005 management plan for Kona Hema Preserve. Those data are not reproduced here.

A small stand of Mexican cypress (*Cupressus lusitanica*) and a few scattered Japanese black pines (*Pinus thunbergiana*) cover about 2.4 acres in the Honomalino unit (4,300 feet elevation). These trees were planted by a former rancher about 1950. They were intended to provide a source of fences posts for the ranching operations (M. Johansen, pers. comm., 2/28/2017). TNC has no plans to harvest timber from this stand.

Significant Cultural and Historic Resources

A high percentage of Hawaiian place names (86%) remain in the language of the aboriginal population and usually have literal meanings. The Hawaiian names of the *ahupua‘a* or land divisions within the preserve can be literally translated as follows: *Pāpā*, “forbidden”; *Honomalino*, “calm bay”; and *Kapu‘a*, “the whistle” (Pukui et al., 1976). Maly (2004) offered an alternate interpretation for the Kapu‘a place name. He translated an old Hawaiian legend explaining that the naming of Kapu‘a in South Kona is associated with the killing of a cruel Hawaiian chief by his people. “We are also told that the place name ‘Kapu-‘a’ commemorates a restriction that was placed upon the stones gathered from that land, and which were used to stone the chief, Koihala.”

Information about cultural resources and historic events at Kona Hema Preserve was gathered from interviews, literature searches, and field trips. Since the preserve lies above the zone of intensive native cultivation (1,000 and 3,000 feet elevation), it is unlikely that historic resources other than temporary residences and trails would be present. These resources are described by Maly (2002):

Primary residences were situated close to the *ala loa* (near the present-day Belt Highway), and on the shore. Temporary residences which were utilized recurrently over a long period of time were maintained further upland in the planting fields and in locations where other mountain resources were collected. This residency and subsistence system, spanning elevations from the shore to the upper forest limits of the high mountain slopes was facilitated by the development of a number of *mauka-makai* trails in each *ahupua‘a*. Many of these trails

continue to be traveled on foot (or horseback in the historic period) by residents and land owners through the early 1900's.

Hawai'i government survey maps dating back to 1887 were searched by the consultant for information about historic sites in the vicinity of the preserve. A 1901 map shows a water feature located near the upper boundary of the preserve labeled "Honomalino waterhole." This site is situated in the Kahuku *ahupua'a*, a short distance upslope from the preserve boundary. Maps dated 1928 and later describe this same feature as the "One Hundred Acre Waterhole." The water hole was located by Mel Johansen in 2008 when he heard his dog lapping water from a pit in the ground. Mel and Jon Giffin visited the site on April 27, 2017 and found that the hole still contained water. A caprock, used for covering the waterhole, was lying nearby.

Historic trails and buildings in the Honomalino area are depicted on a U. S. Geological Survey map (Ho'opuloa quadrangle) dated 1928. These features were mapped during a 1925 land survey of the South Kona District. The map shows a track labeled "Honomalino trail" running *mauka/makai* (upslope/downslope) through the center of the preserve. This trail begins at a point near Miloli'i Village and extends upslope through the Honomalino *ahupua'a* to a site labeled "Honomalino Camp." The trail then veers northward into the Pāpā 2 *ahupua'a* and ends at Kahuku boundary. Most of this trail was obliterated in 1926 by a lava flow from Mauna Loa. A side trail extends southward from Honomalino Camp to the Kapu'a boundary. This lateral trail was probably used by early ranchers for moving cattle between paddocks.

The most puzzling aspect of the 1928 map is the placement of Honomalino Camp. After considerable review and a field reconnaissance trip, it became apparent that the existing Honomalino Camp is not located at the historic site shown on the 1928 map. The original Honomalino Camp was established at 4,720 feet elevation while the existing camp is situated at 4,200 feet. At least four buildings were present at the original camp site before being covered by the 1926 lava flow. The present-day Honomalino Camp was apparently established after the lava flow destroyed the old camp. All survey maps printed after 1928 label the existing camp as "Honomalino Camp." On April 27, 2017 Jon Giffin and Mel Johansen visited the original camp site and searched for evidence of the former buildings. The site was totally covered by 'a'ā lava and no remnants of the camp were found.

An old cattle trail still exists on the 1926 lava flow at approximately 4,680 feet elevation. It extends in a north and south direction, crossing over the 'a'ā lava and through a *kīpuka* (island of vegetation), before fading into the forest. The trail was apparently developed to move cattle back and forth over the rough lava flow.

At least one shelter cave exists in the preserve (Honomalino unit). Cultural features at that site include a fire place, sleeping area, stacked rocks, and charcoal on the floor. Native Hawaiians used these temporary shelter caves for overnight camping when they traveled to the uplands to catch wild goats, capture birds, and gather forest resources. Many similar shelter caves exist on the slopes of Mauna Loa, *mauka* of the preserve.

The koa bearing forest at Honomalino is located upslope of Miloli'i fishing village. In the past, that community may have used the *ahupua'a* as a source of logs for fishing canoes. In more recent times, canoe logs were harvested by previous owners of the preserve lands and given or sold to canoe clubs.

Existing Recreational and Aesthetic Values

Residents and visitors have access to some, but not all, state forest reserves on the Island of Hawai'i for hiking, birding, hunting and other recreational pursuits. Hawai'i Volcanoes National Park (HAVO) is also accessible to the public for many recreational activities. However, the majority of forested land on the Kona flank of Mauna Loa is privately-owned and not open to the general public. In the past, volunteer hunters assisted preserve staff with reduction of ungulate populations at Kona Hema Preserve. However, that opportunity ceased once all ungulates were removed. TNC currently provides some limited opportunity for the public to visit the preserve, generally for scheduled volunteer work days and other prearranged field trips. TNC plans to continue public use opportunities as staffing allows. However, the combination of limited staff, safety hazards, wildfire threat, and sensitive research projects will likely prevent unaccompanied recreational use on the preserve for the foreseeable future. A public use plan, required by the Forest Legacy Program easements, has been prepared and implemented for the entire preserve.

Preserve staff have developed two educational loop trails that provide access to sections of the Honomalino unit. The "big koa tree loop trail", located near Honomalino Camp, passes through a recovering koa/'ōhi'a forest, past an exceptionally large koa tree (approximately 400 years old), and a lava tube skylight. Plants growing below this skylight are protected from ungulate damage by steep walls. This feature provides an excellent example of native vegetation that has never been disturbed by large herbivores. A lava tube in the bottom of the skylight runs downslope and connects to another skylight about 100 yards below. This passage is blocked by a lava plug between the two openings. The lower skylight is significant because it trapped a number of extinct flightless geese centuries ago. These birds fell in the skylight, wandered up the passage to the lava plug, and died. The decaying bones of over 12 geese are still present in the lava tube.

The “wet trail” is located near the lower boundary of the Honomalino unit. It passes through an ‘ōhi‘a forest, drops into a deep lava trench, and exits on the access road. Plants growing along the trail include two species of rare mints (*Phyllostegia floribunda* and *Phyllostegia ambigua*) as well as other native plants. Outplanted loulu palms can be seen growing along the access road.

Infrastructure and Improvements

Some structures dating from the early ranching period still exist on the preserve. Most of these are related to former cattle and logging operations. They include rain sheds, water tanks, fences, corrals, and cabins. Many of these structures continue to be used today in support of preserve activities (fig. 9).

Structures

Several buildings are present at the current Honomalino Camp site (4,200 feet elevation). Two cabins were reportedly built by Robby McWayne, an early rancher, sometime after 1916 (D. Carlsmith, 1999). The oldest existing cabin may be one constructed by Robby McWayne, but was more likely constructed later in the 1930s because its foundation sits on the edge of the 1926 lava flow. Another cabin was built in the 1950s. Both cabins were constructed for ranch use. A smaller workshop was constructed by TNC in 1999. A water catchment shed, water tanks, and a small plant nursery are also present at the camp.

Fences

The preserve boundary and all three management units are completely enclosed with ungulate-proof fencing. Over 24.4 linear miles of fencing have been constructed and are being maintained by TNC staff. The preserve boundary is delineated by at least 17.0 linear miles of fencing while another 7.4 linear miles of interior fencing separates the three management units.

Fences were constructed along bulldozed lanes and consist of woven wire (4 feet high) and topped with smooth wire (2 feet high) on galvanized T-posts. The bottom of the fence was staked flush to the ground to prevent pigs from digging underneath. However, periodic flooding events and erosion from animals walking outside the wire created holes where pigs could gain entry to the preserve. This problem was rectified by attaching a solar powered electric wire to the outside of the fence, effectively discouraging pigs from approaching the barrier. Unfortunately, offset brackets holding the electric wire extended into the neighboring property, creating liability issues, and this system was abandoned. Fence lines around the preserve are now being retrofitted with wire “skirts” to prevent pigs from digging underneath.

The perimeter fence was originally topped with a double strand of barbed wire to discourage sheep from jumping into the preserve. However, the barbed wire was later

removed and replaced with two stands of smooth wire. This modification was made to prevent endangered bats from becoming impaled on the barbs.

Water Systems

South Kona still lacks a county water system and residents generally collect their own water from roof catchment systems and construct reservoirs for agricultural use. The preserve currently has seven water catchment systems (rain sheds and storage tanks). The Pāpā and Honomalino units each have two 50,000 gallon tanks, and another 12,000-gallon tank plus two 6,000 gallon tanks are located at Honomalino Camp. At full capacity, these systems can provide 218,000 gallons of water for wildfire control, planting projects, and overnight/research facilities.

Access Roads

More than 47 miles of interior roads link various areas inside the preserve. This figure does not include access roads leading from the highway to the preserve. Access roads and those inside the preserve are generally constructed on the sparsely vegetated 1926 'a'a lava flow. Side roads pass through older substrates with deeper soils. These are usually graded down to bedrock. None of the roads are paved, but they require very little maintenance due to their rocky base. Roads are in good condition and easily traversed with a 4WD vehicle. All road repairs are made by TNC staff using a D6 bulldozer and Case Farmall L530 tractor. Ungulate-proof gates separate roads between management units.

Wildfire Prevention and Suppression

Wildfires cause loss of plant cover, expose soils to erosion, and create conditions that encourage establishment of invasive weeds. Plant and animal habitats are also damaged, causing displacement or death of native species. The leeward side of Hawai'i Island has regular and prolonged droughts that greatly increase the potential for wildfire ignition.

Wildfires present a serious threat to both the integrity of natural communities and economic viability of forestry activities at Kona Hema Preserve and throughout the west flank of Mauna Loa. Wildfires could deforest large tracts of land in a single event. This fact was demonstrated in the Pāpā unit, where a 633-acre wildfire ravaged the forest in 1994. TNC's highest wildfire priority is to reduce the risk of fire ignition, and secondly, to install fire suppression aids to minimize the impact of any fire that may occur. TNC has developed a Fire Management Plan to minimize ignition risks in the preserve and to ensure a rapid, effective response should a fire occur. Fire prevention and pre-suppression measures are already in place. Infrastructure available for controlling wildfires includes a network of access roads, the availability of significant stored water supplies, and specific fire suppression equipment (water pumps, portable dip tanks, water trucks, bulldozer, and

tractor). Additionally, the sparsely vegetated 1916 and 1926 lava flows serve as natural barriers to retard the spread of wildfires between sections of the preserve.

In 2013, TNC installed a firecam at Puu Keokeo on the upper slopes of Mauna Loa. This site is within HVNP and lies approximately 2.5 miles above the preserve boundary. The camera can detect smoke from wildfires as soon as they start and help direct firefighters to the scene. It scans the western slopes of Mauna Loa between Ka'ū Forest Reserve and Kipahoe NAR. Images of the area are displayed on a video monitor in the preserve office at Honomalino Camp and can be accessed on a cell phone. The camera can also be panned and zoomed to obtain greater detail. TNC operates and maintains the camera equipment on a regular basis.

The Hawai'i County Fire Department (HCFD) is the first responder for wildfires in the preserve. Additionally, DOFAW will respond to wildfires on private lands under certain conditions. Their Fire Response Map depicts areas where DOFAW will assist the HCFD. Portions of Kona Hema Preserve fall within the pink color-coded zone on DOFAW's fire response map (<http://dlnr.hawaii.gov/forestry/fire/response-maps/>), indicating DOFAW will cooperatively respond to fires on the preserve when HCFD requests its assistance.

Human Resources

Five TNC staff members are currently working on the Big Island, two of which are assigned to the Kona Hema Preserve. Kona Hema staff includes a full-time Field Coordinator (Mel Johansen) and a half-time Technician (Lester Gebin). Additionally, the TNC Program Director and a Program Coordinator, based in the Nā'ālehu office, provide administrative support for field crews.

Management Objectives and Practices

This section provides action-oriented prescriptions for various management practices. The primary management goal at the Kona Hema Preserve is to promote watershed protection and conservation of biological diversity while demonstrating the viability of compatible economic activities. The principal means to achieve this three-pronged goal are laid out in this section under the following headings: Threat Abatement, Site Restoration, Forest Management, and Public Use. A discussion of the objectives, strategies, and management practices is then presented under each heading.

Threat Abatement

Biological diversity is conserved by abating threats such as ungulates, weeds, and wildfire, and by protecting and restoring native vegetation and forest habitats. In addition,

TNC is working in partnership with neighboring land owners to address threats on adjacent lands.

Ungulate Management

The long-term goal of the animal management program is to maintain an ungulate-free environment in the preserve. This will prevent soil disturbance by pigs and avoid damage to trees and ground cover by browsing ungulates.

Objective: Maintain an ungulate-free environment in the preserve.

Strategies:

- Construct ungulate-proof fences to protect management units – COMPLETED
- Utilize National Park Service hunters to assist in ungulate removal - COMPLETED
- Conduct aerial shooting operations to remove sheep - COMPLETED
- Maintain ungulate-proof fencing around each management unit -ONGOING
- Monitor management units for evidence of ungulate activity - ONGOING
- Set and monitor pig traps and snares when needed - ONGOING
- Conduct staff hunting to remove animals when needed - ONGOING
- Provide technical assistance to others needing animal removal advice - ONGOING

Management Practice: TNC has an ongoing policy of “zero tolerance” for ungulates in its preserves. TNC will continue its successful ungulate control program at Kona Hema Preserve. Ingress of animals from outside the preserve poses an ongoing threat to forest protection. Fence lines must be constantly maintained to keep the management units ungulate-free. Falling trees and branches, flooding, and earthquakes regularly cause damage to preserve fences, allowing pigs and sheep to enter the preserve. Fence lines are checked regularly for damage and for evidence of ungulate ingress. Inspections are conducted using a four-wheel drive vehicle, as fallen tree removal and fence repairs often require the use of a chainsaw and winch to maneuver downed wood away from the fence.

Gaps in the fence are repaired immediately, as ingress by even a single animal can destroy years of investment towards recovery of rare and endangered plant species in the understory. Management units are also monitored for evidence of ungulate activity. Pig traps, snares, and staff hunting are employed when any ungulates are detected in the management units. Aerial shooting of ungulates has been discontinued due to a new county ordinance that prohibits aerial shooting of animals on private lands.

Seasonal high wind events (Kona winds) often result in treefall requiring days of work to cut and remove multiple downed trees away from fences and roadways so that breaches can be repaired. Fallen 'ōhi'a and koa trees 90 feet in length and 28 inches in diameter are not uncommon along fence lines, requiring substantial effort to saw into manageable size and move aside. Where roadside fences occur, a corridor 18 feet wide is maintained to allow for staff and vehicular access, with 6 feet cleared of brush on either side of fences not occurring along roadways.

Invasive Weed Management

Although the Kona Hema Preserve is relatively free of habitat-modifying weeds, it remains a constant challenge to control established species (such as grasses) within the preserve and to prevent the most serious pests from establishing a foothold. Strategies to achieve this objective include application of herbicide along roads and fence line corridors. The documentation and immediate control of highly invasive species and adherence to weed control protocols will minimize the risk of new species becoming established within the preserve.

Objective: Prevent introduction and spread of habitat modifying weeds

Strategies:

- Apply herbicide to road and fence line corridors - ONGOING
- Locate/control high priority weed infestations - ONGOING
- Prevent new habitat-modifying weeds from establishing/spreading - ONGOING
- Monitor roads, fence line corridors, and trails for new weed infestations – ONGOING
- Control Strawberry guava and Japanese anemone - ONGOING

Management Practice. Strawberry guava has invaded the preserve along the boundary between Pāpā and Ho'omau Ranch. Weed control activities will focus primarily on removing incipient stands of this shrub together with patches of Japanese anemone. At least 50 acres of strawberry guava will be cleared from the Pāpā unit each year. Weed control will be accomplished with assistance of an outside contractor. Japanese anemone will be removed by TNC staff as time permits.

Due to the patchy distribution of strawberry guava, biocontrol organisms may offer some benefit in suppressing the spread this weed. The Brazilian scale insect (*Tectoccus ovatus*) produces leaf galls on strawberry guava and reduces the plant's vigor and fruiting ability but does not kill the plant. Attempts should be made to introduce this organism into the project area to test its effectiveness in controlling strawberry guava. However, biocontrol agents should supplement rather than replace chemical or mechanical control methods.

TNC employs a variety of techniques for weed control, emphasizing non-chemical methods such as pulling by hand whenever feasible. Although labor intensive, hand pulling is quite effective, especially when roots are removed. In some cases where non-chemical weed control techniques are impractical, chemical control methods are implemented under the supervision of a certified pesticide applicator. Recommended chemical application methods include:

- Foliar spraying: Apply Roundup (41.0% glyphosate) or grass-specific Fusilade (24.5% fluazifor-P-butyl) on the leaves of herbaceous weeds or grasses.
- Cut stump treatment: Apply Garlon 4 (61.6% triclopyr) to the stump of a freshly cut tree.
- Incision point application (hack-n-squirt): Apply a metered amount of Garlon 4 and crop oil to cuts around the base of a tree.

Fire Management

Fire is a major risk when vehicles with hot catalytic converters drive over dry grass growing on roadways. All drivers who access Kona Hema Preserve are notified of this risk and required to sign a waiver that clearly articulates fire hazards and risks. No campfires are permitted in the preserve at any time. A fire plan has been developed with neighbors and with appropriate fire department officials. That plan provides a fire response protocol and identifies all fire response agencies and personnel along with their respective responsibilities. This protocol, including emergency phone numbers, is posted at the preserve office.

Objective: Minimize the risk of wildfire

Strategies:

- Develop/update regional fire plan with all cooperators - COMPLETED
- Develop/provide map of water sources and helicopter landing zones - COMPLETED
- Complete fire training for staff - COMPLETED
- Establish/implement fire prevention protocol for staff and visitors - COMPLETED
- Identify/purchase needed fire-suppression equipment - COMPLETED
- Plan/construct additional water catchment/storage capability and landing zones – COMPLETED

Management Practice. Preserve roads are routinely sprayed with herbicide or scraped with a tractor blade to minimize the risk of catalytic converter fires. During drought periods, vehicle use will be restricted to specific access routes. Water catchment systems

in all three management units have been upgraded so helicopter pilots can dip buckets into permanent or portable water tanks. Additional fire suppression tools have been acquired, along with a pickup truck, gas powered water pumper unit, and fire camera. All preserve staff have received fire suppression training. Most importantly, agreements are in place with county, state, and federal fire management agencies to facilitate a timely and coordinated response to wildfires on the preserve and adjacent lands.

Site Restoration

The elimination of ungulates from the preserve presents a unique opportunity to promote the recovery of rare plant and wildlife species. This objective will be accomplished primarily by protecting and restoring rare plant and wildlife habitat.

Rare Species Management.

There are 16 species of rare plants growing on lands within the Kona Hema Preserve (table 2). At least three species of rare birds along with endangered bats also inhabit the area (table 3). As degraded habitat is restored, the preserve will be particularly well suited for future reintroductions of rare species.

Objective: Protect and restore rare plant and animal species.

Strategies:

- Identify, and where necessary construct, exclosures for rare plants – COMPLETED
- Propagate or obtain seeds/seedlings of high priority rare plants – COMPLETED
- Monitor/document status and distribution of Hawaiian bats - COMPLETED
- Monitor/protect outplanted populations of loulu palms - ONGOING
- Cooperate with the PEPP in outplanting rare species - ONGOING
- Document observations of T&E bird species – ONGOING
- Monitor/document status of rare invertebrates – ONGOING

Management Practice. TNC staff and PEPP botanists have outplanted hundreds of rare plants in the preserve over the past decade in an effort to protect these species from extinction. Future outplanting projects will be restricted to those species that the PEPP determines to be of high priority for introduction into the preserve's protected management units. TNC staff will assist PEPP botanists in planting and monitoring the survival and growth of outplanted seedlings.

A single a'e tree has been identified in the Honomalino unit, but its reproductive status is not known. Trees in the genus *Zanthoxylum* are generally dioecious with male and female reproductive structures borne on separate plants. If other trees of the same species are not growing nearby, the Honomalino a'e may never produce seeds. However, the existing tree will be monitored for evidence of flowering and/or seeding. Any seeds produced will

be collected and germinated for outplanting. Propagated a'e seedlings should be outplanted in clusters near the parent tree. This will facilitate pollination and seed set when the seedlings mature. The a'e tree grows in soils classified as "Mawae very cobbly highly decomposed plant material." Any outplanted seedlings should be placed in this same soil type.

Endangered wildlife species currently inhabiting the preserve include Hawaiian hawks, Hawai'i creepers, and Hawaiian bats. Several other rare bird species were formerly present in the preserve, but have not been seen since the late 1970's. Kona Hema Preserve may be particularly well-suited for future re-introduction of species such as Hawai'i 'ākepa, 'akiapōlā'au, and 'alalā.

Habitat Restoration

Much of the wildlife habitat within the Kona Hema Preserve has been degraded by grazing animals, unsustainable logging, and by invasive species. For the past 17 years, efforts have been ongoing to restore wildlife habitat and promote recovery of key forest trees and understory plants. In areas of the preserve where sustainable forestry practices are an intended outcome of the management program, prescriptions will, to a degree, represent a "compromise" between habitat improvement and forestry objectives, and whenever possibly will ideally complement each other. In no area of the preserve will the forest be managed for economic purposes to the detriment of existing wildlife habitat. Management actions in the three biodiversity sub-zones will focus solely on promoting native plant and wildlife values.

Objective: Restore habitat impacted by prior land use

Strategies:

- Identify target sites for experimental planting of native species – COMPLETED
- Obtain seeds and propagate plants including site-adapted koa, key understory species, and 'alala food plants – COMPLETED
- Scarify soil in degraded areas to promote regeneration of native seed bank – COMPLETED
- Outplant seedlings in priority restoration sites – COMPLETED
- Survey plants in the Pāpā and Kapu'a units and update the species list – COMPLETED

Management Practice. In general, TNC employs outplanting techniques that are suitable for forest restoration projects. Techniques vary according to the site characteristics and target species, but some general guidelines are provided. Planting should take place during the wet season when high rainfall is expected. Potted seedlings should be planted

while they are relatively small. They can be transported in 4WD vehicles and unloaded at the planting site. Prior to planting, each site should be treated with herbicide to kill competing grasses and to prepare the ground for digging. Planting holes, about 1/3 larger than the pots, should be dug immediately before planting. Shovels, picks, or other hand tools may be used for digging the holes. A commercial fertilizer should be placed in the bottom of each hole to provide initial nutrients. Plants should then be set in place and the hole covered. Planted seedlings may need to be hand watered for a few months after planting until they become established. The effectiveness of this approach should be monitored and adaptations made when necessary.

Weed control for outplanted species should focus on eliminating competition from invasive grasses. Any grasses growing around plants should be pulled by hand at least two times during the first year. No grass control is needed after seedlings are two years old. All herbicide application, if required, should be made under the supervision of a certified pesticide applicator, if required.

Forest Management

Forest management projects at Kona Hema are part of a larger habitat management initiative. Related projects include boundary fence maintenance, ungulate removal, control of invasive weeds, and wildfire prevention. Reforestation and forest improvement practices have concentrated on those cover types that were altered by wildfire or degraded by past livestock grazing and timber harvesting activities. Forest restoration activities were accomplished by thinning koa in overstocked stands, removing invasive grasses, planting native species, and scarifying soils to stimulate koa seed germination. Reforestation and forest improvement practices were generally restricted to the Pāpā and Honomalino management units. Conservancy staff, volunteers, and contractors were employed to conduct the field work. No reforestation activities took place in undisturbed 'ōhi'a forests, high elevation scrub lands, mixed species *kīpuka*, or sparsely vegetated lava flows.

A number of forest research projects are underway or have been completed at the preserve. These include soil scarification/koa regeneration demonstrations (TNC), resource availability and seedling establishment experiments (USDA Forest Service), koa silviculture studies (USDA Forest Service), and a study to assess the biodiversity and economic viability of various forest types and land uses in Kona (Stanford University).

Forest and Agroforest Improvement (Koa Thinning)

Over 895 acres of forest in the preserve are currently stocked with dense stands of naturally regenerating koa trees. These trees began growing in the mid-1970s, after harvesting operations effectively removed all merchantable koa. Cattle were excluded after logging, allowing cohorts of koa seedlings to become established in the disturbed

soil. By 1999, over seventy-five percent of the resulting trees were ≥ 4 inches DBH and occurred in densities up to 300 trees per acre. Koa thinning trials conducted in the preserve by U.S. Forest Service scientists demonstrated that the growth rate for individual trees will accelerate significantly if competing trees are removed. The prescription for these “dog hair” koa stands included thinning at an operational scale (40 acre plots), both with and without actual removal of downed timber. This practice enabled managers to explore the practical considerations of manipulating overstocked koa stands to develop merchantable timber while promoting recovery of forest biodiversity. TNC anticipates that results obtained from these projects will be directly applicable to the ongoing management of Kona Hema and other privately-owned lands throughout the Kona flank of Mauna Loa.

Objective: Thin overstocked koa stands to increase tree growth rates – COMPLETED

Management Practice. Landscape-scale tree thinning operations were conducted in overstocked, naturally regenerating koa stands beginning in 2001. Saplings and small trees were cut with chainsaws to achieve an optimal tree spacing of 167 trees per acre (400/hectare). Cut stumps were treated with herbicides to prevent re-sprouting in half of the plots, but not in the other half. Downed saplings (nurse logs) were left in place in some plots and removed from others to compare differences in recovery of native understory vegetation. All standing trees were measured and marked in order to establish baseline growth data. Costs of thinning operations were closely monitored to determine the cost-effectiveness of this practice. The potential for defraying some or all of the thinning costs was also explored by making the downed trees available for commercial use.

A detailed prescription for thinning of young koa is included in the FSP Cost-share Assistance section of the plan, representing a new management activity adapted from lessons learned in the U.S.F.S. research plots.

Reforestation and Afforestation (Grass Removal, Soil Scarification & Planting)

More than 1,642 acres of moderately to heavily grazed forest exists within the preserve. These areas were previously grazed by domestic livestock and logged for koa. They contain a thick mat of invasive grasses, primarily meadow rice grass and kikuyu grass. Non-native grasses compete with koa seedlings and inhibit natural regeneration of native understory plants.

Management practices described here were designed to replace lost environmental components and increase botanical diversity in areas that still supported an overstory of endemic trees. This goal was accomplished by removing invasive grasses, scarifying soils, and outplanting nursery grown seedlings. These techniques have proven successful

for augmenting or re-establishing native species in degraded forest. Soil was not scarified in areas that were moderately grazed in the past because of the risk of damaging existing native trees.

Objective: Determine effects of grass removal on koa seed germination rates – COMPLETED

Management Practice. Seed germination trials indicated that viable koa seeds were still present in wooded pasture soils and were available in sufficient quantities to promote koa forest recovery without supplemental planting. Twenty-acre plots were sprayed with herbicide to remove all grass cover and stimulate koa seed germination. This treatment also reduced competition between grasses and emerging koa seedlings. No additional treatments were made in this forest type. Results indicated that koa seedlings will germinate in large numbers and survive if grass cover is removed and seeds are exposed to sunlight.

Objective: Determine effects of soil scarification on koa seed germination rates – COMPLETED

Management Practice: Soil scarification trials in both large and small study plots indicated that this treatment effectively stimulates koa seedling germination from the soil seed bank, even in areas previously covered with invasive grasses or altered by wildfires. Starting in 2003, mats of invasive grasses in the Honomalino unit were scarified (330 acres) with the tracks and blade of a D6 bulldozer in order to break up matted grasses. Alternating lanes of scarified and undisturbed soil were created with the machine. Lane spacing was approximately 14 feet wide (dozer blade width). This spacing was expected reduce competition between rows of germinating koa seedlings and reduce the amount of seedling thinning required in subsequent years (fig. 10). Response to scarification treatments varied depending on substrate, soil moisture, and elevation, but overall germination and survival rates were extremely high. Photos 3-9 document changes in tree cover before and after scarification operations in the Honomalino unit.

Objective: Increase plant diversity in the forest understory by outplanting native species – COMPLETED

Management Practice: A variety of native plants were propagated for outplanting in soils prepared by herbicide spraying or scarification. This treatment was intended to increase plant diversity in the forest understory. Species planted included māmakī (*Pipturus albidus*), pilo, ‘ōlapa, ‘ōhā, ho‘awa (*Pittosporum sp.*), and ‘ie‘ie. Seeds for outplanted seedlings were all collected from within the preserve. TNC has found that the most cost-

effective method for acquiring seedlings is to have them grown in bags or pots by government horticulture program or commercial plant nurseries. Survival of outplanted seedlings in the upper portion of the Honomalino unit was not as great as expected, with some plants failing to survive the dry weather conditions that followed outplanting. Plant survival was much better at lower elevations where wetter conditions allowed the plants to become established.

Undisturbed 'ōhi'a Forest

Undisturbed 'ōhi'a forest covers approximately 3,034 acres in the preserve. Most rare plant species were outplanted in this cover type. Management practices included vegetation assessment (pre-and post-ungulate removal) and periodic monitoring on established transects. In addition, the distribution of rare plant species was documented and monitored over time. No experimental or commercial harvesting of 'ōhi'a or other tree species was attempted in this forest type.

'Ōhi'a/Koa Kipuka, Scrub 'ōhi'a, and Lava Flows

No manipulative management practices were conducted in *kīpuka*, but these islands of vegetation were surveyed to document plant species composition and recovery after ungulate removal. Vegetation in the scrub 'ōhi'a areas or on recent lava flows were not manipulated, although native plants have benefited from fencing and ungulate removal.

Monitoring

Pre-and Post-Treatment Monitoring

There was sufficient acreage of altered habitats within the Kona Hema Preserve to enable establishment of several replicate research plots and larger demonstration plots across an elevational gradient. Monitoring these plots and documenting habitat changes over time provided critically important data for future management actions. Specific information was obtained on growth response of koa after thinning overstocked stands, removal or retention value of downed timber, and effective methods of weed control. Efforts were also made to detect changes in forest biodiversity and identify the relative ecological costs and benefits associated with the various treatments.

Permanent sampling and monitoring sub-plots were also established within treatment plots. The boundaries of each plot were marked on the ground and mapped using digital/GIS technology. Photo points were established and photos were taken annually to record changes in vegetative cover over time. Koa seedling germination, growth, and survival rates were measured and recorded in soil scarification plots as was the extent of invasive grass cover. Survival and growth of outplanted species were monitored in forest restoration plots. Tree growth data was recorded and compared in thinned and non-thinned plots in order to track growth rates and determine the optimal timing of thinning.

Photo plots were also established along existing ungulate activity transects to record long-term changes in forest cover as a result of the ungulate removal program.

Biological Monitoring

Monitoring and documentation of habitat changes over time provides critically important management data. For example, transects to sample ungulate activity were established within the Kapu'a unit before the perimeter fence was completed and pig trapping was initiated. Documentation of changes in the level and distribution of pig damage within the unit allowed preserve staff to gauge the ability of disturbed habitat to recover in the absence of ungulate activity.

Objective: Document the efficacy of management actions

Strategies:

- Establish/monitor ungulate transects - ONGOING
- Establish/monitor vegetation transects to assess recovery - ONGOING
- Monitor efficacy of invasive weed control activities - ONGOING
- Establish/monitor photo plots – ONGOING
- Acquire satellite and aerial imagery to document the progress of canopy recovery over time - ONGOING

Management Practice. No additional management practices are planned for this objective.

Research

Kona Hema Preserve provides an exceptional opportunity for scientific research. Among the preserve's important attributes are its relatively large land area, substantial amount of native habitat, land use diversity, availability of overnight facilities, and security of land tenure for long term studies. Agriculture zoning allows some forms of habitat manipulation more easily than on conservation zoned lands. Most importantly, Kona Hema Preserve provides a virtually ungulate-free environment for researchers. The lack of ungulate activity eliminates a critical impediment to successful forest restoration efforts and removes animal influence on research results.

Objective: Address high priority research needs

Strategies:

- Develop a list of Kona Hema research needs - COMPLETED
- Solicit academic interest in high priority research needs - ONGOING
- Provide opportunities and logistical support for compatible research – ONGOING

Management Practice. No additional management practices are planned for this objective

Forestry Research

As above, U.S. Forest Service researchers have embarked on research projects at Kona Hema Preserve that will provide land managers with needed tools to promote forest recovery. For example, researchers have been conducting thinning trials within very dense, single-age stands of koa that originated from soil disturbance attributable to logging operations. Preliminary data indicates that aggressive thinning will cause the growth rates of remaining trees to accelerate as competition for sunlight, soil nutrients and water is reduced. Researchers have also been evaluating the effects of invasive grasses on koa regeneration and the response of native understory species, both within thinning plots. Replicate study plots have also been established at three elevations in the Honomalino unit to investigate comparative rates of koa regeneration. Plots have been scarified and planted with seedlings, or left undisturbed as controls. Additional studies are planned to investigate patterns of reforestation and the effects of sustainable forestry practices on forest biodiversity.

Objective: Develop capability for sustainable koa forestry

Strategies:

- Conduct planting and scarification trials to document optimum conditions for restoration of koa and understory species on degraded sites - COMPLETED
- Investigate biodiversity values of reforestation sites - COMPLETED
- Conduct koa thinning trials to document spacing for optimum growth - ONGOING
- Evaluate effects of invasive grasses on koa and understory regeneration and growth - ONGOING
- Document response of native understory species to different thinning scenarios - ONGOING
- The Nature Conservancy is investigating the potential costs and benefits, both financial and ecological, for limited, sustainable koa harvesting, but has not yet decided to pursue this direction. If the Conservancy decides to execute a forestry project, the FSP will be updated, in consultation with the State Forester, with a detailed prescription for this activity – ONGOING

Management Practice. No additional management practices are planned for this objective

Information Synthesis

U.S. Forest Service researchers, working on a project co-funded by TNC, have gathered and summarized state-wide data relating to the silviculture of koa. These data also document the relevant variables affecting koa growth response at other sites.

Objective: Document existing knowledge on koa silviculture

Strategies:

- Identify/gather relevant information on prior koa silviculture - COMPLETED
- Visit sites on private/public lands with known-age koa stands - COMPLETED
- Document relevant variables affecting koa growth response at other sites – COMPLETED

Management Practice. No additional management practices are planned for this objective

Demonstration Forestry

Tightly controlled field experiments provide critically important management data, but there is also a need for larger scale habitat manipulation projects which demonstrate the efficacy of forestry practices in a conspicuous way. Habitat manipulation strategies must be practical and cost effective in their application to be relevant to other private lands on the Kona flank of Mauna Loa.

Objective: Demonstrate efficacy of koa forestry practices

Strategies:

- Conduct large scale (>100 acres) scarification trials on degraded sites - COMPLETED
- Continue monitoring the scarification plot and documenting forest recovery - ONGOING.
- Arrange “show me” tours for forest industry representatives and Kona ranchers – ONGOING

Management Practice. Forestry demonstration

A 60-acre plot of degraded forest in the Honomalino unit was scarified with a bulldozer to encourage koa seed germination. All labor, equipment rental, and supply costs associated with the preparation and maintenance of the plot were documented. “Show-me” tours are currently being conducted so private landowners and agency personnel can see the results of this management practice.

In 1994, a wildfire burned 633 acres of forest in the upper Pāpā unit. The fire stimulated germination of koa seeds in the soil and produced a green carpet of young trees. However, the seedlings were repeatedly browsed to the ground by wild sheep and feral goats (M. Johansen, pers. comm., 4/18/2017). The area was devoid of koa seedlings when TNC purchased the Pāpā parcel nine years later (2003). The parcel was fenced in 2004 and all ungulates were removed the same year. Soon after animals were removed, a koa germination test plot (half-acre) was established in the burn area. Soils in the plot were scarified with the tracks and blade of a D6 bulldozer. Within a year, numerous koa seedlings germinated, indicating that viable seeds were still present in the open ground. Between 2005 and 2007, another 328 acres in the burn area were scarified with the bulldozer to stimulate koa seed germination. Alternating lanes of scarified and undisturbed soil were created, as had been done in the Honomalino management unit (fig. 10). That treatment produced dense stands of koa seedlings which exhibited exceptionally high survival rates. Young koa trees in the burn area are now 10 to 20 feet tall and form interlocking crowns. Other native plants including naio and māmane also responded favorably to the scarification treatments. Young koa trees in the burn area flowered for the first time in 2017. Photos 10-14 show changes in tree cover before and after scarification treatments.

Off-Site Forestry Development

Lessons learned at Kona Hema Preserve can be applied to other state and privately-owned forest lands on the Kona flank of Mauna Loa. Some landowners are already experimenting with silvicultural strategies developed at the preserve. TNC has helped to promote sustainable forestry initiatives on other Kona forest lands by providing business planning assistance, assisting with habitat recovery (e.g. ungulate control), facilitating the development of Forest Legacy Programs and other easements, and by helping to reform county tax codes. TNC continues to promote sustainable forestry on private lands by supporting legislative and regulatory initiatives that provide incentives and/or eliminate disincentives that inhibit protection of privately-owned forest.

Objective: Facilitate off-site growth of sustainable forestry

Strategies:

- Acquire additional Forest Legacy easements on Kona private lands - COMPLETED
- Assess interest of private landowners to work with TNC on forest conservation - COMPLETED
- Expand silviculture research on selected private lands - COMPLETED
- Provide technical forestry assistance to private landowners - COMPLETED
- Offer assistance relating to ungulate/vegetation control, fencing, habitat management, rare species protection, reforestation and related topics - ONGOING

- Develop individual koa reforestation partnerships with private landowners - COMPLETED
- Assist with development of business plans - COMPLETED
- Enlist involvement of private forest industry experts in reforestation projects - COMPLETED
- Generate funds to facilitate private landowner adoption of compatible forestry practices - COMPLETED
- Explore/develop grant proposals to assist landowners with upfront forestry development costs - COMPLETED
- Identify/pursue policy initiatives that support forest conservation (e.g. water use tax, invasive species regulations, etc.) - COMPLETED
- Identify/implement outreach initiatives that promote public/political awareness of watershed conservation needs - COMPLETED.

Management Practice. No additional management practices are planned for this objective

Public Use

Recreation

Objective: Provide opportunities for compatible public use

Strategies:

- Develop a public use plan for the preserve – COMPLETED
- Construct an additional loop trail on the northern side of the preserve - COMPLETED
- Obtain equipment to support field tours (e.g. binoculars, rain gear, etc.) – COMPLETED
- Maintain existing loop trail below headquarters – ONGOING

Management Practice. Both loop trails in the Honomalino unit will be routinely maintained to accommodate visitor use. Weeds, downed trees, and limbs will be cleared from the trails when needed. Visitor safety barriers will also be maintained.

Environmental Education

The same attributes which make the Kona Hema Preserve suitable for research and monitoring also make it appropriate for structured environmental education. Preserve staff have developed an educational loop trail that provides access to native koa/‘ōhi‘a forest, including one very large koa tree estimated to be more than 400 years old. This and other trails and roads provide opportunities for students and teachers to learn about native forest communities, conservation, management strategies, and sustainable forestry.

Objective: Develop a site-oriented environmental education program

Strategies:

- Contact local schools to plan field trip opportunities - COMPLETED
- Prepare appropriate exhibits, lesson plans, and informational pamphlets – COMPLETED

Management Practice. No additional management practices are planned for this objective

Historic/Cultural Resource Management

It is apparent that ongoing land management actions can have effects on Hawaiian cultural sites and traditional practices at Kona Hema Preserve. The Conservancy is concerned about the protection of cultural sites and practices within its preserves and strives to conduct all land management activities in a sensitive manner, doing no lasting harm to cultural resources. Where possible, TNC will augment cultural resources and encourage responsible traditional and sustainable access to native plants, animals, and ecosystems.

Land management activities to protect native species and ecosystems can also serve as a first step in the protection of archaeological sites. Ungulates, particularly feral pigs, cattle and goats, are known to disturb archaeological sites because they knock over stone walls, turn over soil, spread noxious weeds, and initiate accelerated erosion and landslides. As native ecosystems degrade in culturally important regions, the original native context of a site may be lost, and elements of the natural world that traditionally characterized a built site or a *wahi pana* (renowned place) may be damaged. TNC's long-term goal is to prevent the loss of historic and cultural resources.

Objective: Identify, protect, and interpret important cultural resources

Strategies:

- Incorporate cultural information into educational programs/products – COMPLETED
- Identify/map culturally significant sites including shelter caves and trails - ONGOING
- Document historic use of Kona Hema lands – ONGOING

Management Practice. No additional management practices are planned for this objective

Public Outreach and Fundraising

Research and management programs at the Kona Hema Preserve are heavily dependent on financial support provided by private donors, foundations, and government grants. This underscores the importance of conspicuous public outreach through the media and other outlets, as well as hosted visits to the preserve for existing and prospective donors, foundation representatives, and agency managers.

Objective: Generate public awareness and support

Strategies:

- Develop narrative/graphics/handouts for “show me” tours - ONGOING
- Identify/host prospective donors and other cooperators on site visits - ONGOING
- Develop documentation to support funding proposals - ONGOING
- Develop/submit grant proposals to address operational funding needs - ONGOING
- Develop/deliver Powerpoint programs for priority audiences – ONGOING

Management Practice. No additional management practices are planned for this objective

Volunteer Program

Volunteers, school groups, Boy Scout troops, and other cooperators have greatly assisted with management projects at the preserve. Projects which have benefited from volunteer participation include ungulate removal, outplanting of koa seedlings and rare plants, invasive weed control, trail development and maintenance, biological monitoring, equipment repair, facility maintenance, and related projects. Preserve staff intend to expand the diversity and frequency of volunteer activities.

Objective: Utilize volunteers to support programs at Kona Hema Preserve

Strategies:

- Identify management actions that can be undertaken by volunteers - ONGOING
- Solicit prospective volunteer organizations (e.g. Boy Scouts) for assistance - ONGOING
- Follow up with individual volunteer contacts - ONGOING
- Develop/use volunteer agreements to address liability concerns - ONGOING

Carbon Sequestration and Storage

The sequestration and storage of carbon in regenerating forests at Kona Hema Preserve provides another example of ecosystem services provided for public benefit. TNC will work with the Climate Action Reserve (CAR) program to explore a TNC-based carbon

project on Hawai'i Island. TNC will also provide logistical support for an island carbon conference, forestry site tours, and will facilitate the USFS/Hawai'i County carbon neutral landscape initiative.

Management Practices Proposed for FSP Cost-share Assistance

The following management practices are proposed for Hawai'i Forest Stewardship Program cost-share assistance. These projects will be implemented over a 10 year period. All management practices except strawberry guava control will occur in the 4,021-acre Honomalino management unit. Strawberry guava control activities will be concentrated in the Pāpā management unit, where the remaining stand of untreated strawberry guava exists.

Fence (Maintenance practices) (FSP component A: Fence).

Regenerating native forest vegetation and endangered plants are vulnerable to damage by browsing ungulates if not protected by fencing. The Honomalino project area is enclosed by 10 miles of six foot high ungulate-proof fencing. This barrier was specifically designed to discourage mouflon sheep and feral goats from jumping over the wire. It is also modified to prevent feral pigs from digging underneath the wire. The fence effectively protects native trees and rare plants from damage by non-native ungulates.

The project area fence was constructed seventeen years ago (2000) and has been continually maintained since then. All galvanized fence posts are still in good condition. However, volcanic smog (vog), consisting of sulfur dioxide gas and other pollutants emitted from Kīlauea Volcano, has corroded the woven fencing wire. As a result, this wire is estimated to have a remaining lifespan of less than five years, at which time it will need to be replaced. Old wire will be removed from the existing fence posts and new wire will be installed. Fence renovations will begin in year six of the project period. Approximately two miles of woven wire will be replaced each year for five years.

Due to the ongoing Kīlauea eruption, TNC has tested improved fence materials such as polyvinyl deer mesh and Bezinal coated hogwire, which have shown some promise in delaying the corrosive effects of vog by two or more years at the Ka'ū Preserve. It is intended that the fence replacement called for in this plan will incorporate one or more of the improved fence materials currently being tested by TNC. In addition, at the request of the Forest Stewardship Committee, a cost comparison for corrosion-resistant galvanized steel hog panels as opposed to woven wire fencing products has been completed.

The Honomalino perimeter fence measures approximately 55,550 feet. The current price (a quote from Lextron Animal Health in Waimea) for one 16-foot hog panel is \$62. The total cost for panels for fence replacement would be \$215,256. In comparison, the price per 330-foot roll of galvanized, Beznal-coated hog wire is \$332. The cost of 169 rolls needed for fence replacement is \$55,887.

A cost analysis between rebuilding the fence with hog panels versus hog wire must also include the labor involved with delivering the materials along the line and installation. Relatively flat terrain would require little modification to the bottom of a hog panel so that gaps be sufficiently narrow to prevent pigs from passing under. However, in the uneven rocky terrain at Kona Hema, the bottom of the panel would need to be modified (cut) to allow the panel to conform to the changing height of the fence path. This modification to the underside of a high percentage of the panels installed would add a significant increase to the labor cost of fence using panels.

This cost analysis takes into consideration that using hog panels would extend the life of the fence significantly. However, the life span of the panels itself are not the only factor that should be used when estimating fence life using panels versus hog wire. T-posts, line posts and anchors and even fence clips all wear and rust away over time. Due to recent innovations in hog wire manufacturing, the lower cost, ease of delivery, installation, and repair, it is our determination that these factors and our understanding of the conditions found at Kona Hema, using hog panels is not cost effective for this project.

Tree and Shrub Establishment (New practice)

(FSP component A: Tree and Shrub Site Preparation)

(FSP component A: Tree/Shrub Establishment)

(FSP component A: Nutrient management)

(FSP component B: Herbaceous weed control)

Practices for enhancing wildlife habitat and limiting the establishment of invasive weeds have been ongoing in the project area since 2003. Over 1,000 endangered plants, comprising five species, and 3,252 native understory plants have been out planted in the preserve. Additionally, soil scarification and herbicide treatments have produced thousands of regenerating koa, 'ōhi'a, and mamane seedlings on former pasture lands and wildfire sites.

TNC intends to continue establishing new populations of endangered plants as an aid in conserving rare species. This is a cooperative effort with the Hawai'i PEPP. That program will determine the species to be propagated, collect seeds, and assist TNC with all aspects of the project. TNC staff and volunteers will germinate the seeds in pots,

prepare the planting sites, plant the seedlings, apply fertilizer, water the seedlings, control weeds, and monitor seedling survival. Species to be planted include loulu palms (*Pritchardia schattaueri*), mēhamehame (*Flueggea neowawraea*), hāhā (*Cyanea marksii*), hāhā (*C. stictophylla*) and others as determined by the PEPP. Seedlings will be planted in clusters of 10 or 15 plants, with individuals spaced 15 feet apart except for mēhamehame which will be planted 30 feet apart. All seedlings will be placed in the biodiversity sub-units at the lower boundary of the project area (fig. 7). Approximately 200 endangered plants will be planted annually, depending entirely on seed availability and germination success. Planting will begin on year one of the project period and continue for 10 years.

Grass and competing vegetation around each newly planted seedling will be cleared by hand at the time of planting (to three feet in diameter). Hand weeding will continue for two years. Seedlings will be fertilized and watered to assure the survival of most individuals. Seedlings will be hand watered once each week for at least one month after planting or until rains wet the soil. Watering will be resumed if drought conditions occur. No mulching fabric will be applied to retard growth of weeds and no herbicide will be used for weed control. This planting technique will increase survival and growth rates of rare plants and help them become established. Outplanted seedlings will be monitored at least once a month for any signs of browsing by ungulates, damage by insect pests, or presence of disease. Appropriate actions will be taken to mitigate any detrimental situations.

Weed Control (Maintenance practice)

(FSP component A: Brush Management)

(FSP component B: Herbaceous Weed Control)

Weed control blocks will be established in the Honomalino and Pāpā management units below 4,000 feet elevation (fig 12). This area contains some of the best native forest in the preserve. Weed control in the Honomalino block (approximately 500 acres) will target high priority invasive species such as strawberry guava, Japanese anemone, and banana poka (*Passiflora mollissima*). Additional species may be added to this list if necessary. At least 50 acres of forest will be treated annually with an appropriate herbicide to kill invasive weeds. This project will begin in year one of the project period and continue for 10 years.

An incipient stand of invasive strawberry guava exists in the lower portion of the Pāpā management unit. This infestation originally covered approximately 690 acres of native forest. Guava shrubs on 450 acres have been successfully treated with herbicide over the past five years. Another 240 acres of infested forest needs to be treated to kill the

remaining shrubs and prevent their spread. Blocks of forest (48 acres in size) will be treated annually with herbicide to kill strawberry guava shrubs. Garlon 4 mixed in crop oil will be applied as a basal application. Shrubs treated with herbicide will be left to die in place. This project will begin in year one of the project period and continue for five years.

Fuel Break (Maintenance practice)

(FSP component A: Fuel break)

Recovering plant and wildlife habitat is vulnerable to destructive wildfires. A wildfire burned 633 acres of forest in the Pāpā management unit in 1994. Fire pre-suppression practices are intended to reduce the possibility of future forest fires in the preserve.

More than 22 miles of roads in the project area serve as fuel breaks that can retard the spread of wildfires. All roads in the Honomalino unit will be cleared of all vegetation using mechanical and chemical methods to maintain an effective firebreak. A corridor 12 feet wide will be sprayed with Roundup herbicide twice each year. These treatments require about 15 man-days of labor every six months. Fuel break maintenance will continue for 10 years.

Forest Stand Improvement (New practice)

(FSP component A: Forest Stand Improvement)

Previous owners of the Pāpā and Honomalino parcels used the mesic forest zone for grazing cattle and harvesting timber. In 2003, TNC began scarifying soils in these degraded forest areas to stimulate koa seed germination. More than 330 acres of land in the Honomalino unit were scarified with a bulldozer between 2003 and 2009. Stands of overstocked koa saplings now exist in these treated areas. Tree thinning practices will be employed to selectively remove a portion of the young trees growing in a 58-acre thinning plot. This treatment will target stems that may compete with designated crop trees. Tree thinning or stem exclusion practices can release selected crop trees from competition and increase their diameter increment by 50 to 100 percent, greatly shortening the time to harvest (Friday, 2010). Recent studies in koa stands at Umikoa and Keauhou indicate that response to thinning depends on crop tree crown condition. Crop trees with less than 25% live crown took more time to respond to thinning. On the other hand, trees with more than 50% live crown probably didn't need to be released (J.B. Friday, pers. comm., 4/29/2017).

Depending on availability of manpower and equipment, various methods are available for thinning overstocked tree stands. Small diameter stems can be severed with a chain saw

and the stump treated with herbicide to prevent re-sprouting. Larger stems may be killed by double-ring chain saw girdling or by incision point application of herbicide (hack-n-squirt). Herbicides tend to be more effective for thinning than mechanical methods. However, some herbicide may translocate from treated trees to non-target trees through root grafts. Triclopyr has been successfully used in thinning stands of koa without showing any signs of translocation to crop trees (Friday, 2010).

Koa saplings in the 58-acre stand improvement plot (fig. 12) will be thinned to increase growth rates of crop trees. Saplings are currently growing in narrow rows along previously bulldozed lanes. Potential crop trees will be selected within the rows and released from competition by thinning competing stems. Phosphorus fertilizer may also be applied to crop trees. Thinning will begin in year one of the project period and continue for five years. Approximately 12 acres will be thinned each year. Thinning practices in this area will be based on recommendations provided by Dr. J. B. Friday, Extension Forester with the University of Hawai'i at Manoa. Guidelines for forest stand improvement in the thinning plot are as follows:

- Crop trees will be selected based on their size, health, vigor, and form. Each individual will be marked with paint.
- Crop trees free of injuries or disease will be selected.
- Selected crop trees will have a single straight stem with no forks
- Health of live crown will be considered when selecting crop trees. Crop trees whose crowns are already severely diminished by competition or drought will not be selected.
- All competing trees out to a radius of 15 feet will be culled. That distance will space crop trees at a minimum of 30 feet apart and create a density of 48 trees per acre. It may be necessary to increase the distance beyond 30 feet if a crop tree is not present.
- Potential competitors (dominant and co-dominant competitor trees) will be the only ones thinned (i.e. those that are really competing with the selected crop tree). Saplings that are already overtopped by the crop tree will not be thinned and will self-thin over time.
- Dominant and co-dominant competitor trees will be killed with Garlon 4 herbicide using the incision point application method. Culled trees will be left

standing. Eventually, they will die and fall over and these stems will be left on the ground to aid in nutrient recycling.

Forest Health and Protection (Maintenance practice)
(FSP component B: Animal Control)

TNC maintains a “zero tolerance” policy towards non-native ungulates in their preserves. Feral pigs, feral goats, and mouflon sheep occasionally gain access to the project area through damaged fencing or by breaking through the wire barrier. These animals must be immediately removed before they can multiply and re-established populations or damage native vegetation.

At least one feral pig or mouflon sheep can be expected to gain access to the project area each year. Responding to these ungulate incursions is a high priority for Kona Hema field staff. Staff will regularly monitor the preserve for signs of soil disturbance (pig rooting) or koa saplings damage (browsing by sheep). Monitoring will also include moving game cameras along animal trails where ingress is suspected. Any detected animals will be immediately removed by trapping, snaring, shooting, or tracking and killing by hunters. The removal of a single animal often takes 20 man-days of effort. Staff must track and locate the animal, bait traps, deploy snares, and remove the carcass. Meat is donated to local families in the south Kona community whenever possible.

The cost of ungulate control in natural areas increases as the population is reduced down towards zero, with disproportionate amounts of time and effort required to catch the last one. Systematic dog-assisted hunting sweeps, trapping, snaring, and tracking using radio-collared “Judas” animals have proven to be highly effective at finding and dispatching the remaining animals in a fence unit. However, it can take many unsuccessful attempts utilizing all of these tools to ultimately achieve success. Due to the uncertainty in cost and time necessary to complete the work, contractors who have worked with TNC in the past have shown reluctance to committing to a deliverable of “zero tolerance,” or reducing the population down to undetectable levels.

The preferred approach to maintaining “zero tolerance” at Kona Hema and Ka‘ū Preserves is to maintain effective fences that are checked often and repaired immediately when breaches occur. As the forest floor recovers from many decades of ungulate damage, the understory has become more difficult to traverse on foot, both for staff and hunting dogs. In 2008, TNC awarded a contract in the amount of \$50,000 for the removal of the remaining 5 boars in Ka‘ū Preserve’s 1,200 acre Kaiholena fence unit, with the deliverables defined as a set number of hunts using GPS-collared trained dogs and a map documenting all GPS track data to show full coverage of the fence unit. The contract

failed to remove any pigs from the unit, and all five boars were subsequently dispatched one by one through staff trapping, snaring and dog-assisted hunting efforts over the following year. No other ungulate control contracts have been awarded at the Kona Hema or Ka'ū Preserves since 2008.

This project will begin on year one and continue for 10 years.

Monitoring and Maintenance (Maintenance practice)
(FSP component A: Access Control)

Perimeter fence lines need to be routinely patrolled to check for damage or signs of animal entry. The perimeter fence will be checked two times per month for any gaps in the wire or damage created by flooding, soil erosion, or falling trees or limbs. Each monitoring trip will require two man-days of labor/month (24 man-days/year), with additional checks and repairs scheduled accordingly following strong wind events. Fallen trees along roadways and fences may be salvaged for woodworking use in alignment with TNC's demonstration of sustainable forestry objectives for this project. Broken wire caused by animals trying to force entry into the unit will be mended or replaced immediately upon detection.

Staff monitoring and maintenance of all Preserve roads and fences relies heavily on the use of four-wheel drive vehicles, resulting in greater than average wear and tear in the steep, rocky terrain of South Kona. The costs associated with fuel use, tire replacement, and vehicle servicing are higher than at other Preserves, much of it directly related to routine use checking and repairing access roads and fences.

Ungulate activity transects in the forest interior will be monitored once each year for signs of animal activity or evidence of animal ingress. Photo points will be established in the management unit by using drones and aerial imagery analysis will be employed to monitor changes in native vegetation over time. Changes in the distribution and abundance of invasive weed species will also be documented. This information serves as the basis for implementing needed management actions. No other data is collected. This project requires ten man-days of labor each year and will be conducted annually during the 10 year project period.

Wildfire Monitoring (Maintenance practice)
(FSP component B: Upland Wildlife Habitat Management)

TNC operates and maintains a firecam on the western slopes of Mauna Loa for early detection of smoke or flames caused by wildfires. This device scans the area between

Ka'ū Forest Reserve and Yee Hop Ranch. Real-time video images of the area are transmitted to a monitor in the preserve office or can be viewed on a cell phone screen. The firecam monitor is checked daily for evidence of wildfires. This remote forest fire monitoring station provides a significant public benefit with no expense to other land owners.

Firecam components are serviced six times per year by TNC personnel to ensure its continuous operation. There are no roads leading to the camera site so inspections are made by hiking the five miles round trip from the upper boundary of the preserve. Additionally, a helicopter is employed twice each year to haul replacement batteries and other heavy equipment to the camera site. Each helicopter trip requires one hour of flight time (\$1,000 per trip). This project will begin on year one of the project period and continue annually for 10 years.

Budget Summary

Year	Total Budget	Applicant Share	FSP Share	Other funding source	Comments/ Justification (optional)
Year 1	\$147,300	\$73,650	\$73,650		
Year 2	\$147,300	\$73,650	\$73,650		
Year 3	\$147,300	\$73,650	\$73,650		
Year 4	\$147,300	\$73,650	\$73,650		
Year 5	\$147,300	\$73,650	\$73,650		
Year 6	\$252,900	\$73,650	\$73,650	\$105,600	
Year 7	\$252,900	\$73,650	\$73,650	\$105,600	
Year 8	\$252,900	\$73,650	\$73,650	\$105,600	
Year 9	\$252,900	\$73,650	\$73,650	\$105,600	
Year 10	\$252,900	\$73,650	\$73,650	\$105,600	
TOTALS	\$2,001,000	\$736,500	\$736,500	\$528,000	

Full 10 year implementation schedule on page 98.

Methods and Materials

The revised Kona Hema Forest Stewardship Management Plan was prepared by Jon Giffin, Natural Resources Consultant. I visited the preserve on five occasions (February 16, February 28, March 29, April 18, and April 27, 2017) to acquire geographic coordinates of roads, structures, and rare plants. Photographs of land features were also obtained. I was accompanied on each field trip by Mel Johansen, TNC Kona Hema Field Coordinator.

This management plan was prepared using available literature, original data, government records, GIS databases (published and unpublished), and information provided by various individuals. Biologists from state and federal agencies and private conservation organizations were also consulted in an effort to document observations of rare plant or wildlife species present on the property.

Forest bird survey results and geographic coordinates of transect locations were obtained from the Hawai'i Forest Bird Interagency Database maintained by the U. S. Geological Survey, Pacific Islands Ecosystem Research Center.

All figures in this report were created with Geographic Information System (GIS) software (ArcMap 10.3.1.) licensed by Environmental Systems Research Institute (ESRI). Approximate acreages of various land features were generated using GIS in lieu of more intensive ground survey methods.

Global Positioning System (GPS) coordinates were obtained with a Garmin GPSMAP 62stc handheld navigation device. Track files for roads and trails were recorded from a moving vehicle or on foot. Waypoints of specific features were acquired on-site. These data were overlaid on GIS base layers to depict the exact location of features on the ground. Coordinates of rare plant species were recorded, but are not available without permission from TNC.

Satellite imagery (2011) was obtained from the USDA Farm Service Agency, National Agriculture Imagery Program (NAIP). It was accessed by connecting online to <http://gis.apfo.usda.gov/arcgis/services>, then adding data from the public ArcGIS Server into ArcMap 10.1.3. The imagery was acquired by NAIP in 2009 at a one-meter ground sample distance.

Digital orthophoto high resolution imagery of Hawai'i Island (2016) was obtained online from the USDA–NRCS Geospatial Data Gateway (GDW) at

<https://gdg.sc.egov.usda.gov/>. The imagery was acquired with 50 centimeter ground resolution by DigitalGlobe, Inc. and NRCS.

Photometry aerial images (4–12 inches resolution) of the Honomalino and Pāpā soil scarification areas were provided by Stephane Tom, TNC Conservation Info Manager, through access provided by Jim Jacobi, USGS Pacific Island Research Center.

A 1928 U.S. Geological Survey map (Ho‘opuloa quadrangle) was downloaded from the USGS historical map collection website at <http://geonames.usgs.gov/pls/toptmaps/>. Two historic features, no longer present at Kona Hema Preserve, are depicted on that map. They are labeled “Honomalino Trail” and “Honomalino Camp.” ArcMap software was used to create a georeferenced version of the old map so that both historic features could be matched to real-world coordinates. The map raster file was added to ArcMap, along with a modern topographic base map. Reference points on the two maps were then matched using the software’s georeferencing toolbar. After that, a new shapefile layer was created, overlaid on the georeferenced 1928 map, and digitized by plotting trail and camp locations. The digitized layer was then added to the modern topographic base map to show the exact position of both sites in relation to existing landmarks. Accuracy of the final product was verified by acquiring GPS coordinates at known control points on the ground and adding them to the base map. These points were compared with the digitized trail alignment to confirm that the trail and associated camp were mapped at the correct location.

Photographs taken by the author were captured on a Canon EOS 60D digital camera with a Canon EFS 18-200mm lens. GPS points were recorded for each photograph and images were georeferenced using the UTM coordinate system (NAD 83, Zone 5N). Elevation data for each photo was obtained using the barometric altimeter built into the Garmin GPS device.

Acknowledgments

This revised management plan includes portions of text taken directly from the 2005 Kona Hema Forest Management Plan and credit is given to TNC staff members who developed the original document. I wish to acknowledge assistance received from various individuals in completing this project. I am especially indebted to Mel Johansen and Shalan Crysdale (TNC) for assisting with field work and providing reports, maps, cost estimates, and other data used for developing the revised plan. Irene Sprecher and Malia Nabara (DOFAW) offered assistance that aided in the preparation of this document. Richard Camp (USGS) provided forest bird survey data collected by various government agencies and researchers. J. B. Friday (U.H., Manoa), Laura Nelson (NRCS), and Rick Warshauer offered information on the location and identification of rare plants. J. B.

Friday visited the koa thinning plot and provided recommendation for thinning overstocked trees. Rob Shallenberger donated aerial and landscape photos of the preserve. Stephanie Tom (TNC) located and processed aerial imagery for the plan and offered technical advice on GIS software techniques. Theresa Menard (TNC) provided aerial imagery and photographs of the Honomalino soil scarification area. Corinna Pinzari (USGS) contributed Hawaiian bat survey data collected at the preserve. Thanks to all of you for your help and support.

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Table 1. List of native plant species detected at Kona Hema Preserve since 2005.

TAXON	COMMON NAME	¹ORIGIN	²STATUS
DICOTS		E	
<i>Antidesma pulvinatum</i>	hame or mehame	E	
<i>Dubautia ciliolata</i>	na'ena'e	E	
<i>Embelia pacifica</i>	kilioe	E	
<i>Labordia tinifolia</i>	kamakahala	E	
<i>Nestegis sandwicensis</i>	olopua	E	
<i>Pittosporum hosmeri</i>	ho'awa	E	
<i>Phytolacca sandwicensis</i>	popolo, pokeberry	E	
<i>Santalum paniculatum</i>	'iliahi, sandalwood	E	
<i>Stenogyne macrantha</i>	NCN	E	SOC
<i>Tetramolopium humile</i>	NCN	E	
<i>Tetraplasandra hawaiiensis</i>	'ohe	E	
<i>Wikstroemia phillyreifolia</i>	'ākia	E	
<i>Xylosma hawaiiensis</i>	maua	E	
<i>Zanthoxylum hawaiiensis</i>	a'e	E	END
MONOCOTS		E	
<i>Dianella sandwicensis</i>	'uki 'uki	E	
<i>Eragrostis deflexa</i>	lovegrass	E	SOC
<i>Panicum tenuifolium</i>	mountain pili	E	

¹Origin: E = endemic

²Status: END = Endangered; SOC = rare "species of concern"

Table 2. List of rare plant species established at Kona Hema Preserve.

Scientific Name	Common Name	Status*	Origin
<i>Cyanea marksii</i>	hāhā	END	outplanted
<i>Cyanea stictophylla</i>	hāhā	END	outplanted
<i>Eragrostis deflexa</i>	lovegrass	SOC	wild
<i>Fragaria chiloensis sandwicensis</i>	‘ohelo papa	ROI	wild
<i>Melicope hawaiiensis</i>	alani	SOC	wild
<i>Nothocestrum longifolium</i>	‘aiea	ROI	wild
<i>Phyllostegia ambigua</i>	mint	ROI	outplanted
<i>Phyllostegia floribunda</i>	mint	END	wild
<i>Pritchardia schattaueri</i>	loulou	END	outplanted
<i>Rubus macraei</i>	‘ākala	SOC	wild
<i>Sicyos macrophyllus</i>	‘anunu	C	outplanted
<i>Sisyrinchium acre</i>	mau‘u lā‘ili	SOC	wild
<i>Stenogyne macrantha</i>	mint	SOC	wild
<i>Stenogyne rugosa</i> var. <i>mollis</i>	mint	ROI	wild
<i>Urera glabra</i>	opuhe	ROI	wild
<i>Zanthoxylum hawaiiensis</i>	a‘e,	END	wild

* Key to federal status: END = Endangered; C = Candidate for listing; SOC = rare “species of concern”

* Key to island status: ROI = Rare-on-island

Table 3. List of bird species inhabiting Kona Hema Preserve.

TAXON	COMMON NAME	¹ ORIGIN	² STATUS
<i>Alauda arvensis</i>	sky lark	X	SC
<i>Buteo solitarius</i>	'io	E	CO, END
<i>Asio flammeus sandwichensis</i>	short-eared owl, pueo	E	SC
<i>Cardinalis cardinalis</i>	northern cardinal	X	CO
<i>Carpodacus mexicanus</i>	house finch	X	SC
<i>Cettia diphone</i>	Japanese bush-warbler	X	SC
<i>Chasiempis sandwichensis</i>	Hawai'i 'elepaio	E	CO
<i>Hemignathus virens virens</i>	Hawai'i amakihi	E	AB
<i>Himatione sanguinea</i>	apāpāne	E	AB
<i>Leiothrix lutea</i>	red-billed leiothrix	X	SC
<i>Lonchura punctulata</i>	nutmeg manikin	X	SC
<i>Lophura leucomelanos</i>	kalij pheasant	X	CO
<i>Meleagris gallopavo</i>	wild turkey	X	CO
<i>Myadestes obscurus</i>	'ōma'o	E	SC
<i>Oreomystis mana</i>	Hawai'i creeper	E	SC, END
<i>Pluvialis fulva</i>	Pacific golden-plover	V	SC
<i>Pternistis erckelii</i>	erckel's francolin	X	CO
<i>Serinus mozambicus</i>	yellow-fronted canary	X	SC
<i>Sicalis flaveola</i>	saffron finch	X	SC
<i>Tyto alba</i>	common barn-owl	X	SC
<i>Vestiaria coccinea</i>	'i'iwi	E	T
<i>Zosterops japonicus</i>	Japanese white-eye	X	AB

¹Origin: E = endemic; V = visitor (common migrant); X = alien species

²Status: AB = abundant; CO = common; SC = scarce; T = Threatened; END = Endangered; PL = proposed for listing under the Endangered Species Act

Table 4. Timber inventory results at Kona Hema Preserve (1999). The cover type abbreviations refer to those used in the inventory.

Cover Type	General Description	Acres	Honomalino Acres	Kapu'a Acres	Total Acres
AK3	Koa and 'ōhi'a with heavy regeneration	0	429	0	429
AK4	Koa and 'ōhi'a with moderate. regeneration	466	0	0	466
MP2	Heavily grazed pasture with 'ōhi'a and koa	0	535	0	535
MP3	Mod. grazed pasture with 'ōhi'a and koa	96	1,012	0	1,108
MP4	Undisturbed 'ōhi'a forest	826	623	1,585	3,034
MP1	Scrub 'ōhi'a	0	58	0	58
MP5	'Ōhi'a and koa <i>kīpuka</i> five acres or less	5	23	0	28
XX0	Clearings and former burn sites	550	83	0	633
XX1	Lava flows	336	1,247	215	1,798
	Total	2,279	4,010	1,800	8,089

Figure 1. Location of Kona Hema Preserve on the Island of Hawai'i.

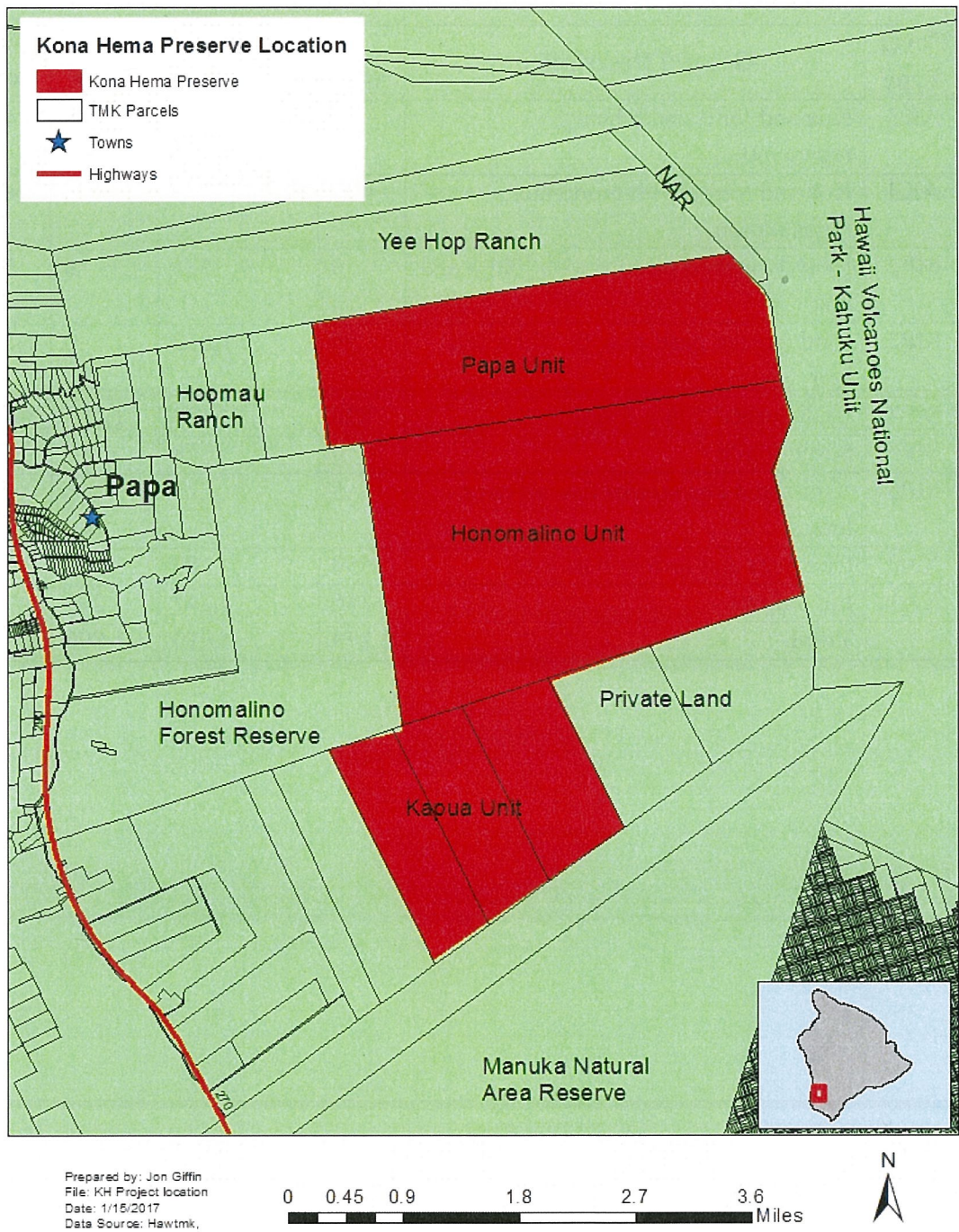


Figure 2. Location of access roads serving Kona Hema Preserve.

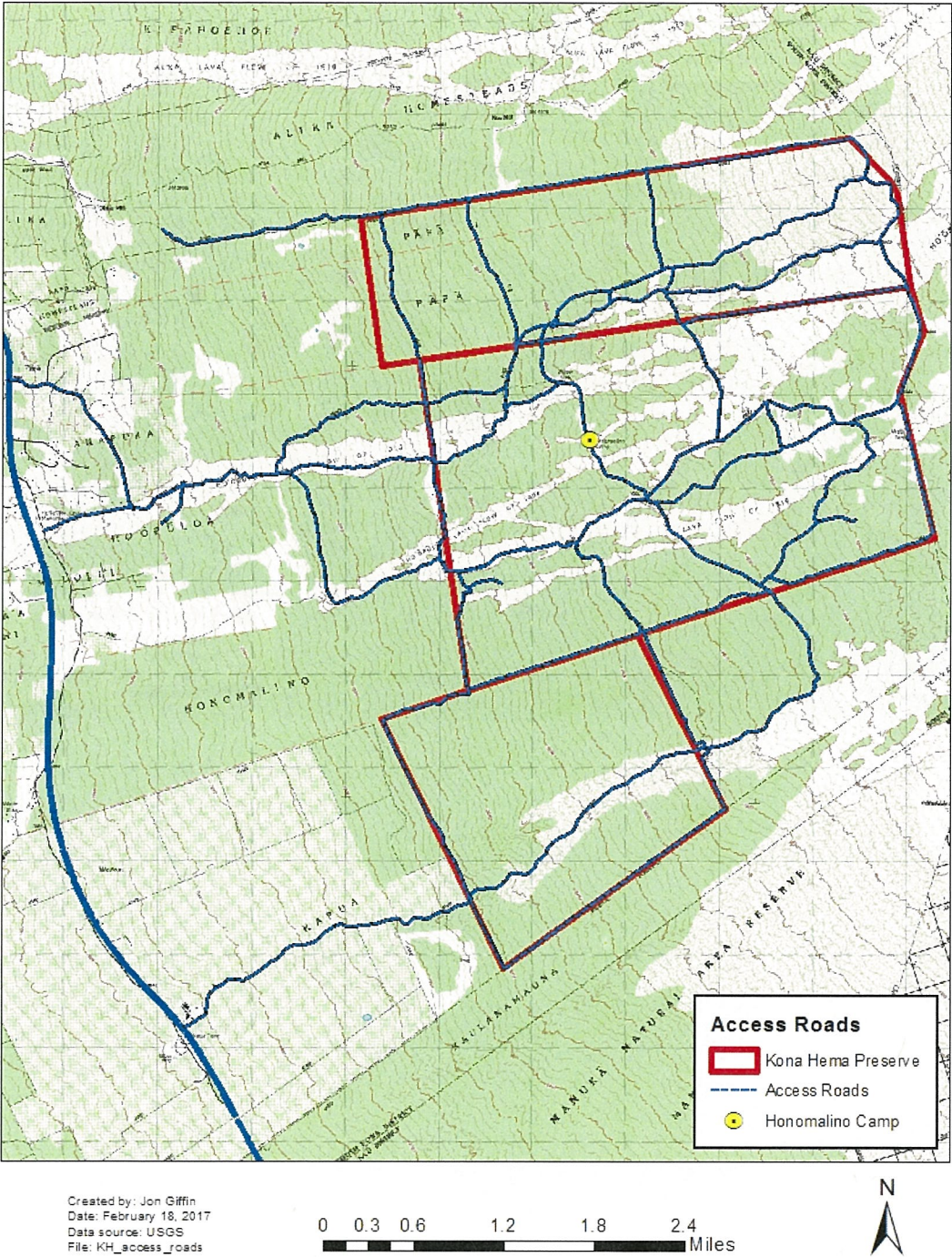


Figure 3. Future development sites within the Honomalino management unit.

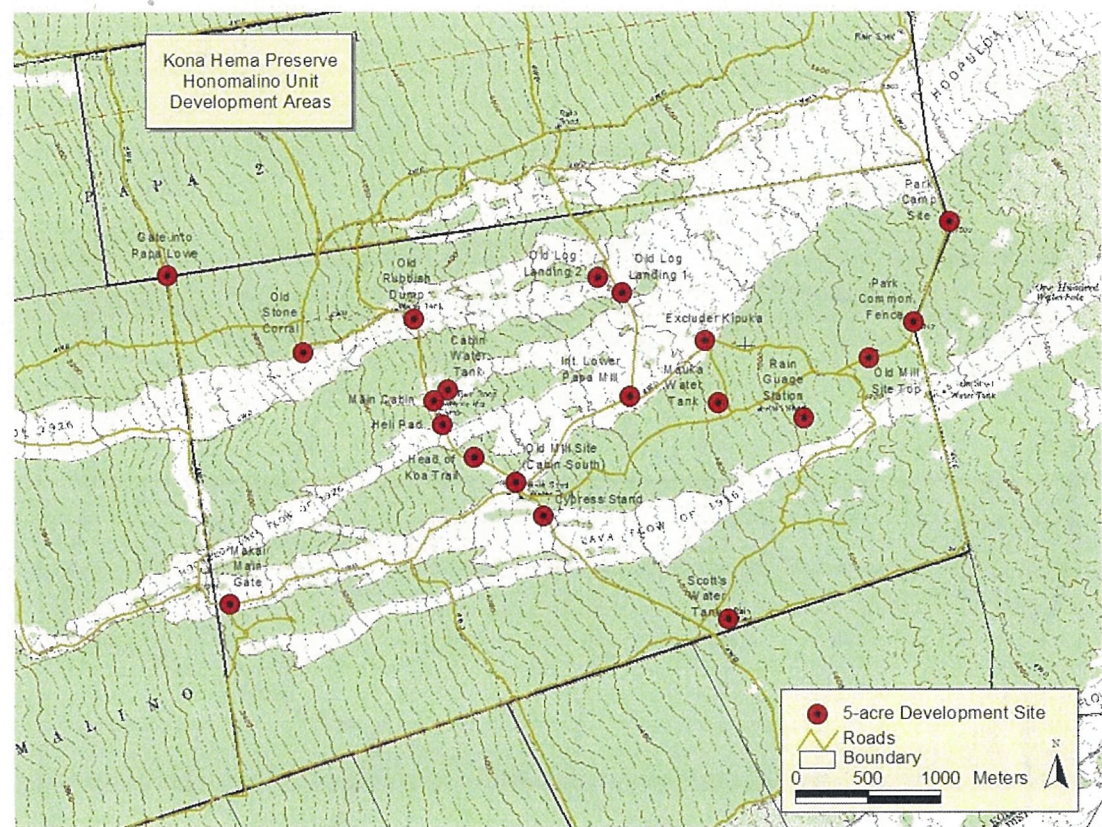
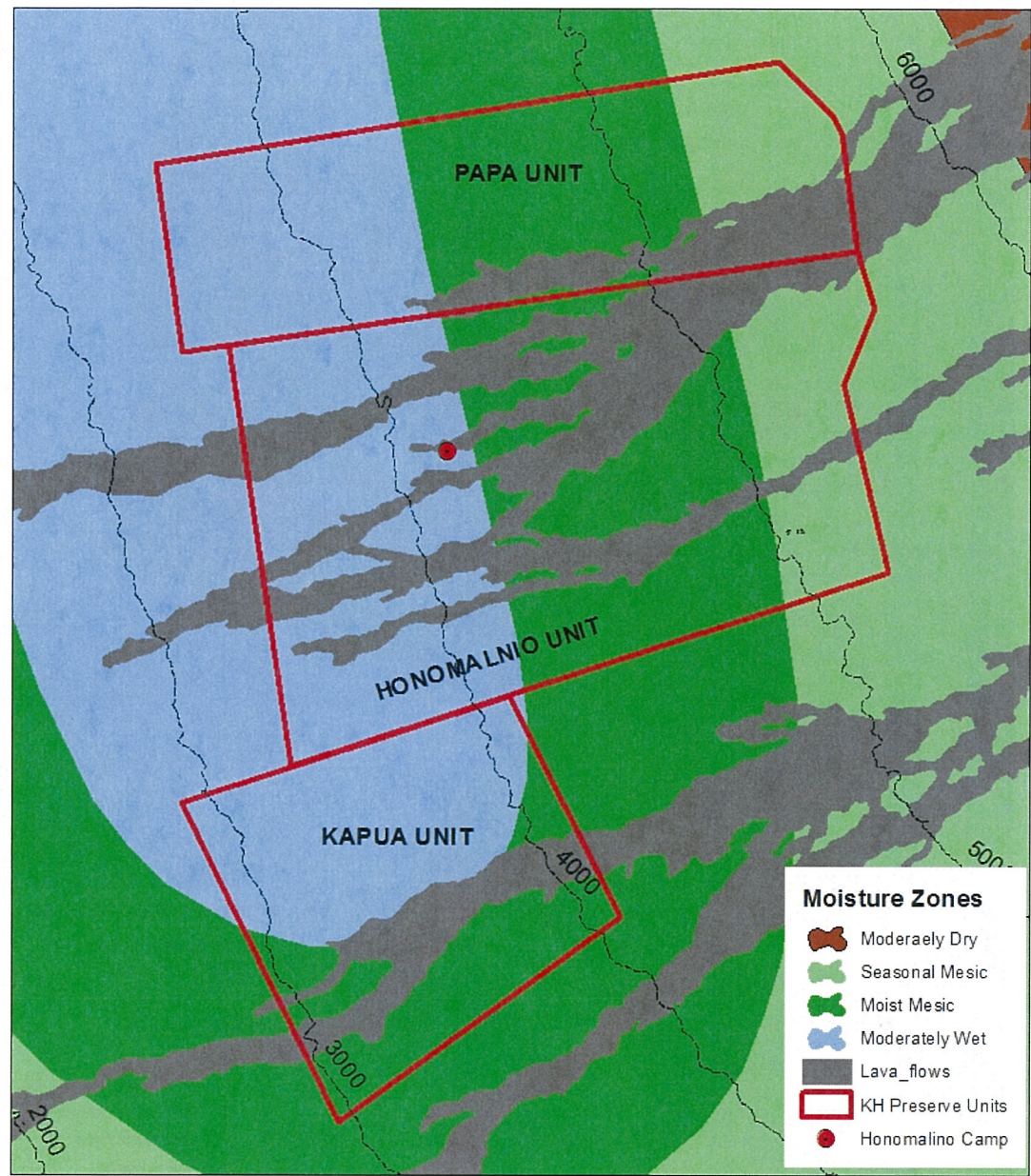


Figure 4. Relationship of Kona Hema Preserve to moisture zones mapped by Price et al., 2007.

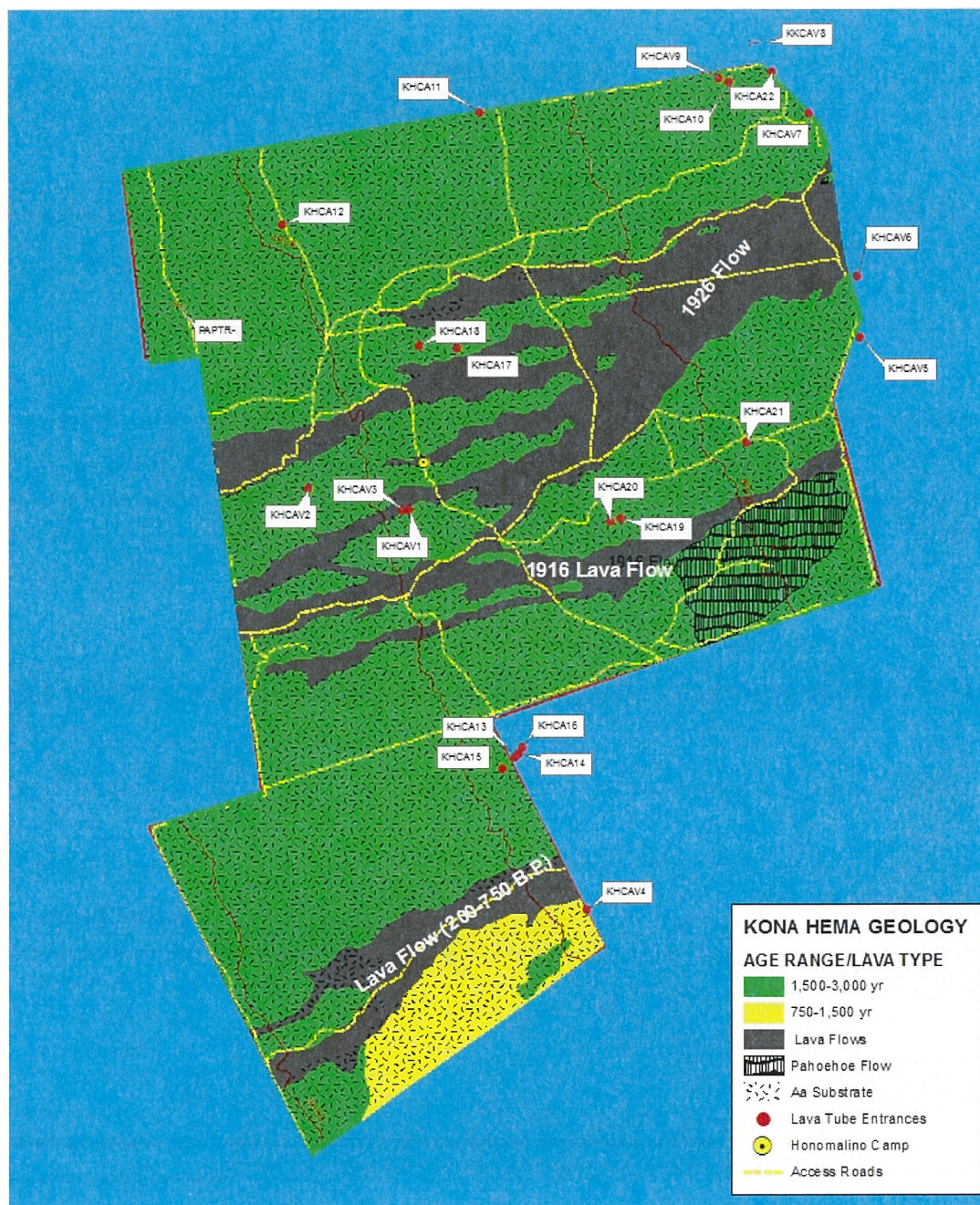


Prepared by Jon Giffin
Date: 1/15/2017
File: Price_moisture_zones
Source: Price et al., 2012

0 0.3 0.6 1.2 1.8 2.4 Miles



Figure 5. Geological features at Kona Hema Preserve.

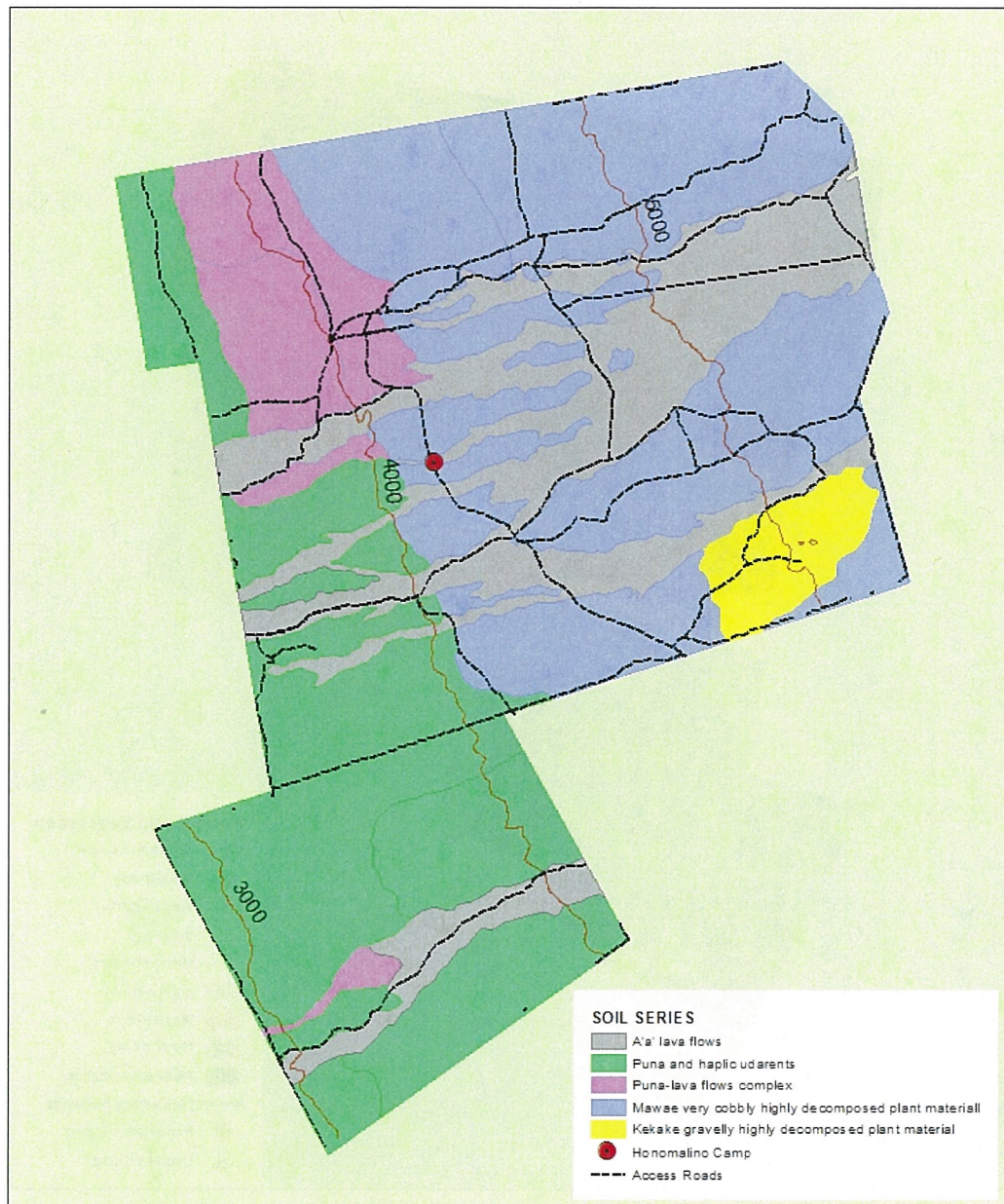


Prepared by: Jon Giffin
 Date: 3/2/17
 File: KH geologic features
 Source: USGS, NRCS, TNC

0 0.25 0.5 1 1.5 2 Miles



Figure 6. Distribution of soil types at Kona Hema Preserve.



Prepared by Jon Giffin
 Date: 1/15/2017
 Source: NRCS, USDA, 2013
 File: KH_Soils

0 0.25 0.5 1 1.5 2 Miles



Figure 7. Distribution of vegetation types at Kona Hema Preserve.

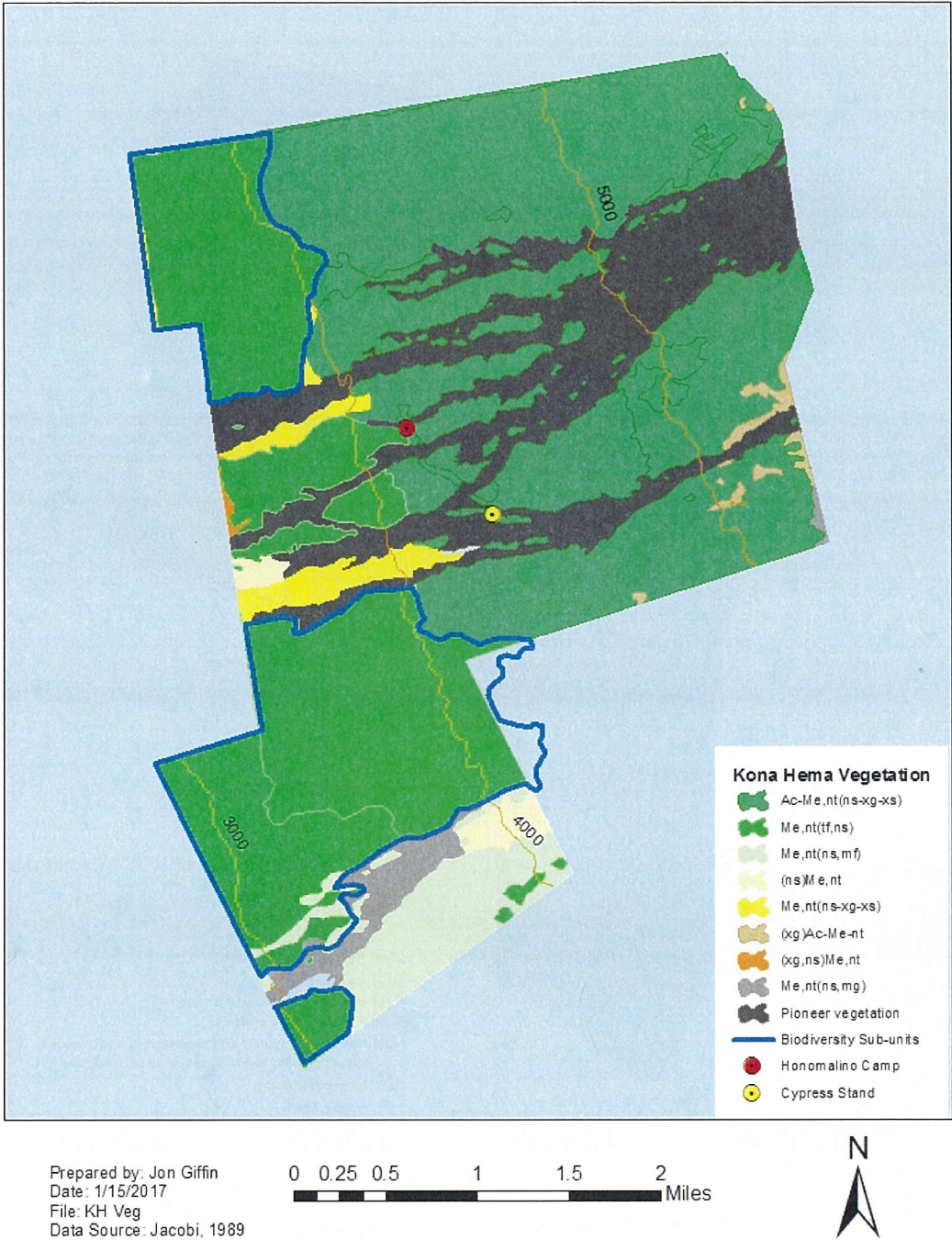
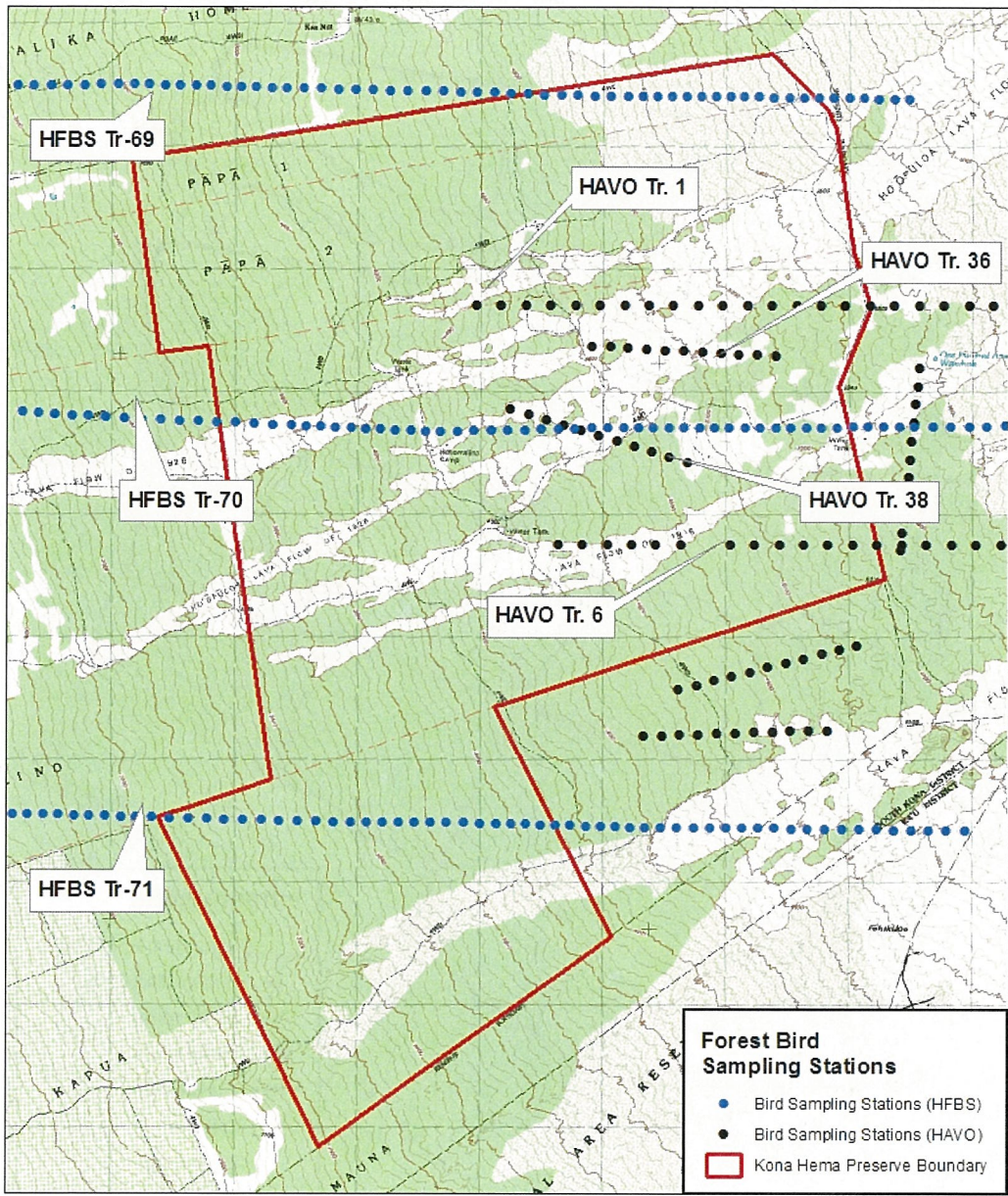


Figure 8. Location of forest bird transects and sampling stations within and nearby Kona Hema Preserve.

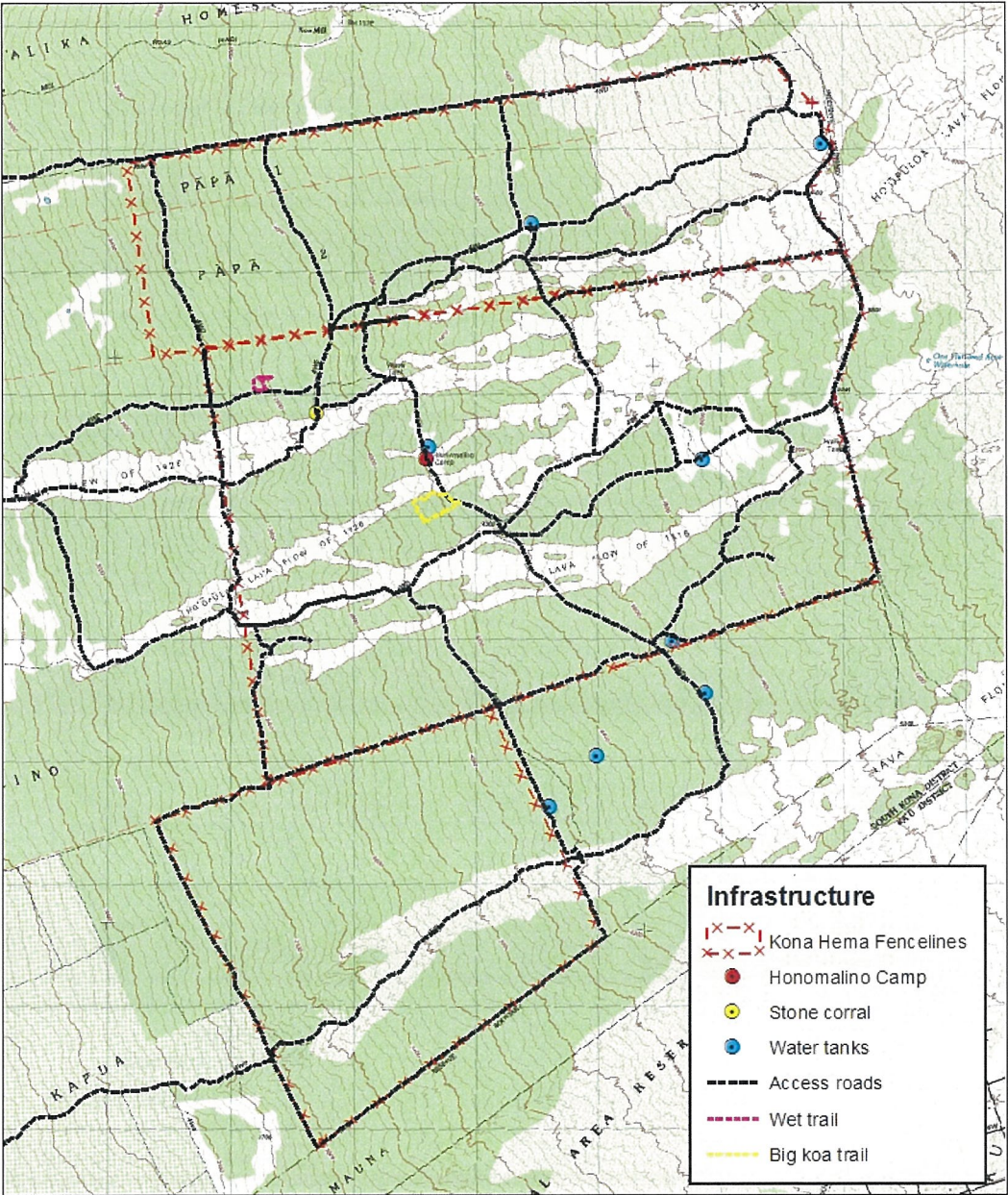


Prepared by: Jon Giffin
 File: Kona-Hema_rare_species
 Date: January 15, 2017
 Source: Hawaii Forest Bird Interagency Database

0 0.25 0.5 1 1.5 2 Miles



Figure 9. Location of infrastructure and improvements at Kona Hema Preserve.



Prepared by: Jon Giffin
Date: February 2, 2017
File: KH_infrastructure
Data source: TNC

0 0.35 0.7 1.4 2.1 2.8 Miles



Figure 10. Location of soil scarification plots at Kona Hema Preserve.

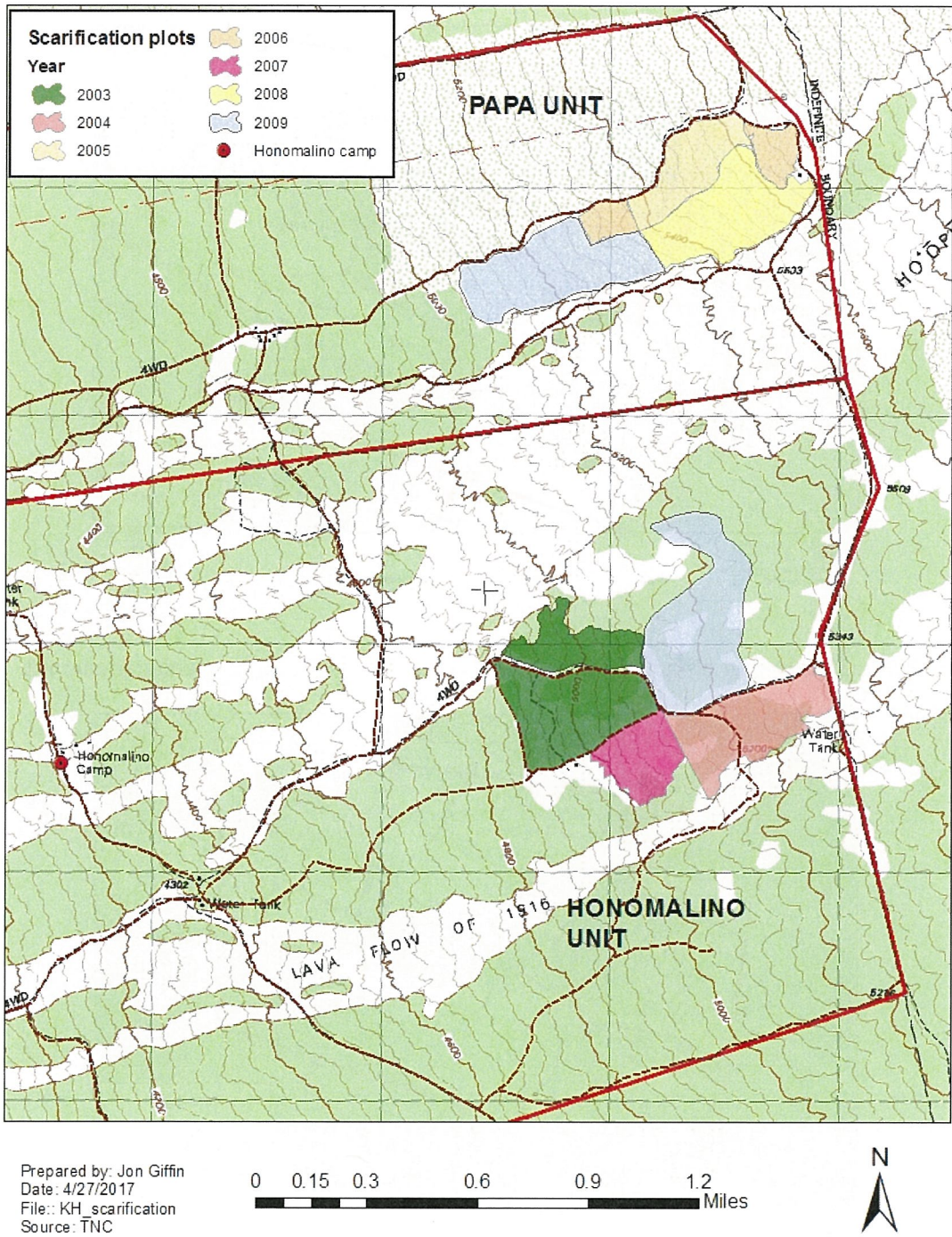


Figure 11. Location of weed control blocks in the Honomalino and Pāpā management units.

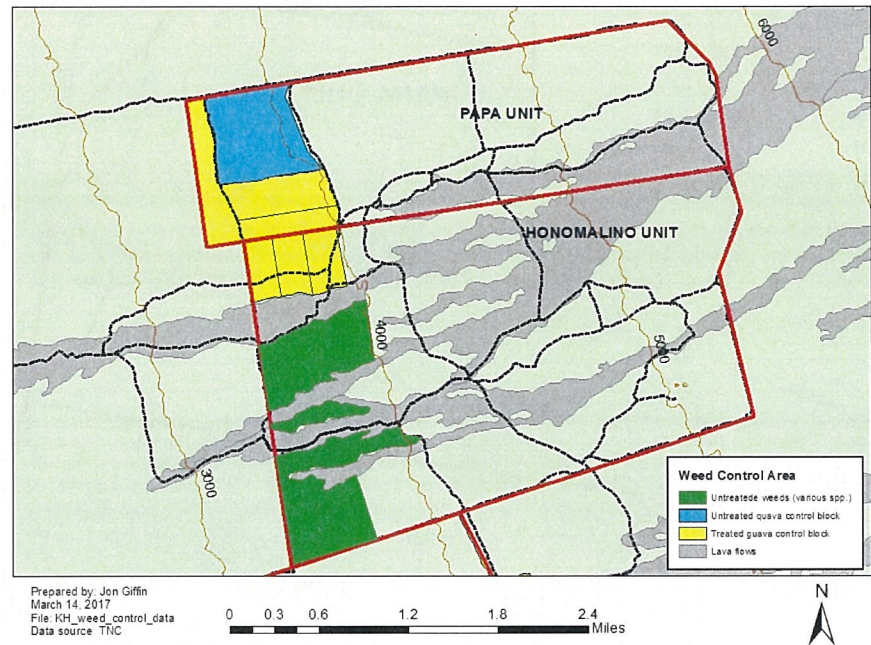


Figure 12. Location of 58-acre koa thinning plot in the Honomalino management unit.

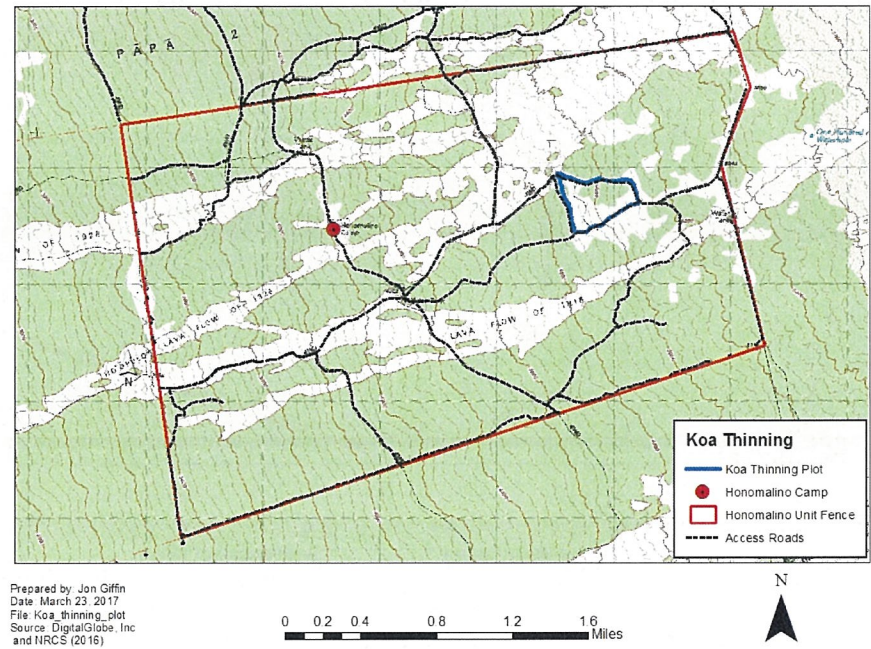




Photo 1. Leaves of the endangered a'e tree (*Zanthoxylum hawaiiensis*) at Kona Hema Preserve. Photograph by Jon Giffin.



Photo 2. Endangered loulu palm (*Pritchardia schattaueri*) outplanted at Kona Hema Preserve. Mel Johansen and Lester Gebin provide scale. Photograph by Jon Giffin.



Photo 3. Aerial view of the Honomalino soil scarification area prior to treatments with a bulldozer (2003). Ikonos imagery courtesy of Theresa Menard.

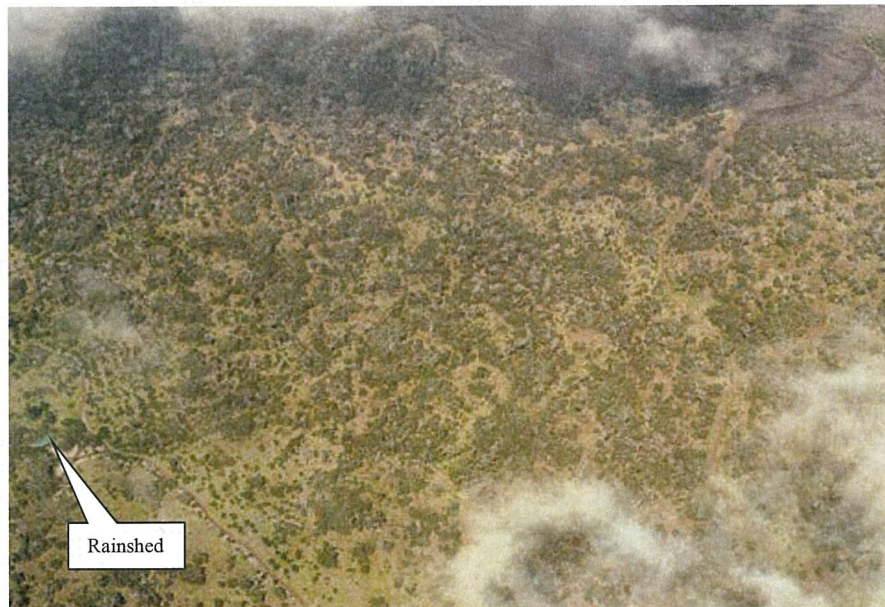


Photo 4. Aerial view of the Honomalino soil scarification area six years post-treatment (2009). Rows of koa seedling are already visible in the bulldozer lanes. Photometry image courtesy of Stephanie Tom and Jim Jacobi.



Photo 5. Aerial view of the Honomalino soil scarification area thirteen years post-treatment (2016). Photometry image courtesy of Stephanie Tom and Jim Jacobi.



Photo 6. Landscape view of the Honomalino soil scarification area (2003). Note the tree snag in center background. Photograph by Laura Nelson.



Photo 7. Landscape view of the Honomalino soil scarification area (2005). Note the tree snag in center background. Photograph by Laura Nelson.



Photo 8. Landscape view of the Honomalino soil scarification area (2006). Note the tree snag in center background. Photograph by Laura Nelson.



Photo 9. Landscape view of the Honomalino soil scarification area (2016). Note the tree snag in center background. Photograph by Shalan Crysdale.



Photo 10. Aerial view of the Pāpā burn area shortly after completion of soil scarification treatments (2007). No koa seedlings are visible 13 years after the 1994 wildfire event. Photograph by Rob Shallenberger.



Photo 11. Aerial view of the Pāpā soil scarification area two years post-treatment (2009). Koa is regenerating, but bulldozer track scars are still evident. Photometry image courtesy of Stephanie Tom and Jim Jacobi.



Photo 12. Aerial view of the Pāpā soil scarification area six years post-treatment (2015). Photometry image courtesy of Stephanie Tom and Jim Jacobi.



Photo 13. Landscape view (looking north) of the soil scarification area at Pāpā (2017). Koa trees are 10-15 feet tall. Photograph by Jon Giffin.



Photo 14. Landscape view (looking west) of the soil scarification area at Pāpā (2017). Koa trees are forming interlocking crowns. Photograph by Jon Giffin.

Appendix 1. Description of lava tube features at Kona Hema Preserve. Data compiled by Jon Giffin, TNC Field Representative (2005).

Waypoint	Easting	Northing	Mgmt. Unit	Comments
KHCAV1	2125116	204496	Honomalino	See #1
KHCAV2	2125297	203674	Honomalino	See #2
HCAV3	2125115	204444	Kapua	See #3
KHCAV4	2121847	205935	Kapua	See #4
KHCAV5	2126527	208162	HVNP	See #5
KHCAV6	2127032	208135	HVNP	See #6
KHCAV7	2128352	207752	Pāpā	See #7
KKCAV8	2128926	207309	HVNP	See #8
KHCAV9	2128637	207022	Pāpā	See #9
PAPTR	2126803	202615	Pāpā	See #PAPTR
KHCA10	2128615	207101	Pāpā	See #10
KHCA11	2128362	205073	Pāpā	See #11
KHCA12	2127449	203462	Pāpā	See #12
KHCA13	2123095	205347	Kapua	See #13
KHCA14	2123129	205381	Kapua	See #14
KHCA15	2123003	205244	Kapua	See #15
KHCA16	2123179	205412	Kapua	See #16
KHCA17	2126439	204887	Honomalino	See #17
KHCA18	2126459	204577	Honomalino	See #18
KHCA19	2125045	206207	Honomalino	See #19
KHCA20	2125023	206128	Honomalino	See #20
KHCA21	2125669	207236	Honomalino	See #21
KHCA22	2128697	207451	Pāpā	See #22

Comments:

1. Skylight on loop trail. Entry is possible on north side of opening. No passage upslope, but large passage downslope leading to KHCAV3.
2. Skylight reported by Laura Nelson. Not visited.
3. Large skylight and fossil bird site. Entry is possible on south side. Upslope passage connects to KHCAV1 through a small hole in in the wall. Flightless goose remains (12+ birds) found at upper end of passage. No passage downslope.
4. Not explored due to dangerous entry.
5. Small cave with evidence of temporary human use. Features include a possible fire pit and water catchment cradles. Short lava passage only.
6. Short lava passage only.
7. Native mint (*Stenogyne rugosa*) in trench. Small passage heading mauka was not explored.

Appendix 1. (continued).

8. Unexplored deep skylight.

9. Small skylight only.

PAPTR Skylight in bottom of lava trench. Vertical drop of about 30 feet to lava tube floor. Not explored.

10. Short lava tube. Possible habitat for cave adapted insects.

11. Lava trench on side of road. Short dead end lava tube.

12. Lava trench and small cave. No passage.

13. Skylight on makai side of access road. No walk in entrance. Not explored.

14. Large skylight with diverse native vegetation on private property (S. Rolles). Passage downslope ends after 100 feet. No connection to skylight KHCA13 on access road.

Upslope passage leads to KHCA16.

15. Large skylight. No passage makai, short passage mauka.

16. Cultural features at entrance. Enter from KHCA14, walk upslope through a short passage into the large skylight at KHCAV16. Features include a rock platform and water cradles in the mouth of a passage that continues upslope for about 100 feet. Site is on private property (S. Rolles).

17. Cultural site in a short passage. Features include a fireplace, sleeping area, stacked rocks, and charcoal on floor.

18. Lava trench containing a small cave with no passage.

19. Short passage with a skylight 40 above.

20. Short passage only.

21. Short passage approx. 100 feet long.

22. Short passage on side of road containing marijuana growing equipment and abandoned camping gear.

Appendix 2. Description of forest cover types at Kona Hema Preserve.

Unit Symbols	General Descriptions
Ac-Me, nt(ns-xg-xs)	Koa/'ōhi'a forest with other native trees. Understory composed of native shrubs, introduced grasses, and introduced shrubs.
Me,nt(tf,ns)	'Ōhi'a forest with other native trees. Understory composed of tree ferns, and native shrubs.
Me,nt(ns,mf)	Understory composed of native shrubs and matted ferns.
(ns)Me,nt	Native shrub community with scattered 'ōhi'a and other native trees.
Me,nt(ns-xg-xs)	'Ōhi'a forest with other native trees. Understory composed of native shrubs, introduced grass and shrubs.
xg(Ac-Me-nt)	Introduced grassland with scattered koa, 'ōhi'a, and other native trees.
xg,ns(Me,nt)	Introduced grass and native shrub community with scattered 'ōhi'a and other native trees.
Me,nt(ns,mg)	'Ōhi'a forest with mixed native trees and a native shrub and mixed grass understory.
Pioneer vegetation	Short stature native vegetation, primarily 'ōhi'a.

Source: Jacobi, 1989

Appendix 3: Flora of Kona Hema Preserve					
Prepared by the Hawai'i Natural Heritage Program (Sam Gon, Joel Lau)					
R = Rare plants (see T & E section)					
DICOTS					
Endemic:					
Acacia koa A. Gray	Koa	Fabaceae	x	x	
Alyxia oliviformis Gaud.	Maile	Apocynaceae	x	x	
Broussaisia arguta Gaud.	Kanawao, pu`ahanui	Hydrangeaceae	x	x	
Cheirodendron trigynum (Gaud.) A. Heller ssp. Trigynum	`Olapa	Araliaceae	x	x	
Clermontia clermontioides (Gaud.) A. Heller	`Oha, `ohawai	Campanulaceae	x	x	
Coprosma ernodeoides A. Gray	Kukaenene	Rubiaceae		x	
Coprosma rhynchocarpa A. Gray	Pilo	Rubiaceae	x	x	
Cyrtandra mensiezii Hook. & Arnott R	Ha`iwale	Gesneriaceae	x	x	
Dubautia scabra (DC) D. Keck ssp. Scabra	Na`ena`e	Asteraceae	x		x
Hedyotis centranthoides (Hook. & Arnott) Steud.		Rubiaceae		x	x
Hedyotis terminalis (Hook. & Arnott) W. L. Wagner & Herbst	Manono	Rubiaceae	x	x	
Ilex anomala Hook. & Arnott	Kawa`u	Aquifoliaceae	x	x	
Melicope clusiifolia (A. Gray) T. Hartley & B. Stone	Alani	Rutaceae	x	x	
Melicope hawaiiensis (Wawra) T. Hartley & B. Stone R	Alani	Rutaceae		x	
Melicope volcanica (A. Gray) T. Hartley & B. Stone	Alani	Rutaceae	x		
Metrosideros polymorpha Gaud.	`ōhi`a , `ōhi`a lehua, lehua	Myrtaceae	x	x	x
Myrsine lessertiana A. DC	Kolea	Myrsinaceae	x	x	
Nothocestrum longifolium A. Gray R	`Aiea	Solanaceae	x		
Peperomia cookiana C. DC	`Ala`ala wai nui	Piperaceae	x	x	x
Perrottetia sandwicensis A. Gray	Olomea	Celastraceae	x	x	
Phyllostegia floribunda Benth. R		Lamiaceae	x	x	
Pipturus albidus (Hook. & Arnott) A. Gray	Mamaki	Urticaceae	x	x	x
Pittosporum hawaiiense Hillebr.	Ho`awa	Pittosporaceae	x	x	
Psychotria hawaiiensis (A. Gray) Fosb. var. hillebrandii (Rock) Fosb.	Kopiko, `opiko	Rubiaceae	x	x	
Rubus hawaiiensis A. Gray	`Akala	Rosaceae	x	x	
Rubus macraei A. Gray R	`Akala	Rosaceae		x	
Rumex giganteus W. T. Aiton	Pawale, uhauhako	Polygonaceae	x	x	
Sisyrinchium acre H. Mann R	Mau`u la`ili	Iridaceae		x	x
Sophora chrysophylla (Salisb.) Seem.	Mamane	Fabaceae		x	
Stenogyne rugosa Benth. R	Ma`ohi`ohi	Lamiaceae	x	x	
Tetraplasandra oahuensis R	Ohe mauka	Araliaceae	x		
Urera glabra R	Opuhe	Urticaceae	x		
Vaccinium calycinum Sm.	`Ohelo kau la`au	Ericaceae	x	x	x
Vaccinium reticulatum Sm.	`Ohelo	Ericaceae		x	x
Indigenous:					
Cocculus trilobus (Thunb.) DC	Huehue	Menispermaceae	x	x	
Dodonaea viscosa Jacq.	`A`ali`i	Sapindaceae		x	
Fragaria chiloensis (L.) Duchesne R	`Ohelo	Rosaceae	x		

<i>Lythrum maritimum</i> Kunth (ind?)	Pukamole	Lythraceae	x	x	
<i>Myoporum sandwicense</i> A. Gray	Naio, bastard sandalwood	Myoporaceae	x	x	
<i>Solanum americanum</i> Mill. (ind?)	Glossy nightshade, Popolo	Solanaceae		x	
<i>Styphelia tameiameia</i> (Cham. & Schlechtend.) F. v. Muell.	Pukiawe	Epacridaceae		x	x
Alien:					
<i>Ageratina riparia</i> (Regel) R. King & H. Robinson	Hamakua pamakani	Asteraceae	x	x	x
<i>Anagallis arvensis</i> L.	Scarlet pimpernel	Primulaceae		x	
<i>Anemone hupehensis</i> Lemoine var. <i>japonica</i> (Thunb.) Bowles & W. Stern	Japanese anemone	Ranunculaceae	x	x	
<i>Asclepias physocarpa</i> (E. Mey.) Schlechter	Balloon plant	Asclepiadaceae	x	x	x
<i>Bidens alba</i> (L.) DC var. <i>radiata</i> (Schultz-Bip.) Ballard ex Melchert	-	Asteraceae	x		
<i>Buddleia asiatica</i> Lour.	Dogtail	Buddlejaceae	x	x	
<i>Cardamine flexuosa</i> With.	Bittercress	Brassicaceae	x	x	
<i>Castilleja arvensis</i> Cham. & Schlechtend.	Indian paintbrush	Scrophulariaceae			x
<i>Centaurium erythraea</i> Raf. ssp. <i>Erythraea</i>	Bitter herb, European centaury	Gentianaceae	x		
<i>Cerastium fontanum</i> Baumg. ssp. <i>triviale</i> (Link) J alas	Common mouse-ear chickweed	Caryophyllaceae	x		
<i>Cirsium vulgare</i> (Savi) Ten.	Bull thistle	Asteraceae	x	x	
<i>Conyza bonariensis</i> (L.) Cronq.	Hairy horseweed, ilioha	Asteraceae	x	x	
<i>Conyza canadensis</i> (L.) Cronq. var. <i>pusilla</i> (Nutt.) Cronq.	Horseweed	Asteraceae			x
<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	-	Asteraceae	x	x	
<i>Cuphea carthagenensis</i> (Jacq.) Macbr.	Tarweed, Columbian cuphea	Lythraceae	x	x	
<i>Desmodium intortum</i> (Mill.) Urb.		Fabaceae	x		
<i>Drymaria cordata</i> (L.) Willd. ex Roem. & Schult. var. <i>pacifica</i> Mizush.	Pipili, pilipili	Caryophyllaceae	x		
<i>Epilobium billardierianum</i> Ser. ssp. <i>cinereum</i> (A. Rich.) Raven & Engelhorn	Willow herb	Onagraceae	x	x	x
<i>Eucalyptus</i> sp.	Eucalyptus	Myrtaceae			x
<i>Euphorbia peplus</i> L.	Petty spurge	Euphorbiaceae	x	x	
<i>Fraxinus uhdei</i> (Wenzig) Lingelsh.	Tropical ash	Oleaceae			x
<i>Geranium homeanum</i> Turcz.		Geraniaceae	x	x	
<i>Gnaphalium japonicum</i> Thunb.	Cudweed, everlasting	Asteraceae	x	x	
<i>Gnaphalium purpureum</i> L.	Purple cudweed	Asteraceae	x	x	
<i>Hydrocotyle bowlesioides</i> Mathias & Constance	Marsh pennywort	Apiaceae	x		
<i>Hypochoeris radicata</i> L.	Hairy cat's ear, gosmore	Asteraceae	x	x	x
<i>Kalanchoe pinnata</i> (Lam.) Pers.	Air plant, `oliwa ku kahakai	Crassulaceae		x	
<i>Lotus subbiflorus</i> Lag.		Fabaceae	x	x	
<i>Lotus uliginosus</i> Schkuhr		Fabaceae		x	
<i>Ludwigia palustris</i> (L.) Elliott	Marsh purslane	Onagraceae	x		

Myosotis discolor Pers.	Forget-me-not	Boraginaceae		x	
Oxalis corniculata L. (alien?)	Yellow wood sorrel, 'ihi makole	Oxalidaceae	x		x
Oxalis corymbosa DC	Pink wood sorrel, 'ihi pehu	Oxalidaceae		x	
Passiflora edulis Sims	Passion fruit, liliko'i	Passifloraceae	x	x	
Passiflora ligularis Juss.	Sweet granadilla, lemi wai	Passifloraceae	x	x	
Physalis peruviana L.	Cape gooseberry, poha	Solanaceae	x	x	
Plantago lanceolata L.	Narrow-leaved plantain	Plantaginaceae	x		
Plantago major L.	Broad-leaved plantain, laukahi	Plantaginaceae	x	x	
Pluchea symphytifolia (Mill.) Gillis	Sourbush	Asteraceae	x		x
Polycarpon tetraphyllum (L.) L.		Caryophyllaceae			x
Polygala paniculata L.	Milkwort	Polygalaceae	x		x
Polygonum capitatum F. Ham.		Polygonaceae	x		x
Polygonum glabrum Willd.		Polygonaceae	x		
Polygonum punctatum Elliot	Water smartweed	Polygonaceae			x
Prunella vulgaris L.	Selfheal	Lamiaceae	x		
Psidium cattleianum Sabine	Strawberry guava, waiawi	Myrtaceae	x		
Rubus rosifolius Sm.	Thimbleberry	Rosaceae	x	x	
Rumex crispus L.	Curly dock	Polygonaceae		x	
Schinus terebinthifolius Raddi	Christmas berry, wilelaiki	Anacardiaceae	x		
Senecio mikanioides Otto ex Walp.	German ivy, Italian ivy	Asteraceae		x	
Senna septemtrionalis (Viv.) H. Irwin & Barneby	Kolomona	Fabaceae	x		
Sonchus oleraceus L.	Sow thistle, pualele	Asteraceae	x		
Spermacoce assurgens Ruiz & Pav.	Buttonweed	Rubiaceae	x	x	
Stachytarpheta dichotoma (Ruiz & Pav.) Vahl	Oi	Verbenaceae	x		
Trifolium dubium Sibth.	Small hop-clover	Fabaceae	x	x	
Verbascum thapsus L.	Woolly mullein, common mullein	Scrophulariaceae			x
Verbena litoralis Kunth	Ha'uoi, oi	Verbenaceae	x	x	x
Veronica arvensis L.	Corn speedwell	Scrophulariaceae	x	x	
Veronica plebeia R. Br.	Trailing speedwell	Scrophulariaceae	x	x	
Veronica serpyllifolia L.	Thyme-leaved speedwell	Scrophulariaceae	x	x	
Youngia japonica (L.) DC	Oriental hawksbeard	Asteraceae	x	x	

MONOCOTS					
Endemic:					
Carex alligata Boott		Cyperaceae	x		
Carex wahuensis C. A. Mey. ssp. rubiginosa (R. Krauss) T. Koyama		Cyperaceae		x	
Luzula hawaiiensis Buchenau var. hawaiiensis	Wood rush	Juncaceae		x	
Deschampsia nubigena Hillebr.	Hairgrass	Poaceae		x	
Pritchardia schattaueri R	Loulu	Arecaceae	x		
Smilax melastomifolia Sm.	Hoi kuahiwi	Smilacaceae	x	x	
Indigenous:					
Agrostis avenacea J. G. Gmelin	He'upueo	Poaceae			x
Freycinetia arborea Gaud.	`le`ie	Pandanaceae	x		
Gahnia gahniiformis (Gaud.) A. Heller		Cyperaceae		x	
Machaerina angustifolia (Gaud.) T. Koyama	`Uki	Cyperaceae			x
Pycreus polystachyos (Robbt.) P. Beauv.		Cyperaceae	x	x	x
Uncinia uncinata (L. fil.) Kukenth.		Cyperaceae	x	x	
Alien:					
Agrostis stolonifera L.	Redtop bentgrass	Poaceae	x		
Anthoxanthum odoratum L.	Sweet vernalgrass	Poaceae		x	
Arundina graminifolia (D. Don) Hochr.	Bamboo orchid	Orchidaceae		x	
Axonopus fissifolius (Raddi) Kuhlm.	Narrow-leaved carpet grass	Poaceae	x		x
Briza minor L.	Little quaking grass	Poaceae	x		
Dactylis glomerata L.	Cocksfoot	Poaceae	x	x	
Digitaria pentzii Stent	Pangola grass	Poaceae	x	x	
Digitaria violascens Link	Smooth crabgrass, violet crabgrass	Poaceae	x		x
Ehrharta stipoides Labill.	Meadow ricegrass	Poaceae	x	x	x
Festuca arundinacea Schreber		Poaceae	x	x	
Festuca rubra L.	Red fescue	Poaceae		x	
Holcus lanatus L.	Common velvet grass	Poaceae	x	x	
Juncus tenuis Willd.	Rush	Juncaceae	x	x	
Kyllinga brevifolia Rottb.	Kili'o'opu	Cyperaceae	x		
Lolium perenne L.	Perennial ryegrass	Poaceae		x	
Melinis minutiflora P. Beauv.	Molasses grass	Poaceae	x		x
Paspalum conjugatum Bergius	Hilo grass	Poaceae	x		
Paspalum dilatatum Poir.	Dallis grass	Poaceae	x	x	
Paspalum urvillei Steud.	Vasey grass	Poaceae	x		
Pennisetum clandestinum Chiov.	Kikuyu grass	Poaceae	x	x	
Phaius tankarvilleae (Banks ex L'Her.) Blume	Chinese ground orchid	Orchidaceae	x		
Poa annua L.	Annual bluegrass	Poaceae	x	x	
Pycreus sanguinolentus (Vahl) Nees		Cyperaceae		x	
Rhynchospora caduca Elliott		Cyperaceae	x		
Sacciolepis indica (L.) Chase	Glenwood grass	Poaceae	x		x
Schizachyrium condensatum (Kunth) Nees	Little bluestem, beardgrass	Poaceae	x	x	
Setaria gracilis Kunth	Yellow foxtail	Poaceae		x	x
Sporobolus indicus (L.) R. Br.	Smutgrass, West Indian dropseed	Poaceae	x	x	x
Stenotaphrum secundatum (Walter) Kuntze	St. Augustine grass	Poaceae		x	
Vulpia bromoides (L.) S. F. Gray	Brome fescue	Poaceae			x

FERNS AND FERN ALLIES					
Endemic:					
Asplenium contiguum Kaulf.				X	
Asplenium cookii Copel.			X	X	
Asplenium sphenotomum Hillebr.			X	X	
Athyrium microphyllum (J. Sm.) Alston	`Akolea		X	X	
Cibotium glaucum (Sm.) Hook. & Arnott	Hapu`u pulu, treefern		X	X	
Cibotium menziesii Hook.	Hapu`u `i`i, treefern		X	X	
Ctenitis rubiginosa (Brack.) Copel.				X	
Diplazium sandwichianum (Presl) Diels	Ho`i`o, pohole		X	X	
Dryopteris fusco-atra (Hillebr.) Rob.			X	X	
Dryopteris glabra (Brack.) O. Kuntze			X	X	
Dryopteris hawaiiensis (Hillebr.) Christ			X	X	
Dryopteris unidentata (Hook. & Arnott) C. Chr.			X		
Dryopteris wallichiana (Spreng.) Hyl.			X	X	X
Elaphoglossum parvisquameum Skottsb.			X	X	
Mecodium recurvum (Gaud.) Copel.			X		
Nephrolepis exaltata (L.) Schott ssp. hawaiiensis W.H. Wagner	Kupukupu, ni`ani`au		X	X	X
Polypodium pellucidum Kaulf.	`Ae				X
Pseudophegopteris keraudreniana (Gaud.) Holttum			X		
Pteridium decompositum Gaud.				X	X
Pteris x hillebrandii Copel. (P. cretica L. x P. irregularis Kaulf.)			X	X	
Sadleria cyatheoides Kaulf.	`Ama`u, ma`u		X	X	X
Tectaria gaudichaudii (Mett.) Maxon	`Iwa`iwa lau nui		X		
Thelypteris globulifera (Brack.) Reed	Palapalai-a-kamapua`a		X		
Thelypteris stegnogrammoides (Baker) Fosberg	Ho`i`o kula		X	X	
Vandenboschia davallioides (Gaud.) Copel.			X	X	
Indigenous:					
Asplenium adiantum-nigrum L.				X	X
Asplenium trichomanes L.				X	X
Cyrtomium caryotideum Presl	Ka`ape`ape		X		
Dicranopteris linearis (N. L. Burm.) Underw.	Uluhe		X	X	X
Elaphoglossum paleaceum (Hook. & Grev.) Sledge			X	X	
Lepisorus thunbergianus (Kaulf.) Ching	Pakahakaha, `ekaha `akolea		X		X
Microlepia strigosa (Thunb.) Presl	Palapalai		X	X	
Nephrolepis cordifolia (L.) Presl	Kupukupu, ni`ani`au			X	
Odontosoria chinensis (L.) J. Sm.	Pala`a		X	X	
Palhinhaea cernua (L.) Franco & Carv. Vasc.	Wawae`iole				X
Psilotum complanatum Sw.	Moa		X		
Psilotum nudum (L.) Beauv.	Moa		X	X	X
Psilotum x intermedium W.H. Wagner	Moa		X		
Pteris cretica L.			X	X	
Pteris excelsa Gaud.	Waimakanui		X	X	
Aliens:					
Adiantum hispidulum Sw.	Rough maidenhair		X	X	
Cyrtomium falcatum (L. fils.) Presl			X		
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	Kupukupu, ni`ani`au		X		X
Macrothelypteris torresiana (Gaud.) Ching			X		
Thelypteris parasitica (L.) Fosberg			X	X	

Appendix 4. Native arthropod species collected at Kona Hema Preserve. Species identified by various arthropod specialists.

PHYLUM ARTHROPODA	
CLASS ARACHNIDA	MITES, SPIDERS, AND RELATIVES
ORDER ARANEAE	Spiders
Thomisidae (Thomsid crab spiders)	
<i>Misumenops</i> sp. on <i>Acacia koa</i>	
Philodromidae (Philodromid crab spiders)	
undet. genus and species	
Tetragnathidae (Long-jawed spiders)	
<i>Tetragnatha brevignatha</i> on <i>Clermontia clermontioides</i>	
<i>Tetragnatha</i> spp. (brown) on <i>Acacia koa</i>	
Theridiidae (Comb-footed spiders)	
<i>Theridion grallator</i> (happy-face spider)	
ORDER PSEUDOSCORPIONIDA	Pseudoscorpions
Chernetidae	
No data	
CLASS INSECTA	INSECTS
ORDER COLLEMBOLA	Springtails
undet. genus/species.	
ORDER ODONATA	Dragonflies, damselflies
Aeshnidae (Darners)	
No data	
Coenagrionidae (Damselflies)	
No data	
ORDER ORTHOPTERA	Grasshoppers, katydids, crickets
Gryllidae (Crickets)	
<i>Laupala</i> sp. on various plants	
<i>Prognathogryllus</i> sp.	
Tettigoniidae (Katydids)	
No data.	
ORDER HETEROPTERA	True bugs
Anthocoridae (Minute pirate bugs)	
<i>Lasiochilus</i> sp. on <i>Freycinetia arborea</i>	
Lygaeidae (Seed bugs)	
<i>Neseis</i> sp. on <i>Melicope volcanica</i>	
<i>Neseis</i> sp. on <i>Pipturus albidus</i>	
<i>Oceanides</i> sp. on <i>Ilex anomala</i>	
Miridae (Leaf bugs)	

<i>Hyalopeplus pellucidus</i>	
<i>Koanoa</i> sp. on mossy log	
<i>Metrarga nuda</i> at light trap	
<i>Nesiomiris</i> sp. at light trap and on <i>Cheirodendron trigynum</i>	
<i>Orthotylus melicopi</i> on <i>Melicope hawaiiensis</i> (new species)	
<i>Othrotylus psychotriodes</i> . on <i>Psychotria hawaiiensis</i>	
<i>Orthotylus neopsychotriae</i> on <i>Psychotria hawaiiensis</i> (new species)	
<i>Orthotylus clermontiae</i> . on <i>Clermontia clermontioides</i>	
<i>Sulamita lunalilo</i> on <i>Freycinetia arborea</i>	
<i>Sarona adonias</i> on <i>Metrosideros polymorpha</i>	
<i>Sarona</i> sp. on <i>Pittosporum hosmeri</i>	
<i>Sarona</i> sp. on <i>Pipturus albidus</i>	
Nabidae (Damsel bugs)	
<i>Nabis blackburni</i> on <i>Acacia koa</i>	
<i>Nabis oscillans</i> on <i>Acacia koa</i>	
Pentatomidae (Stink bugs)	
<i>Oechalia patruelis</i> on <i>Acacia koa</i> (rare species)	
Reduviidae (Kissing bugs)	
No data	
ORDER HOMOPTERA	Leafhoppers, planthoppers
Cicadellidae (Leafhoppers)	
<i>Nesophrosyne</i> spp. on various plants	
Cixiidae (Planthoppers)	
<i>Oliarus</i> spp. on various plants	
<i>Iolania perkinsi</i> on various plants	
Delphacidae (Planthoppers)	
undet. genus/species on various plants	
Pysllidae (Jumping plant lice)	
undet. genus/species on various plants	
ORDER NEUROPTERA	Lacewings, Antlions
Chrysopidae (Green lacewings)	
<i>Anomalochrysa debilis</i> (det. M. Tauber)	
<i>Anomalochrysa hepatica</i> (det. J. Giffin)	
<i>Anomalochrysa maclachlani</i> (det. M. Tauber)	
<i>Anomalochrysa ornatipennis</i> (det. J. Giffin)	
Hemerobiidae (Brown lacewings)	
<i>Micromus minimus</i> (det. J. Giffin)	
<i>Micromus rubrinervis</i> (det. M. Tauber)	
<i>Micromus subochraceus</i> (det. J. Giffin)	
<i>Micromus vagus</i> (det. M. Tauber)	

ORDER COLEOPTERA	Beetles
Aglycyderidae (Primitive weevils)	
<i>Proterhinus</i> spp. on <i>Tetraplasandra hawaiiensis</i> and <i>Ilex anomala</i>	
Anobiidae (Anobiid beetles)	
<i>Holcobius</i> sp. at light trap	
<i>Mirosternus</i> sp. at light trap	
<i>Xyletobius</i> sp. at light trap	
Anthribidae (Fungus weevil)	
<i>Araecerus varians</i> on <i>Melicope volcanica</i>	
Cerambycidae (long-horned beetles)	
<i>Parandra puncticeps</i> at light trap and on <i>Tetraplasandra hawaiiensis</i> bark	
Carabidae (Ground beetles)	
Ciidae (minute tree-fungus beetle)	
<i>Cis</i> sp. on <i>Tetraplasandra hawaiiensis</i> bark	
Curculionidae (weevils)	
<i>Dryophthorus</i> sp. at light trap	
Eucnemidae (false click beetle)	
No data	
Nitidulidae (Souring beetles)	
<i>Nesopeplus</i> spp.) on various plants	
Scolytidae (Bark beetles)	
<i>Xyleborus</i> sp. at light trap and on <i>Tetraplasandra hawaiiensis</i> bark	
ORDER LEPIDOPTERA	Butterflies, moths
Carposinidae (Carposinid fruit moths)	
<i>Carposina gemmata</i>	
<i>Carposina inscripta</i>	
<i>Carposina nigronotata</i>	
<i>Carposina tinctoria</i>	
<i>Carposina olivaceonitens</i>	
<i>Carposina</i> sp. undet. #1	
Cosmopterygidae (Cosmopterygid moths)	
<i>Hypasmocoma chilonella</i>	
<i>Hypasmocoma exornata</i>	
<i>Hypasmocoma</i> sp. undet. #1	
<i>Hypasmocoma</i> sp. undet. #2	
<i>Hypasmocoma</i> sp. undet. #3	
<i>Hypasmocoma</i> sp. undet. #4	
<i>Hypasmocoma</i> sp. undet. #5	
Crambidae (Crambid moths)	
<i>Eudonia loxocentra</i>	

<i>Eudonia tetranesa</i>
<i>Eudonia venosa</i>
<i>Eudonia</i> sp. undet. #1
<i>Eudonia</i> sp. undet. #2
<i>Eudonia</i> sp. undet. #3
<i>Eudonia</i> sp. undet. #4
<i>Eudonia</i> sp. undet. #5
<i>Mestolobes abnormis</i> (new island record)
<i>Mestolobes chlorolychna</i>
<i>Mestolobes droseropa</i> ?
<i>Mestolobes minuscula</i>
<i>Omiodes accepta</i>
<i>Omiodes continuatalis</i>
<i>Omiodes localis</i>
* <i>Omiodes monogona</i>
<i>Orthomecyna exigua exigua</i>
<i>Orthomecyna metalycia</i>
<i>Uresiphita polygonalis virescens</i>
<i>Udea argoscelis</i>
<i>Udea callistra synastra</i>
<i>Udea liopis</i>
<i>Udea phaethontia</i>
<i>Udea pyranthes</i>
Gelechiidae (Gelechiid moths)
<i>Merimnetria gigantea</i>
Geometridae (Inchworms)
<i>Eupithecia craterias</i>
<i>Eupithecia monticolens</i>
<i>Eupithecia staurophragma</i>
<i>Progonostola</i> n. sp. #1 (rare species)
<i>Scotorythra arboricolans</i>
<i>Scotorythra artemidora</i>
<i>Scotorythra euryphae</i>
<i>Scotorythra gomphias</i>
<i>Scotorythra rara</i>
<i>Scotorythra trapezias</i>
<i>Scotorythra</i> n. sp. #5 (yellow sp.)
<i>Scotorythra</i> n. sp. #15 (small brown species)
Gracillariidae (Gracillariid leaf miners)
<i>Philodora</i> sp. undet. #1

Lycaenidae (Gossamer-winged butterflies)
<i>Udara blackburni</i>
Noctuidae (Underwings, cutworms, and relatives)
<i>Agrotis baliopa</i>
<i>Agrotis ceramophaea</i>
<i>Agrotis dislocata</i>
* <i>Agrotis melanoneura</i>
<i>Agrotis psammophaea</i>
<i>Agrotis xiphias</i>
<i>Agrotis</i> n. sp. (undescribed, small black)
<i>Agrotis</i> n. sp. (undescribed, large black)
<i>Anomis hawaiiensis</i> (rare species)
<i>Haliophyle anthracias</i>
<i>Haliophyle compsias</i>
<i>Haliophyle euclidias</i>
<i>Haliophyle flavistigma</i>
<i>Haliophyle niphadopa</i>
<i>Peridroma albiorbis</i>
<i>Peridroma coniotis</i>
<i>Schrankia sarothrura</i>
<i>Schrankia simplex</i>
Nymphalidae (Brushfooted butterflies)
<i>Venessa tameamea</i>
Oecophoridae (Oecophorid moths)
<i>Thyrocopa indecora</i>
<i>Thyrocopa</i> sp. undet. #1
Olethreutidae
<i>Cydia walsinghamii</i>
<i>Cydia</i> sp. undet. #1 (rust & black scales on brown background)
Pyralidae (Pyralids)
<i>Homoeosoma alboparsum</i>
Sphingidae (Hawkmoths)
<i>Hyles wilsoni</i>
Tortricidae (Leaf rollers, leaf tiers)
<i>Bactra</i> sp. (non-native?)
<i>Eccoptocera</i> sp. undet. #1
<i>Macraesthetica rubigenis</i>
<i>Pararrhaptica longiplicata</i>
<i>Pararrhaptica sublichenoides</i>
<i>Pararrhaptica</i> sp. undet. #1 (black hind wings)

<i>Spheterista pleonectes</i>	
<i>Spheterista</i> sp. undet. #1 (small white/brown speckles)	
Yponomeutidae	
<i>Prays fulvocanella</i>	
ORDER DIPTERA	True flies
Calliphoridae (Blowflies)	
<i>Dyscritomyia</i> spp. (pan trap)	
Dolichopodidae (Long-legged flies)	
<i>Campsicnemus</i> spp. (pan trap)	
Drosophilidae (Pomace flies)	
<i>Drosophila conspicua</i> (rare species)	
<i>Drosophila hawaiiensis</i>	
<i>Drosophila murphyi</i>	
<i>Drosophila sproati</i>	
Muscidae	
<i>Lispocephala</i> sp. at light trap	
Phoridae (Hump-backed flies)	
<i>Megaselia</i> sp. in pan trap	
Pipunculidae (Big-headed fly)	
<i>Cephalops</i> sp. at light trap	
Tephritidae (fruit flies)	
No Data	
Tipulidae	
<i>Limonia</i> sp. at light trap	
ORDER HYMENOPTERA	Wasps, bees, ants
Colletidae (Yellow-faced bees)	
<i>Hylaeus difficilis</i> ?? on <i>Metrosideros polymorpha</i>	
Ichneumonidae (Ichneumon wasps)	
<i>Enicospilus</i> sp. ?? at light trap	
Sphecidae (Square-headed wasp)	
<i>Ectemnius</i> sp. in flight	
Vespidae (Potter wasps)	
<i>Odynerus</i> sp. on lava	

* Rare = Species of Concern

Year 1

Practice Components	NRCS Code	Allowable Cost Share Rate	Practice Application		Estimated costs					Comments/Justification (optional)
			# of Units	Unit	Cost/Unit	Total Cost	Landowner Share	FSP Share	Other funding source share	
Tree shrub site prep	490 Tree/Shrub Site Prep	\$400-\$1,000	3	acre	\$1,000.00	\$3,000.00	\$1,500.00	\$1,500.00		Endangered species site prep
Nutrient management	590 Nutrient Management	\$100-\$700	3	acre	\$700.00	\$2,100.00	\$1,050.00	\$1,050.00		Endangered species fertilizing
Tree shrub establishment	612 Tree/Shrub Establishment	\$1.00-\$12.00	200	seedling	\$12.00	\$2,400.00	\$1,200.00	\$1,200.00		Endangered species seedling purchase
Weed control	315 Herbaceous Weed control	\$200-\$600	3	acre	\$600.00	\$1,800.00	\$900.00	\$900.00		Endangered species weed control
Weed control	314 Brush Management	\$200-\$600	50	acre	\$400.00	\$20,000.00	\$10,000.00	\$10,000.00		High priority weeds in the Honomaliu unit
Fuelbreak	383 Fuelbreak	\$300-\$1,000	32	acre	\$500.00	\$16,000.00	\$8,000.00	\$8,000.00		Fire prevention
Forest Stand Improvement	666 Forest Stand Improvement	\$200-\$1,000	12	acre	\$1,000.00	\$12,000.00	\$6,000.00	\$6,000.00		Tree thinning
Forest Health and Protection		quotes needed	1	acre/tree/unit	\$10,000.00	\$10,000.00	\$5,000.00	\$5,000.00		Animal control
Monitoring	472 Access Control	\$20-\$150	48	acre	\$1,333.34	\$64,000.32	\$32,000.00	\$32,000.00		Fence inspections
Monitoring	645 Upland Wildlife Habitat Management	\$20-\$150	4000	acre	\$4.00	\$16,000.00	\$8,000.00	\$8,000.00		Wildfire monitoring and firecam system maintenance
TOTALS			-	-	-	\$147,300.32	\$73,650.00	\$73,650.00		-

Year 2

Practice Components	NRCS Code	Allowable Cost Share Rate	Practice Application		Estimated costs					Comments/Justification (optional)
			# of Units	Unit	Cost/Unit	Total Cost	Landowner Share	FSP Share	Other funding source share	
Tree shrub site prep	490 Tree/Shrub Site Prep	\$400-\$1,000	3	acre	\$1,000.00	\$3,000.00	\$1,500.00	\$1,500.00		Endangered species site prep
Nutrient management	590 Nutrient Management	\$100-\$700	3	acre	\$700.00	\$2,100.00	\$1,050.00	\$1,050.00		Endangered species fertilizing
Tree shrub establishment	612 Tree/Shrub Establishment	\$1.00-\$12.00	200	seedling	\$12.00	\$2,400.00	\$1,200.00	\$1,200.00		Endangered species seedling purchase
Weed control	315 Herbaceous Weed control	\$200-\$600	3	acre	\$600.00	\$1,800.00	\$900.00	\$900.00		Endangered species weed control
Weed control	314 Brush Management	\$200-\$600	50	acre	\$400.00	\$20,000.00	\$10,000.00	\$10,000.00		High priority weeds in the Honomaliu unit
Fuelbreak	383 Fuelbreak	\$300-\$1,000	32	acre	\$500.00	\$16,000.00	\$8,000.00	\$8,000.00		Fire prevention
Forest Stand Improvement	666 Forest Stand Improvement	\$200-\$1,000	12	acre	\$1,000.00	\$12,000.00	\$6,000.00	\$6,000.00		Tree thinning
Forest Health and Protection		quotes needed	1	acre/tree/unit	\$10,000.00	\$10,000.00	\$5,000.00	\$5,000.00		Animal control
Monitoring	472 Access Control	\$20-\$150	48	acre	\$1,333.34	\$64,000.00	\$32,000.00	\$32,000.00		Fence inspections
Monitoring	645 Upland Wildlife Habitat Management	\$20-\$150	4000	acre	\$4.00	\$16,000.00	\$8,000.00	\$8,000.00		Wildfire monitoring and firecam maintenance
TOTALS	-	-	-	-	-	\$147,300.00	\$73,650.00	\$73,650.00		-

Year 3

Practice Components	NRCS Code	Allowable Cost Share Rate	Practice Application		Estimated costs					Comments/Justification (optional)
			# of Units	Unit	Cost/Unit	Total Cost	Landowner Share	FSP Share	Other funding source share	
Tree shrub site prep	490 Tree/Shrub Site Prep	\$400-\$1,000	3	acre	\$1,000.00	\$3,000.00	\$1,500.00	\$1,500.00		Endangered species site prep
Nutrient management	590 Nutrient Management	\$100-\$700	3	acre	\$700.00	\$2,100.00	\$1,050.00	\$1,050.00		Endangered species fertilizing
Tree shrub establishment	612 Tree/Shrub Establishment	\$1.00-\$12.00	200	seedling	\$12.00	\$2,400.00	\$1,200.00	\$1,200.00		Endangered species seedling purchase
Weed control	315 Herbaceous Weed control	\$200-\$600	3	acre	\$600.00	\$1,800.00	\$900.00	\$900.00		Endangered species weed control
Weed control	314 Brush Management	\$200-\$600	50	acre	\$400.00	\$20,000.00	\$10,000.00	\$10,000.00		High priority weeds in the Honomalino unit
Fuelbreak	383 Fuelbreak	\$300-\$1,000	32	acre	\$500.00	\$16,000.00	\$8,000.00	\$8,000.00		Fire prevention
Forest Stand Improvement	666 Forest Stand Improvement	\$200-\$1,000	12	acre	\$1,000.00	\$12,000.00	\$6,000.00	\$6,000.00		Tree thinning
Forest Health and Protection		quotes needed	1	acre/tree/unit	\$10,000.00	\$10,000.00	\$5,000.00	\$5,000.00		Animal control
Monitoring	472 Access Control	\$20-\$150	48	acre	\$1,333.34	\$64,000.00	\$32,000.00	\$32,000.00		Fence inspections
Monitoring	645 Upland Wildlife Habitat Management	\$20-\$150	4000	acre	\$4.00	\$16,000.00	\$8,000.00	\$8,000.00		Wildfire monitoring and firecam maintenance
TOTALS	-	-	-	-	-	\$147,300.00	\$73,650.00	\$73,650.00		-

Year 4

Practice Components	NRCS Code	Allowable Cost Share Rate	Practice Application		Cost/Unit	Total Cost	Landowner Share	FSP Share	Other funding source share	Comments/Justification (optional)
			# of Units	Unit						
Tree shrub site prep	490 Tree/Shrub Site Prep	\$400-\$1,000	3	acre	\$1,000.00	\$3,000.00	\$1,500.00	\$1,500.00		Endangered species site prep
Nutrient management	590 Nutrient Management	\$100-\$700	3	acre	\$700.00	\$2,100.00	\$1,050.00	\$1,050.00		Endangered species fertilizing
Tree shrub establishment	612 Tree/Shrub Establishment	\$1.00-\$12.00	200	seedling	\$12.00	\$2,400.00	\$1,200.00	\$1,200.00		Endangered species seedling purchase
Weed control	315 Herbaceous Weed control	\$200-\$600	3	acre	\$600.00	\$1,800.00	\$900.00	\$900.00		Endangered species weed control
Weed control	314 Brush Management	\$200-\$600	50	acre	\$400.00	\$20,000.00	\$10,000.00	\$10,000.00		High priority weeds in the Honomalino unit
Fuelbreak	383 Fuelbreak	\$300-\$1,000	32	acre	\$500.00	\$16,000.00	\$8,000.00	\$8,000.00		Fire prevention
Forest Stand Improvement	666 Forest Stand Improvement	\$200-\$1,000	12	acre	\$1,000.00	\$12,000.00	\$6,000.00	\$6,000.00		Tree thinning
Forest Health and Protection		quotes needed	1	acre/tree/unit	\$10,000.00	\$10,000.00	\$5,000.00	\$5,000.00		Animal control
Monitoring	472 Access Control	\$20-\$150	48	acre	\$1,333.34	\$64,000.00	\$32,000.00	\$32,000.00		Fence inspections
Monitoring	645 Upland Wildlife Habitat Management	\$20-\$150	4000	acre	\$4.00	\$16,000.00	\$8,000.00	\$8,000.00		Wildfire monitoring and firecam maintenance
TOTALS		-	-	-	-	\$147,300.00	\$73,650.00	\$73,650.00		-

Year 5

Practice Components	NRCS Code	Allowable Cost Share Rate	Practice Application		Estimated costs					Comments/Justification (optional)
			# of Units	Unit	Cost/Unit	Total Cost	Landowner Share	FSP Share	Other funding source share	
Tree shrub site prep	490 Tree/Shrub Site Prep	\$400-\$1,000	3	acre	\$1,000.00	\$3,000.00	\$1,500.00	\$1,500.00		Endangered species site prep
Nutrient management	590 Nutrient Management	\$100-\$700	3	acre	\$700.00	\$2,100.00	\$1,050.00	\$1,050.00		Endangered species fertilizing
Tree shrub establishment	612 Tree/Shrub Establishment	\$1.00-\$12.00	200	seedling	\$12.00	\$2,400.00	\$1,200.00	\$1,200.00		Endangered species seedling purchase
Weed control	315 Herbaceous Weed control	\$200-\$600	3	acre	\$600.00	\$1,800.00	\$900.00	\$900.00		Endangered species weed control
Weed control	314 Brush Management	\$200-\$600	50	acre	\$400.00	\$20,000.00	\$10,000.00	\$10,000.00		High priority weeds in the Honomalino unit
Fuelbreak	383 Fuelbreak	\$300-\$1,000	32	acre	\$500.00	\$16,000.00	\$8,000.00	\$8,000.00		Fire prevention
Forest Stand Improvement	666 Forest Stand Improvement	\$200-\$1,000	12	acre	\$1,000.00	\$12,000.00	\$6,000.00	\$6,000.00		Tree thinning
Forest Health and Protection		quotes needed	1	acre/tree/unit	\$10,000.00	\$10,000.00	\$5,000.00	\$5,000.00		Animal control
Monitoring	472 Access Control	\$20-\$150	48	acre	\$1,333.34	\$64,000.00	\$32,000.00	\$32,000.00		Fence inspections
Monitoring	645 Upland Wildlife Habitat Management	\$20-\$150	4000	acre	\$4.00	\$16,000.00	\$8,000.00	\$8,000.00		Wildfire monitoring and firecam maintenance
TOTALS	-	-	-	-	-	\$147,300.00	\$73,650.00	\$73,650.00		-

Year 6

Practice Components	NRCS Code	Allowable Cost Share Rate	Practice Application		Cost/Unit	Total Cost	Landowner Share	FSP Share	Other funding source share	Comments/Justification (optional)
			# of Units	Unit						
Fence	382 Fence	\$5.00-\$14.00	10,560	feet	\$10.00	\$105,600.00			\$105,600.00	Wire replacement for animal exclusion (2 mi.)
Tree shrub site prep	490 Tree/Shrub Site Prep	\$3,000-\$10,400	3	acre	\$1,000.00	\$3,000.00	\$1,500.00	\$1,500.00		Endangered species site prep
Nutrient management	590 Nutrient Management	\$100-\$700	3	acre	\$700.00	\$2,100.00	\$1,050.00	\$1,050.00		Endangered species fertilizing
Tree shrub establishment	612 Tree/Shrub Establishment	\$1.00-\$12.00	200	seedling	\$12.00	\$2,400.00	\$1,200.00	\$1,200.00		Endangered species seedling purchase
Weed control	315 Herbaceous Weed control	\$200-\$600	3	acre	\$600.00	\$1,800.00	\$900.00	\$900.00		Endangered species weed control
Weed control	314 Brush Management	\$200-\$600	50	acre	\$400.00	\$20,000.00	\$10,000.00	\$10,000.00		High priority weeds in the Honomaliino unit
Fuelbreak	383 Fuelbreak	\$300-\$1,000	32	acre	\$500.00	\$16,000.00	\$8,000.00	\$8,000.00		Fire prevention
Forest Stand Improvement	666 Forest Stand Improvement	\$200-\$1,000	12	acre	\$1,000.00	\$12,000.00	\$6,000.00	\$6,000.00		Tree thinning
Forest Health and Protection		quotes needed	1	acre/tree/unit	\$10,000.00	\$10,000.00	\$5,000.00	\$5,000.00		Animal control
Monitoring	472 Access Control	\$20-\$150	48	acre	\$1,333.34	\$64,000.00	\$32,000.00	\$32,000.00		Fence inspections
Monitoring	645 Upland Wildlife Habitat Management	\$20-\$150	4000	acre	\$4.00	\$16,000.00	\$8,000.00	\$8,000.00		Wildfire monitoring and firecam maintenance
TOTALS			-	-	-	\$252,900.00	\$73,650.00	\$73,650.00	\$105,600.00	-

Year 7

Practice Components	NRCS Code	Allowable Cost Share Rate	Practice Application		Cost/Unit	Total Cost	Landowner Share	FSP Share	Other funding source share	Comments/Justification (optional)
			# of Units	Unit						
Fence	382 Fence	\$5.00-\$14.00	10,560	feet	\$10.00	\$105,600.00			\$105,600.00	Wire replacement for animal exclusion (2 mi.)
Tree shrub site prep	490 Tree/Shrub Site Prep	\$3,000-\$10,400	3	acre	\$1,000.00	\$3,000.00	\$1,500.00	\$1,500.00		Endangered species site prep
Nutrient management	590 Nutrient Management	\$100-\$700	3	acre	\$700.00	\$2,100.00	\$1,050.00	\$1,050.00		Endangered species fertilizing
Tree shrub establishment	612 Tree/Shrub Establishment	\$1.00-\$12.00	200	seedling	\$12.00	\$2,400.00	\$1,200.00	\$1,200.00		Endangered species seedling purchase
Weed control	315 Herbaceous Weed control	\$200-\$600	3	acre	\$600.00	\$1,800.00	\$900.00	\$900.00		Endangered species weed control
Weed control	314 Brush Management	\$200-\$600	50	acre	\$400.00	\$20,000.00	\$10,000.00	\$10,000.00		High priority weeds in the Honomaliino unit
Fuelbreak	383 Fuelbreak	\$300-\$1,000	32	acre	\$500.00	\$16,000.00	\$8,000.00	\$8,000.00		Fire prevention
Forest Stand Improvement	666 Forest Stand Improvement	\$200-\$1,000	12	acre	\$1,000.00	\$12,000.00	\$6,000.00	\$6,000.00		Tree thinning
Forest Health and Protection		quotes needed	1	acre/tree/unit	\$10,000.00	\$10,000.00	\$5,000.00	\$5,000.00		Animal control
Monitoring	472 Access Control	\$20-\$150	48	acre	\$1,333.34	\$64,000.00	\$32,000.00	\$32,000.00		Fence inspections
Monitoring	645 Upland Wildlife Habitat Management	\$20-\$150	4000	acre	\$4.00	\$16,000.00	\$8,000.00	\$8,000.00		Wildfire monitoring and firecam maintenance
TOTALS		-	-	-	-	\$252,900.00	\$73,650.00	\$73,650.00	\$105,600.00	-

Year 8

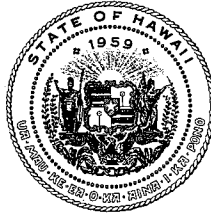
Practice Components	NRCS Code	Practice Application		Estimated costs					Comments/Justification (optional)
		# of Units	Unit	Cost/Unit	Total Cost	Landowner Share	FSP Share	Other funding source share	
Fence	382 Fence	10,560	feet	\$10.00	\$105,600.00			\$105,600.00	Wire replacement for animal exclusion (2 mi.)
Tree shrub site prep	490 Tree/Shrub Site Prep	3	acre	\$1,000.00	\$3,000.00	\$1,500.00	\$1,500.00		Endangered species site prep
Nutrient management	590 Nutrient Management	3	acre	\$700.00	\$2,100.00	\$1,050.00	\$1,050.00		Endangered species fertilizing
Tree shrub establishment	612 Tree/Shrub Establishment	200	seedling	\$12.00	\$2,400.00	\$1,200.00	\$1,200.00		Endangered species seedling purchase
Weed control	315 Herbaceous Weed control	3	acre	\$600.00	\$1,800.00	\$900.00	\$900.00		Endangered species weed control
Weed control	314 Brush Management	50	acre	\$400.00	\$20,000.00	\$10,000.00	\$10,000.00		High priority weeds in the Honomaliu unit
Fuelbreak	383 Fuelbreak	32	acre	\$500.00	\$16,000.00	\$8,000.00	\$8,000.00		Fire prevention
Forest Stand Improvement	666 Forest Stand Improvement	12	acre	\$1,000.00	\$12,000.00	\$6,000.00	\$6,000.00		Tree thinning
Forest Health and Protection		1	acre/tree/unit	\$10,000.00	\$10,000.00	\$5,000.00	\$5,000.00		Animal control
Monitoring	472 Access Control	48	acre	\$1,333.34	\$64,000.00	\$32,000.00	\$32,000.00		Fence inspections
Monitoring	645 Upland Wildlife Habitat Management	4000	acre	\$4.00	\$16,000.00	\$8,000.00	\$8,000.00		Wildfire monitoring and firecam maintenance
TOTALS		-	-	-	\$252,900.00	\$73,650.00	\$73,650.00	\$105,600.00	-

Year 9

Practice Components	NRCS Code	Allowable Cost Share Rate	Practice Application		Cost/Unit	Total Cost	Landowner Share	FSP Share	Other funding source share	Comments/Justification (optional)
			# of Units	Unit						
Fence	382 Fence	\$5.00-\$14.00	10,560	feet	\$10.00	\$105,600.00			\$105,600.00	Wire replacement for animal exclusion (2 mi.)
Tree shrub site prep	490 Tree/Shrub Site Prep	\$3,000-\$10,400	3	acre	\$1,000.00	\$3,000.00	\$1,500.00	\$1,500.00		Endangered species site prep
Nutrient management	590 Nutrient Management	\$100-\$700	3	acre	\$700.00	\$2,100.00	\$1,050.00	\$1,050.00		Endangered species fertilizing
Tree shrub establishment	612 Tree/Shrub Establishment	\$1.00-\$12.00	200	seedling	\$12.00	\$2,400.00	\$1,200.00	\$1,200.00		Endangered species seedling purchase
Weed control	315 Herbaceous Weed control	\$200-\$600	3	acre	\$600.00	\$1,800.00	\$900.00	\$900.00		Endangered species weed control
Weed control	314 Brush Management	\$200-\$600	50	acre	\$400.00	\$20,000.00	\$10,000.00	\$10,000.00		High priority weeds in the Honomaliu unit
Fuelbreak	383 Fuelbreak	\$300-\$1,000	32	acre	\$500.00	\$16,000.00	\$8,000.00	\$8,000.00		Fire prevention
Forest Stand Improvement	666 Forest Stand Improvement	\$200-\$1,000	12	acre	\$1,000.00	\$12,000.00	\$6,000.00	\$6,000.00		Tree thinning
Forest Health and Protection		quotes needed	1	acre/tree/unit	\$10,000.00	\$10,000.00	\$5,000.00	\$5,000.00		Animal control
Monitoring	472 Access Control	\$20-\$150	48	acre	\$1,333.34	\$64,000.00	\$32,000.00	\$32,000.00		Fence inspections
Monitoring	645 Upland Wildlife Habitat Management	\$20-\$150	4000	acre	\$4.00	\$16,000.00	\$8,000.00	\$8,000.00		Wildfire monitoring and firecam maintenance
TOTALS		-	-	-	-	\$252,900.00	\$73,650.00	\$73,650.00	\$105,600.00	-

Year 10

Practice Components	NRCS Code	Allowable Cost Share Rate	Practice Application		Estimated costs					Comments/Justification (optional)
			# of Units	Unit	Cost/Unit	Total Cost	Landowner Share	FSP Share	Other funding source share	
Fence	382 Fence	\$5.00-\$14.00	10,560	feet	\$10.00	\$105,600.00			\$105,600.00	Wire replacement for animal exclusion (2 mi.)
Tree shrub site prep	490 Tree/Shrub Site Prep	\$3,000-\$10,400	3	acre	\$1,000.00	\$3,000.00	\$1,500.00	\$1,500.00		Endangered species site prep
Nutrient management	590 Nutrient Management	\$100-\$700	3	acre	\$700.00	\$2,100.00	\$1,050.00	\$1,050.00		Endangered species fertilizing
Tree shrub establishment	612 Tree/Shrub Establishment	\$1.00-\$12.00	200	seedling	\$12.00	\$2,400.00	\$1,200.00	\$1,200.00		Endangered species seedling purchase
Weed control	315 Herbaceous Weed control	\$200-\$600	3	acre	\$600.00	\$1,800.00	\$900.00	\$900.00		Endangered species weed control
Weed control	314 Brush Management	\$200-\$600	50	acre	\$400.00	\$20,000.00	\$10,000.00	\$10,000.00		High priority weeds in the Honomali unit
Fuelbreak	383 Fuelbreak	\$300-\$1,000	32	acre	\$500.00	\$16,000.00	\$8,000.00	\$8,000.00		Fire prevention
Forest Stand Improvement	666 Forest Stand Improvement	\$200-\$1,000	12	acre	\$1,000.00	\$12,000.00	\$6,000.00	\$6,000.00		Tree thinning
Forest Health and Protection		quotes needed	1	acre/tree/unit	\$10,000.00	\$10,000.00	\$5,000.00	\$5,000.00		Animal control
Monitoring	472 Access Control	\$20-\$150	48	acre	\$1,333.34	\$64,000.00	\$32,000.00	\$32,000.00		Fence inspections
Monitoring	645 Upland Wildlife Habitat Management	\$20-\$150	4000	acre	\$4.00	\$16,000.00	\$8,000.00	\$8,000.00		Wildfire monitoring and firecam maintenance
TOTALS		-	-	-	-	\$252,900.00	\$73,650.00	\$73,650.00	\$105,600.00	-



**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES**

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

May 25, 2018

DECLARATION OF EXEMPTION

Regarding the preparation of an environmental assessment under the authority of
Chapter 334, HRS and Chapter 11-200-8, HAR

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

JEFFREY T. PEARSON, P.E.
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

Project Title:	Kona Hema Forest Stewardship Management Plan and Forest Stewardship Agreement with The Nature Conservancy
Project Number:	N/A
Project Location:	Tax Map Key Numbers (3) 8-8-001:001, (3) 8-9-001:001, (3) 8-9-006:030, (3) 8-9-006:031, (3) 8-9-006:033; South Kona District, Hawaii County, Hawaii
Chapter 343 Trigger(s):	Use of State Funds
Project Description:	<p>Forest Stewardship Agreement and associated management plan for the native forest restoration at Kona Hema. The project proposes to actively manage and restore approximately 8,072.7 acres characterized as having a koa/‘ōhi’a montane mesic forest and ‘ōhi’a montane wet forest. The native vegetation has been degraded by logging, grazing, lava flows, and fire. The primary objectives are to protect watershed values, promote the recovery of native plants, animals, and natural communities, and explore and demonstrate the potential of compatible economic activities.</p> <p>Over the course of the 10-year management plan, The Nature Conservancy (TNC) intends to promote the recovery and protection of the native forest primarily within their Honomalino (4,021 acres) management unit by maintaining and enhancing their current restoration efforts. Proposed management activities include fence maintenance, as well as monitoring for ungulate activity and fence damage. Weed control will be addressed in the Honomalino unit, and changes to the native vegetation and the abundance of invasive species will be surveyed and documented yearly. A dense 240-acre stand of strawberry guava in the Papa unit will be treated with herbicides over a course of five years. Wildfire prevention will include fuelbreak maintenance that will occur every six months for the full 10 years, and the maintenance of a fire-camera operated by TNC that provides early detection of wildfires for the entire region. TNC is collaborating with Hawai’i Plant Extinction Prevention Program to establish endangered</p>

	<p>species in the Honomalino unit. Loulu palms, (<i>Pritchardia schattaueri</i>), mehamehame (<i>Flueggea neowawraea</i>), haha (<i>Cyanea marksiii</i>), haha (<i>C. stictophylla</i>) and other species will be planted, with the goal of planting approximately 200 endangered plants annually. Active maintenance of the endangered plants will include monitoring, watering, and weed control. Approximately 330 acres in the Honomalino unit were scarified between 2003 and 2009, and are now overstocked with koa saplings. A 58 acre plot will be treated with tree thinning practices to remove a portion of the saplings and increase growth rates of selected crop trees.</p>
Consulted Parties:	<p>U.S. Department of Agriculture, Natural Resources Conservation Service; U.S. Department of Interior, Fish and Wildlife Service; Department of Land and Natural Resources Commission on Water Resource Management; County of Hawaii, Department of Planning</p>
Authorization:	<p>Approved by the Environmental Council on June 5, 2015</p>
Exemption Class & Description:	<p>Activities and actions associated with this project fall under the following Exemption Classes and Descriptions which are included in the Exemption List for the Department of Land and Natural Resources.</p> <p>http://oeqc2.doh.hawaii.gov/Agency_Exemption_Lists/State-Department-of-Land-and-Natural-Resources-Exemption-List-2015-06-05.pdf</p> <p>Exemption Class No. 1, Item 4, Fire management activities, including prevention and restoration measures, when conducted in accordance with Departmental and Division procedures.</p> <p>Exemption Class No. 1, Item 14, Operation, repair or maintenance of existing fire tool caches, fuel breaks, and helispots.</p> <p>Exemption Class No. 1, Item 34, Routine pruning, trimming, thinning, and removal of trees, excluding commercial logging.</p> <p>Exemption Class No. 2, Item 8, Replacement or reconstruction of existing bollards, walls, gates, fences, lighting and other similar items necessary for the security or continued operation of a facility or structure.</p> <p>Exemption Class No. 3, Item 1, Fences around or to manage rare, threatened or endangered plants, covered or open areas for endangered species, game birds and mammals, auxiliary buildings for food or equipment storage, incubators and brooders, open-top breeding and release pens, field aviaries, and hacking boxes, and for watershed and native forest management and restoration.</p> <p>Exemption Class No. 4, Item 6, Minor vegetation clearing and</p>

	<p>management, including mowing, pruning, trimming, and application of federal and state approved herbicides in conformance with label instructions.</p> <p>Exemption Class No. 4, Item 8, Removal of invasive vegetation utilizing cutting, mowing, application of federal and state approved herbicides in conformance with label instructions, distribution of biocontrol agents approved by the State of Hawaii, and other approved methods.</p> <p>Exemption Class No. 4, Item 12, Establish temporary or permanent vegetative cover including trees, shrubs, grasses, and sod for landscaping, reforestation, soil stabilization, watershed protection, native wildlife habitat, native ecosystem restoration, and rare plant preservation; provided, however, that this exemption shall not apply to vegetation that is likely to be invasive or for tree plantings for which harvesting is planned or is reasonably foreseeable.</p> <p>Exemption Class No. 4, Item 13, Gathering plant seed, cuttings, or other vegetative matter for propagation.</p> <p>Exemption Class No. 4, Item 16, Control of pests utilizing federal and state approved pesticides, herbicides, fungicides, and toxicants in conformance with label instructions; traps, snares, lures, and repellents; distribution of biocontrol agents approved by the state of Hawaii; and other approved methods.</p> <p>Exemption Class No. 4, Item 22, Natural resource management actions that the Department declares are designed specifically to monitor, conserve, or enhance the status of native species or native species' habitats, such as removal of introduced vegetation, reintroduction of native species into their historic range, or construction of fencing. This exemption would not apply to biocontrol of invasive species or commercial logging.</p>
Determination:	<p>The Board of Land and Natural Resources declares that this project will likely have minimal or no significant impact on the environment and is therefore exempt from the preparation of an environmental assessment under the above exemption classes.</p>

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

Date