State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Forestry and Wildlife

December 8, 2023

Chairperson and Members
Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

Land Board Members:

SUBJECT: AUTHORIZATION OF FUNDING FOR THE NATURE CONSERVANCY FOR $965,197 DURING FY 25-30 FOR CONTINUED ENROLLMENT IN THE NATURAL AREA PARTNERSHIP PROGRAM AND ACCEPTANCE AND APPROVAL OF THE KAʻŪ PRESERVE LONG RANGE MANAGEMENT PLAN, TMK 3-9-7-001:002, 003, 004, 007, HAWAIʻI

BACKGROUND:

The State's Natural Area Partnership Program was established in 1991 and provides matching funds (2:1 State to private) for the management of qualified private lands that have been permanently dedicated to conservation (Hawai'i Revised Statutes § 195-6.5).

The attached Long-Range Management Plan (LRMP) for Fiscal Years 2025-2030 provides a detailed description of the natural resources protected in the Preserve and the management activities planned over the next six years. Although Natural Area Partnership agreements are made in perpetuity, funding is authorized on a six-year basis to allow for regular periodic State and public review.

A Finding of No Significant Impact was issued for this project in 2006, which includes all activities proposed in this continuing LRMP.

RECOMMENDATIONS:

That the Board:

1) Approve the Kaʻū Preserve Long-Range Management Plan submitted for Fiscal Years 2025-2030.

2) Authorize the matching funding for the management of the Kaʻū Preserve for the full six-year period as outlined in the Long-Range Management Plan for Fiscal Years 2025-2030; and

3) Authorize the Chairperson to negotiate and sign a Partnership Agreement with The Nature Conservancy, subject to approval as to form by the Attorney General's office.

Respectfully submitted,

DAVID G. SMITH, Administrator
Division of Forestry and Wildlife

APPROVED FOR SUBMITTAL:

DAWN N. S. CHANG, Chairperson
Board of Land and Natural Resources

Attachment

Kaʻū Preserve

Hawaiʻi Island, Hawaiʻi

Long-Range Management Plan
Fiscal Years 2025-2030

Submitted to
Hawaiʻi Department of Land and Natural Resources
Natural Area Partnership Program

Submitted by

The Nature Conservancy – Hawaiʻi and Palmyra Chapter
December 2023

CONTENTS

LIST OF TABLES AND FIGURES

EXECUTIVE SUMMARY

The Nature Conservancy, Hawai‘i and Palmyra chapter, (TNCHP) is an affiliate of The Nature Conservancy (TNC), an international, private, non-profit conservation organization with a mission to conserve the lands and waters on which all life depends. Established in 1980, TNC's Hawai‘i and Palmyra program manages 40 thousand acres and has influenced the management of over 2 million acres of natural lands and has grown to include Palmyra Atoll. We currently manage 14 preserves and other sites in Hawai‘i and Palmyra Atoll. In Hawai‘i, we work with government agencies, private landowners, businesses, community partners and local stakeholders to protect and restore Hawai‘i's native watershed forests, coral reefs, and nearshore fisheries for both their ecological value and the many benefits they provide to people.
In total, TNC owns or manages 12,800 acres across Hawai‘i Island. Our primary conservation work for this project will occur at TNC's Ka‘ū Preserve. Our forest conservation priorities at Ka'u Preserve are to: 1) protect Hawai‘i's remaining native forests and ensure they are managed as functioning watersheds and habitat for native species that are resilient to climate change; 2) address the threats that invasive species pose to their health, our economy and way of life; 3) develop, pilot, and/or standardize innovative tools and technologies to make conservation work more efficient; and 4) ensure community access to and benefit from the Ka'u Forest Reserve.

The State's Natural Area Partnership Program (NAPP) is an innovative program that aids private landowners in the management of their native ecosystems. NAPP provides matching funds ($2 state to $1 private) for the management of qualified private lands that have been permanently dedicated to conservation. TNCHP is seeking reauthorization of NAPP funding for the next six-year period for the programs described within this *Ka‘ū Preserve FY2025–FY2030 Long-Range Management Plan*. This plan continues the programs implemented under the previous plans and Environmental Assessment (TNC, 2006-09-23-HA-FEA-KAU-PRESERVE-NATURAL-AREA-PARTNERSHIP). Herein, we request $807,133 over six years in matched state funds for the six years spanning FY2025–2030. Due to higher management costs resulting from a 67% increase in acreage managed resulting from construction of the 2016 Maka'ālia fence unit (funded through NAPP and FWS Partners Program), we request an increase in funding over the FY2025–2030 Ka‘ū LRMP, shown as a separate line item. This plan was prepared in compliance with the NAPP agreement between the state, TNCH, and Hawai‘i Administrative Rules Chapter 13-210.

The state Department of Land and Natural Resources (DLNR), which administers the NAPP, is kept apprised of our progress in the preserve through data reporting and an annual inspection. Semiannual and annual reports are submitted in February and September, respectively. These documents are posted on the DLNR NAPP website.

The first section of this plan is a brief overview of the native natural resources that are protected at Ka‘ū Preserve. In the second section are management considerations that have

shaped our programs. Finally, each management program is discussed in turn. Program goals are followed by an explanation of the management method we have chosen. Annual objectives and costs for each program from FY2025–2030 are also listed.

Activities covered under this long-range plan will focus on: maintaining zero levels of ungulates across the Preserve; maintaining the eight miles of fences built in 2008 and 2016, other fences, and gully and gulch barriers; invasive plant mapping and control; threat and resource monitoring; support for partner surveys and monitoring; improvements and utilization of innovation for management; and infrastructure maintenance (workshop and remote camp facilities, landings zones and trails).

We successfully implemented the resource management projects of the previous six-year long-range plan, as well as many others. See Table 1 and Appendix 1.

Table 1. Overview of Ka‘ū Preserve Accomplishments by Program, FY 2019 - 2023 (5 years)

	Indicator	Measure of Success
Ungulate Control	Total pig catches	30 pigs within Preserve fences, 582 in Manukā Natural Area Reserve
	Total community volunteer hunt pig catches	86 pigs in Ka‘ū Forest Reserve
	Miles of fence constructed and maintained	8 miles maintained with 1.5 miles replaced
Invasive Plant Control	Acres of priority invasive plants treated or removed	47 acres and semiannual treatment of 15 miles of roads and 8 miles of fence
Resource Monitoring	Frequency of ungulate sign on ungulate transects	Reduction from 80 to 0 percent ungulate sign on transects
Rare Species Protection and Research		
	Number of species outplanted and recovered	19 endangered *loulu* outplanted, 4 reproducing *loulu* located
	Number of research projects supported in Ka‘ū	10
Outreach	Total volunteer hunts coordinated	115
	Numbers of visitors or public educated	1,084
	Total volunteer hours	3,339 volunteer & 1,159 partner hours

Ka‘ū Preserve’s FY2019–2023 accomplishments include maintaining 1,200 acres at Kaiholena in zero tolerance ungulates (ZTU) since January 2009, and reaching and maintaining ZTU in 800 additional acres in 2019. Forty-seven acres have been cleared of habitat-modifying weeds and an additional 18-acres are treated semiannually along preserve roads, fences and trails.

Beginning in September 2018, 64 Goodnature A24 rat trap stations were in use controlling rats and mongoose in a ~3-acre grid at founder populations of *Pittosporum hawaiiense* and at two stands of *Pritchardia lanigera*. The spread of Rapid ʻŌhiʻa Death (ROD) was assessed by collecting high resolution aerial imagery of overstory, revisiting of 6 long term USFS monitoring plots, and sampling of suspect trees.

164 *Pritchardia lanigera* seedlings outplanted at Kaiholena in 2016 were monitored and many dozens more observed sprouting beneath two groves of founder palms. 10 research projects were facilitated, and TNC hosted two Kaʻū community youth through Kupu's Extended Internship Program (one for two years and the second for three), continued a weekend community hunting program, volunteer workdays, educational hikes for students, and supported conservation efforts through participation in community events. In FY2019, just over a mile of severely rusted VOG-affected fence was replaced to ensure that the recovery of the understory continues.

In 2007, TNCH staff installed nine kilometers of ungulate transects both in the Preserve and adjacent Kaʻū State Forest Reserve. The initial data showed ground disturbance in 72% of the area surveyed, with 80% for stations in Kaiholena unit alone. After the 1,200-acre ungulate fence was completed, successful eradication efforts resulted in zero ungulate sign within the fenced area from January 2009 to January 2021. To maintain these gains, routine fence checks are conducted on a bi-weekly basis, and all breaches caused by tree fall repaired.

In 2016 an additional 2.5 miles of fence was built adjoining the pig-free lower Kaiholena unit. The 800-acre Makaʻālia fence unit was completed in January 2016, linking together a one-mile wide corridor of protected forest from 1,800 to 4,500 feet elevation adjacent to Kaʻū Forest Reserve's planned 12,000 acre fenced management area.

In FY17 new fence construction expanded our ZTU protected watershed at Kaiholena by an additional 68% with no increase in State NAPP funding. Federal Fish and Wildlife Service funding was sourced over the past four years to support quarterly remote fence and ungulate transect monitoring, heliops, predator control efforts in groves of listed endangered trees, and targeted incipient weed control work. Three major wind events occurring in the first quarter of 2023 resulted in breaches and pig ingress that now must be addressed through bi-monthly if not monthly weeklong camp trips to repair damaged fences, set and bait traps, and replace storm-damaged heavy tarps at gully crossings.

Construction of these ungulate fences stands as our most important project to date, having resulted in significant regeneration of the understory. Native seedlings and mosses have filled in former wallows and pig trails, and species usually observed growing epiphytically such as *Trematolobelia wimmeri* and *Lobelia hypoleuca* have carpeted open sections of trail along the fence.

The hunter access program has resulted in 115 hunts which has effectively reduced ungulate pressure outside of the fence unit and provides for a productive outreach opportunity between TNC staff and Kaʻū hunters.

Over the next six-year period, we will focus on the following programs and goals. Details are discussed in each program section:

1. **Ungulate control** – The Nature Conservancy's primary management activity in Kaʻū will be to reduce feral ungulate levels through use of standard management tools, thereby maintaining forest integrity, reducing erosion, and limiting weed invasion. Pigs are the primary targets of our removal programs, while mouflon sheep, goats, and Axis deer will also be targeted if they occur in the preserve. Innovative technologies will be used to achieve these management goals using real-time GPS tracking collars, cellular-linked game cameras, and remotely operated traps. Ungulate monitoring transects will be read to measure the success of our techniques, and presence of pig sign will be documented during routine field operations.

2. **Invasive Plant Control** – The goal of this program is to control high-priority invasive plants in the preserve, and prevent the introduction and spread of problem weeds to areas where they are not currently established. As part of our routine management program, the Conservancy will survey for and maintain data of habitat-modifying weeds and initiate control at strategic locations. Priority weed control areas along the Kaʻū Forest Reserve's lower boundary will be identified and controlled in collaboration with the Three Mountain Alliance (TMA) watershed plan.

3. **Resource Monitoring** – Monitoring is imperative to providing data that can be used to guide management programs at Kaʻū Preserve. Our goal is to monitor changes in the integrity of the ecosystems in and around the preserve and to determine whether critical threats to those ecosystems are increasing or decreasing. We will use these data to gauge the effectiveness of our conservation strategies. Aerial imagery will be collected by unmanned aerial vehicle (UAV) and analyzed to identify priority areas for control.

4. **Rare Species Protection and Research** – To date, seven rare plant species, four rare bird species, and the endangered Hawaiian hoary bat have been observed in Kaʻū Preserve. Additional rare species reported from adjacent lands and similar habitats are likely to be found in Kaʻū Preserve with future surveys. Our goal is to prevent the extirpation of rare species in the preserve and to encourage research, predator control, and captive propagation of rare plant and bird species. Protecting habitat essential to the majority of the preserve's native plants and animals will be our primary protection strategy. We will also assess threats to the rarest species and take measures to protect them, as

needed. Staff will also search for rare plant populations during routine management activities, and rare species maps will be updated on a periodic basis.

5. **Community Outreach** – The main objective of our outreach program is to increase awareness of the Kaʻū Preserve, the Kaʻū watershed and native ecosystems, and to help people understand their importance, threats to them, and efforts to protect them. More specifically, we seek to encourage and facilitate active participation and community pride among the residents of the Kaʻū District in the effective conservation of this special resource. The key strategies for our public outreach include a variety of potential programs, including: environmental education, year-round and summer intern and youth employment, volunteer opportunities, guided trips, community meetings, and hiking and hunting programs.

6. **Watershed Partnerships –** TNC is a member of, and our preserves are included within, the Three Mountain Alliance (TMA), an extension of the Olaʻa-Kīlauea Partnership. The members of this alliance (consisting of federal, state and private organizations) have coordinated information gathering, management planning, community outreach, and on-the-ground conservation action. Our goal is to participate in the leadership and facilitate further development of the TMA and help to implement initiatives that address the top watershed, forest, and biodiversity threats.

RESOURCES SUMMARY

General Setting

Kaʻū Preserve (Figure 1) was established by TNCHP in 2002 to protect biologically rich and intact forest. It was purchased by the Conservancy from a subsidiary of C. Brewer & Co. Ltd., who had owned the lands for over 100 years. It is contiguous to and within the external boundaries of the State's Kaʻū Forest Reserve on the southeast flank of Mauna Loa volcano, upslope from the coastal agricultural area between Waiʻōhinu and Pāhala in the Kaʻū District of Hawaiʻi Island. The 3,511-acre Preserve, which includes four separate units, is positioned within one of the largest areas of intact forest land in the State, totaling 61,500 acres.

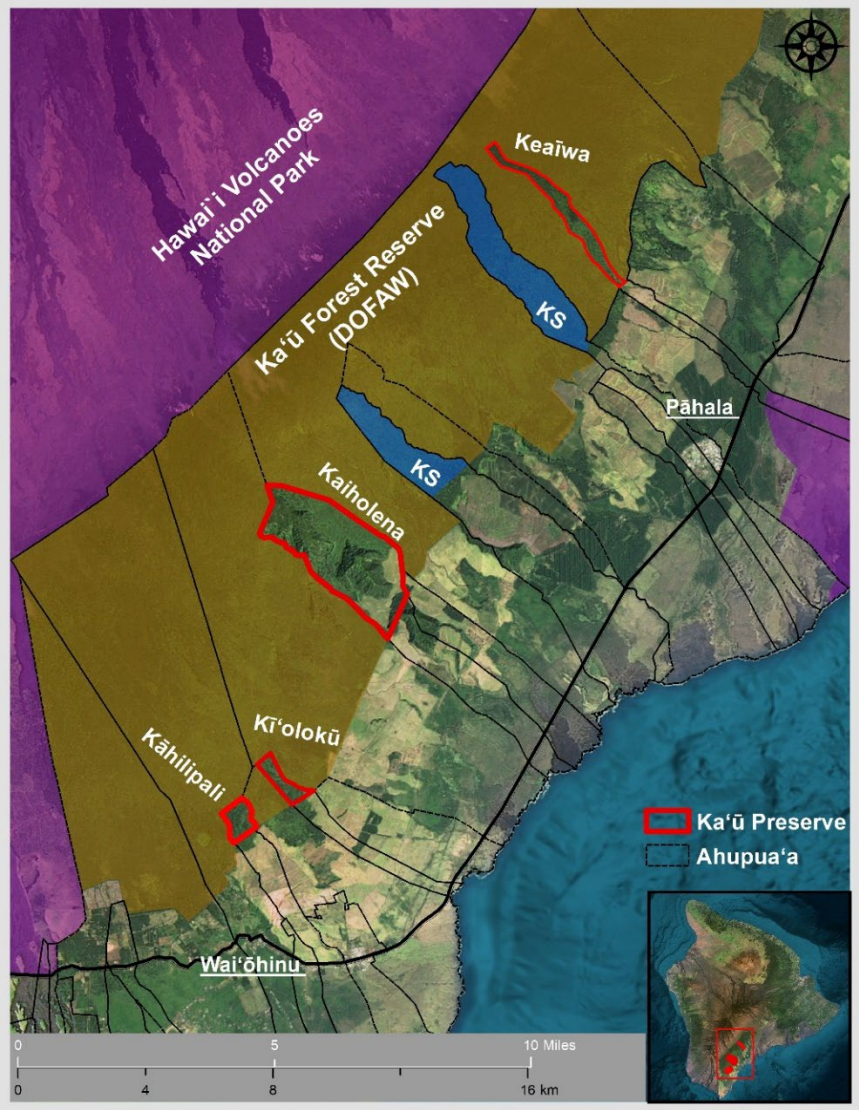


Figure 1: TNC lands outlined in red. Kaʻū Forest Reserve in brown, Volcanoes National Park lands are purple, and Kamehameha School (KS) lands are in blue.

Flora and Fauna

Native Natural Communities

There are four native-dominated natural communities in the Kaʻū Forest Reserve (Figure 2, Appendix 2), and all four are also represented in Kaʻū Preserve:

1. Koa/ʻŌhiʻa Montane Mesic Forest is present at the highest elevation portion of the Keaīwa unit,
2. Koa/ʻŌhiʻa Montane Wet Forest covers the middle portion of the Keaīwa unit,
3. ʻŌhiʻa Montane Wet Forest covers the lower portion of the Keaīwa unit and the upper portion of the Kaiholena unit, and
4. ʻŌhiʻa Lowland Wet Forest covers the lower portion of the Kaiholena unit and all of the Kāhilipali and Kīʻolokū units.

The very high quality of the wet and mesic forest communities in Kaʻū provides a rare opportunity to implement management before it is too late or too costly.

On Hawaiʻi Island, **Koa/ʻŌhiʻa Montane Mesic Forest** is the habitat of the endangered Hawaiian broadbean (*Vicia menziesii*) and a number of rare plant taxa, including members of the genera *Clermontia*, *Phyllostegia*, *Stenogyne*, and *Melicope*. This rare forest type is often important habitat for endangered forest birds. Protected examples of this community are in the Hakalau National Wildlife Refuge and Manukā Natural Area Reserve on Hawaiʻi, and the Kuia Natural Area Reserve on Kauaʻi.

Koa/ʻŌhiʻa Montane Wet Forest occurs on the islands of Kauaʻi, Maui, and Hawaiʻi and is not considered rare. This moderately imperiled forest type has a good representation of ʻōhiʻa and are often rich in native forest birds and invertebrates.

ʻŌhiʻa Montane Wet Forest is one of the most widespread wet forest communities in the Hawaiian Islands. This community type is moderately imperiled, and some occurrences are known to include rare plants, birds, and invertebrates. It is often important habitat for endangered forest birds. The steep slopes of the Kaiholena unit contain a subtype of this community called Wet Cliff, dominated by a mix of ferns and shrubby *ʻōhiʻa*.

In Kaʻū, the **ʻŌhiʻa Lowland Wet Forest** is floristically similar to the ʻŌhiʻa Montane Wet Forest immediately above it in elevation. This community type is moderately imperiled and provides habitat for rare native plants. It is typically not important habitat for endangered forest birds on Hawaiʻi Island due to the presence of mosquitoes associated with its lower elevation. The lower portions of the Kāhilipali and Kīʻolokū units contain a subtype of this community, *ʻŌhiʻa/Uluhe* (*Metrosideros/Dicranopteris*) Fern Forest, which is composed of a nearly continuous blanket of uluhe (*Dicranopteris linearis*) with emergent and widely spaced *ʻōhiʻa* trees.

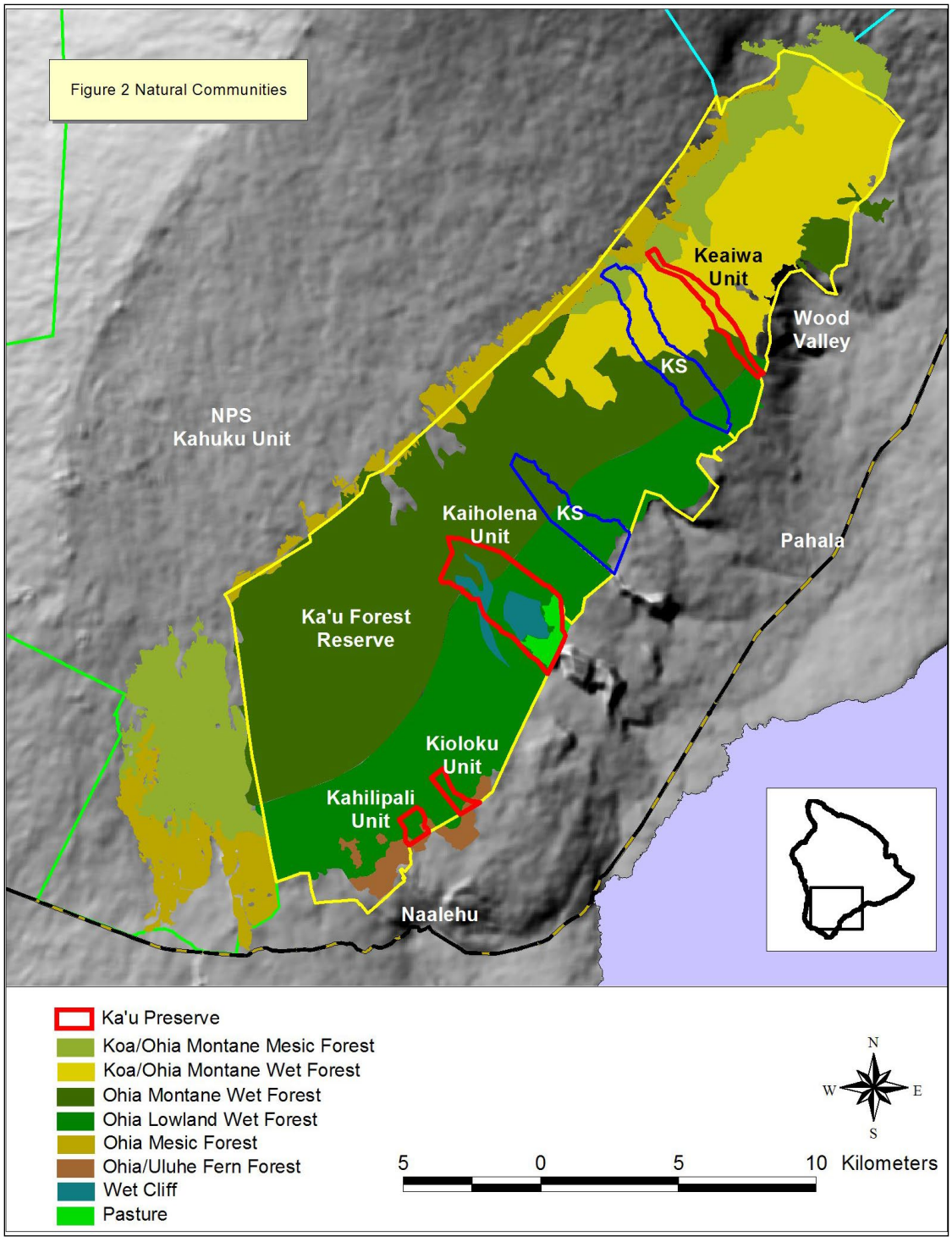


Figure 2: Natural communities located within the Kaʻū Forest Reserve. The area outlined in yellow is the Kaʻū Forest Reserve. Areas outlined in red are TNC managed lands. Outlined in blue are Kamehameha schools lands.

Native Flora

From a statewide perspective, the southeast portion of Mauna Loa (eastern side of the Southwest Rift Zone), is surpassed only by East Maui in the number of different types of ecosystems present. Considering all of its nine ecosystems, this region is home to more extant, endemic species of flowering plants (178 species) than any other region of Hawai‘i Island. In fact, its mesic and wet forest ecosystems alone support 153 endemic plant species. While Ka‘ū Preserve does not contain the full diversity of species found within the region, the majority of the lands are very high quality. A list of native plants that occur in the Kaiholena unit is now being developed (see Appendix 7 for a draft listing of native plants).

Data for rare plants and animals in Ka‘ū come from widely-spaced survey transects, very few of which actually fall within the preserve. Much of the rest of the land, within and outside the preserve, has not been surveyed but almost certainly harbors more rare elements.

Seven rare plant species have been observed in Ka‘ū Preserve. Three species, *Cyanea tritomantha* (listed endangered), *Nothocestrum breviflorum* (listed endangered), and *Phyllostegia vestita* (species of concern) have been reported within the Kaiholena unit: *C. tritomantha*, last observed in Kaiholena in 1912 and *P. vestita*, last observed in Kaiholena in 1961, have never been reported within the nearby Ka‘ū Forest Reserve. Four additional species have been observed in the Kaiholena unit by TNCH staff: *Trematolobelia grandifolia* (species of concern), *Lobelia hypoleuca* (restricted range), and *Strongylodon ruber* (species of concern), and *Pritchardia lanigera* (listed endangered). The mesic and wet forests of the Ka‘ū region are home to at least 22 known species of rare plants. Eleven of these are endangered, five are species of concern, and one has a restricted range.

Many of the plants that occur on Conservancy lands in Ka‘ū are not listed in the State or Federal Register in any of the categories that may make them rare (Appendix 5); however, plants like *Charpentiera obovata* and *Touchardia latifolia* are rare on Hawai‘i Island and/or rare from a population standpoint and will be treated as such with regards to rare species management for this proposal. Subpopulations of *Pritchardia lanigera* near Kaiholena were last observed in 1980 and were thought to be extirpated. However, three small subpopulations were located by TNCH staff working with local hunters and volunteers. This species was listed endangered in 2013 and has been regenerating naturally within the ungulate-free Kaiholena fence unit.

Native Terrestrial Fauna

Four endangered forest birds have been reported in the wet and mesic forests of Ka‘ū: the Hawai‘i ‘Ākepa, the Hawai‘i Creeper or ‘Alawi, the Akiapōlā‘au, the Hawaiian Crow or ‘Alalā, along with the ‘I‘iwi, listed as threatened in 2017 (Appendix 3). In 2020 the ‘Io or Hawaiian Hawk was delisted as endangered and now recognized as Near Threatened. ‘Alalā had been observed within the proposed fence area as recently as the mid-sixties in the valleys above and

below Waterfall, but by 1968 no crows were to be found in either area (Pers. Comm. Alfred Galimba 9/17/2013). Efforts to reintroduce ʻAlalā into the Kaʻū forest began in late 2016 with the release of over a dozen birds to date. Over the past 5 years TNCH has collaborated in targeted outreach within the Kaʻū community in support of protecting habitat in the adjacent Forest Reserve, and through active management have constructed a fenced area providing a 1 mile-wide band of ungulate-free habitat ranging from 1,800' to 4,500' elevation for this critically endangered species.

Endangered Hawaiian hoary bats, ʻŌpeʻapeʻa, have also been observed on the preserve, inhabiting the wet montane forests of Kaʻū and likely roost, forage, and breed in the preserve.

In 2008, USFWS designated 245 acres of critical habitat in two separate areas of Kaʻū Forest Reserve for a species of Picture Wing Fly (*Drosophila heteroneura*), which is unknown in TNCH's Kaʻū Preserve. The intact natural communities of Kaʻū no doubt include hundreds of native invertebrates, the majority of which are endemic to the archipelago, and several of which are likely endemic to the Kaʻū region.

MANAGEMENT

Management Considerations

1. Our primary management focus is to prevent degradation of the native forest by reducing feral ungulate damage, limiting the spread of non-native, habitat-modifying plants, and preventing the introduction of other invasive species. We are also committed to improving community outreach and to continue providing access as required by law for people who want to use the preserve in ways that will not degrade its natural resources.

2. The preserve is divided into four separate units spanning a distance of 12 miles (Figure 1). Each unit shares three boundaries with the State's Kaʻū Forest Reserve, and one boundary with a private landowner who purchased the properties from Kaʻū Agribusiness, a subsidiary of C. Brewer. As a result of sharing the southern (lowland) boundary with private agricultural lands, public access via unimproved roads is somewhat limited, and we carefully coordinate our management and interpretive activities with work in these adjacent agricultural areas.

3. Although the threat of fire is somewhat diminished due to the high level of precipitation on the preserve (approximately 60-120 inches annually), the proximity of the units to paved roads increases the possibility that a fire could start either accidentally or intentionally and affect the Preserve, particularly after a period of drought. Our

participation with the Three Mountain Alliance includes working on a fire initiative with the other Alliance members.

4. The acquisition of Kahuku Ranch by the National Park Service (NPS) creates a mosaic of Kaʻū lands, with four principal landowners, all sharing a mandate for conservation and management of Hawaiʻi's natural resources: The Nature Conservancy, NPS, the State Department of Land and Natural Resources, and Kamehameha Schools. This provides the foundation for collaborative management at the watershed level as an effective way to address shared management challenges and opportunities.

5. There is potential to provide additional public access to the Forest Reserve and the preserve at several points along their lower boundaries, as most access roads are not open to the public at this time. Roads that are currently used by the public to access Kaʻū watershed lands include: Hāʻao Springs Road, Mountain House Road and Lorenzo Road. Access into the upper areas of the preserve is limited by difficult terrain and a lack of roads and trails, so helicopter access is necessary.

6. There is a high level of interest regarding forest management in Kaʻū from various groups of people living near the preserve. This provides a rationale for coordinated community outreach and functional partnerships that promote compatible uses of the forest (e.g., environmental education, recreation, native gathering, hunting, rare species conservation).

7. As provided by law, appropriate access to the preserve for traditional practice will help to mitigate the perception of decreased access. Three gates are available for preserve access on the Kaiholena side and fence step-overs have been installed where needed; the locations were determined in consultation with the community.

Management Areas/Units

Kaʻū Preserve is divided into four separate units: Kāhilipali, Kīʻolokū, Kaiholena, and Keaīwa (Figure 1).

1. The Kāhilipali unit is the smallest (169 acres) and westernmost unit, accessed via the 4WD Mountain House Road. The elevation ranges from approximately 2,400 to 2,640 ft. The annual precipitation is 2,000 mm (79 in). A portion of this unit is zoned Agriculture and the rest is zoned for Conservation (subzone: Resource). Most of the unit contains ʻŌhiʻa Lowland Wet Forest, however the forest in the lower portion of the unit grades into the community subtype ʻŌhiʻa /Uluhe Fern Forest. Portuguese Springs is located in the upper northeast corner, at the head of Alapaʻi Gulch, which runs along the northeast boundary of the unit. A population of Himalayan ginger (*Hedychium gardnerianum*) is found near the Springs, where ongoing TNC and volunteer control efforts have cleared

and maintained 30 acres. A maintained pipeline diagonally traverses the middle of the unit providing a corridor for non-native invasive plants such as guinea grass (*Panicum maximum*), sourbush (*Pluchea carolinensis*) and bamboo orchid (*Arundina graminifolia*), and more serious weeds such as strawberry guava (*Psidium cattleianum*), Koster's curse (*Clidemia hirta*), and Christmas berry (*Schinus terebinthifolius*). Glorybush (*Tibouchina urvilleana*) occurs along the Mountain House Road.

2. The Kīʻolokū unit is the next largest (211 acres) and is located approximately one mile north of the Kāhilipali unit. The elevation ranges from approximately 2,400 to 2,700 ft. The annual precipitation is 2,000 mm (79 in). The lower portion is accessed via ranch roads, while the upper elevation is accessed via the 4WD Mountain House Road. Waiaele Gulch runs along a portion of the northeast boundary of the unit. The forest, like the Kāhilipali unit, is mainly ʻŌhiʻa Lowland Wet Forest, with some areas of ʻŌhiʻa/Uluhe Fern Forest. Glorybush (*Tibouchina urvilleana*) occurs along the Mountain House Road, and weeds such as strawberry guava (*Psidium cattleianum*) and Koster's curse (*Clidemia hirta*) are present in the forest. An incipient population of Himalayan ginger has been cleared and maintained in 24 acres at Kīʻolokū. This unit is zoned for Agriculture.

3. The Kaiholena unit is the largest (approximately 2,620 acres) and is centrally located four miles from the Kīʻolokū unit and six miles from the Keaīwa unit. A puʻu (hill or mount), Kaiholena, rises sharply from its base elevation of 2,000 ft to a height of 3,723 ft and is geologically much older than the surrounding, more gently rolling Mauna Loa flows. Just northwest of the Puʻu Kaiholena, Puʻu Makaʼālia rises to a height of 4,240 ft. and is flanked on three sides by sheer cliffs. At its crest are sphagnum bogs where pollen cores dating back 22,000 years have been documented, and ongoing geological research dates the hill formation as the oldest found on Mauna Loa, at greater than 150,000 years before present. Hīlea Gulch runs between these two puʻu. Old Plantation Springs, a portion of whose water rights are held by the previous owner, is nestled in the southern folds of Puʻu Makaʼālia at approximately 3,500 ft. The annual precipitation is 2,000 mm (79 in) except for a wetter area on the south side of Puʻu Kaiholena which has 3,000 mm (118 in) annual precipitation. A portion of this unit is zoned Agriculture and the rest is zoned for Conservation (subzones: Protective and Resource).

   Directly south of Puʻu Makaʼālia lies Puʻu One (3,220 ft elevation), on State land just outside of the Kaiholena unit boundary. Historically this puʻu was considered with the others as all one place. The western side of Puʻu One is accessed via a 4WD road that leads to a gauging station on one branch of Hīlea Gulch.

   The forest in the lower portion of the Kaiholena unit is ʻŌhiʻa Lowland Wet Forest, becoming *ʻŌhiʻa* Montane Wet Forest at approximately 3,200 ft elevation. Five rare plants have been reported in this unit. Very few weeds have established in Kaiholena.

Those present and still controllable include Japanese anemone (*Anemone hupehensis*), palm grass (*Setaria palmifolia*), and strawberry guava (*Psidium cattleianum*). A large population of Koster's Curse (*Clidemia hirta*) is found in the Lower Hīlea area, and Himalayan ginger (*Hedychium gardnerianum*) is infrequently spotted during routine field operations. *Tibouchina herbacea* is present along the Pu'u One access road, and continues to spread into the surrounding forest. There are 315 acres of former cane land at the base of the Pu'u Kaiholena which have been converted to pasture and are now leased by a local rancher for cattle grazing. The incipient population of silk oak (*Grevillea robusta*) has been eradicated from the pasture. 260 acres of priority weed species have been cleared at Kaiholena since 2006.

4. The Keaīwa unit is the second largest (511 acres) and easternmost unit. Keaīwa Reservoir (on State land) lies at the base of the unit at approximately 3,000 ft elevation. From there the unit stretches mauka. A 6 km-long strip of land, the Keaīwa unit is only 570 m wide at its widest point. Its northern boundary (5,700 ft) is approximately 1 km from the Kahuku unit of Hawai'i Volcanoes National Park. The annual precipitation in the lower portion of the unit is 3,000 mm (118 in), in the middle portion is 2,000 mm (79 in), and in the upper portion is 1,500 mm (59 in). Pi'ikea and Kā'ala'ala Gulches meander in and out of the Keaīwa unit. The uppermost portion of the unit (above 5,300 ft) contains Koa/'Ōhi'a Montane Mesic Forest (50 acres), while much of the rest of the unit consists of Koa/'Ōhi'a Montane Wet Forest, except for lower third of the site (below 4,000 ft) which is 'Ōhi'a Montane Wet Forest and the bottom 50 acres (below 3,400 ft) which are 'Ōhi'a Lowland Wet Forest. The endangered forest bird, Hawai'i 'Ākepa, has been reported in this unit, observed between 4,000 and 5,000 ft elevation in 1995. Several highly invasive plants occur near the Keaīwa Reservoir, including Himalayan ginger (Hedychium *gardnerianum*), night-blooming jasmine (*Cestrum nocturnum*), Japanese anemone (*Anemone hupehensis*), and strawberry guava (*Psidium cattleianum*). In partnership with Ed Olson Trust II, TNCH has treated 6.5 acres for Himalayan ginger along a flume trail north of the reservoir. The nearby village of Wood Valley (2 km away) is heavily infested with plume poppy (*Bocconia frutescens*), and the community there continues to work at containing a population of coqui frogs. This unit is zoned for Conservation (subzone: Protective).

Management Programs

Program 1: Ungulate Control

Program Goal: To reduce ungulate (cattle, pigs, sheep, goats, and axis deer) damage from 2,000 fenced acres of the Kaiholena Unit and in the Kāhilipali, Kī'olokū, and Keaīwa Units.

This program represents an estimated 30% of the overall effort and budget in this long-range management plan.

Of the four Kaʻū Preserve units, the largest expanse of intact, high-quality native lowland wet forest and most significant biological resources (rare plants and high native diversity) occur in the roughly 2,600-acre Kaiholena Unit. Therefore, Kaiholena was chosen for the first fencing effort in the Kaʻū Preserve. The initial phase of fence construction was completed in 2007, enclosing 1,200 acres. Over a period of two years following fence construction, 33 pigs were removed from the Kaiholena unit during 44 hunts, conducted by volunteer hunters, contracted experts, and TNC staff. The last pig was removed by TNC staff in January of 2009.

A second fence was constructed in 2016 and incorporated a steep natural barrier at Palimuku to enclose an additional 800 acres. One-way gates monitored by game cameras and a remotely-triggered trap with an automatically dispensed feed hopper were installed to bring the number of pigs within the new unit from 18 to zero by January, 2019. Quarterly fence monitoring over the past 5 years has shown that the weakest points along this fence are along the eastern boundary where stormflow events have caused undermining of the fence where a total of 52 tarps between 8 and 50 feet in length have been draped over the hog wire just above ground level to prevent pigs from pushing under the bottom wire. The cost to install additional tarps and replacement of storm-damaged tarps and sections of wire is included in this proposal in the budget summary under the heading "Maka'ālia Fence Maintenance and Ungulate Control."

Large areas of the Kaʻū Preserve units remain unprotected, however. Relying on public hunting, aerial shooting, staff hunts, and other means to reduce feral animal populations instead of fenced enclosures is not a feasible alternative because as long as areas remain unfenced, feral animals will continue to enter them from adjacent lands. Animal removal would have to continue indefinitely, would be expensive and unpopular, and make the goal of natural resource protection and rare plant reintroduction impossible. The best long-term solution is therefore to build additional fenced areas and remove all feral ungulates as quickly as possible.

In the unfenced units, as well as the unfenced portions of the Kaiholena unit, our objective is to reduce ungulate damage by enhancing hunter access (by installing signs, check-in stations, etc.) and encouraging public hunting in these areas through outreach. A back-country camp consisting of two modular cabins is in the upper reaches of the Kaiholena unit. This gives staff a dry place to camp overnight while conducting surveys, monitoring, and checking the fence. Permanent ungulate activity monitoring transects have been installed in these units and will be monitored periodically for detection of changes in ungulate activity level.

Survey transects completed in 2007 showed pig activity and extremely high levels of ground disturbance by pigs in all 123 stations of the Kaiholena Unit. Additional surveys conducted in the Keaīwa Unit and parts of the Kaʻū Forest Reserve showed extensive, severe ground disturbance by pig activity. Diminished diversity of groundcover and understory species had been observed over large areas. In some severely impacted parts of the forest, common groundcover and understory plants were persisting only epiphytically upon trees and tree ferns.

Weed surveys conducted in the Kaiholena Unit showed a direct correlation between presence of weed species and pig activity. High levels of ground disturbance, coupled with reduced groundcover, led to an increase in water runoff, sheet erosion, and stream bank collapse. There was also a very high likelihood of wild cattle, mouflon sheep, and feral goats in the vicinity.

Volunteer hunters continued to hunt outside the preserve, reducing the pressure on the fence. During Covid (2021-2022) we saw a reduction in hunters and an increase in pig activity outside the fence. In 2020, two pigs were detected in the Maka'ālia unit and removed. In 2022, pigs were detected in the lower portion of the Kaiholena management unit. After removing six pigs detected in 2022, we had two large storms (December 2022 and February 2023) that created several ingress points along multiple fence lines and washed out the access road. We detected ingress in the lower and upper Kaiholena units and began active trapping and monitoring. After the storms, we removed 24 pigs from the lower Kaiholena unit and six from Maka'ālia. We currently have camera identification of at least two remaining pigs in the lower unit. We have hired an additional employee, deployed trap cameras, and are actively trapping at this time.

Ungulate Control Program Activities

Years 1-6 (FY2025 – FY2030)

- Monitor and maintain 8 miles of preserve fences on a monthly schedule
- Continue hunter access program at Kaiholena
- Monitor ungulate transects annually in all four Preserve units and Kaʻū Forest Reserve
- Use game cameras to monitor for ingress in the Kaiholena fence units

Program 2: Invasive Plant Control

Program Goal: To control high priority invasive plants in the preserve, and prevent the introduction and spread of problem weeds to core areas of native habitat where they are not currently established.

This program represents an estimated 30% of the overall effort and budget in this long-range management plan.

Habitat-modifying weeds are non-native plants that have demonstrated the ability to suppress regeneration of and/or displace native vegetation. Many weeds become established when an area is disturbed by ungulates, which may also carry and spread seeds. Elimination of ungulates, therefore, may be one of the most effective means of controlling the introduction and spread of many habitat-modifying weeds in the preserve. To complement these efforts, our invasive plant control program focuses on removing habitat-modifying weeds that are already established in the preserve.

The presence of several serious invasive plant species both on and in the vicinity of the preserve has been identified (Table 2). In 2006–2012 we completed a systematic, preserve-wide inventory, survey and mapping effort to identify the location and extent of weed infestations. Later, in 2017, twenty-four understory monitoring plots were installed at Maka'ālia, identifying and assessing leaf area for all plant species within a 10-meter radius of each plot (Figure 4). Priority weed maps and a species- and unit-specific management plan continues to guide control efforts, and future management efforts will be prioritized according to feasibility of control, proximity to sensitive core areas of the preserve, and along corridors leading into the preserve.

Table 2. Known Pest Plants of Ka'ū Preserve

Common Name	Scientific Name
Australian tree fern	*Sphaeopteris cooperi*
Christmas berry	*Schinus terebinthifolius*
Common guava	*Psidium guajava*
Glorybush	*Tibouchina urvilleana*
Himalayan ginger	*Hedychium gardnerianum*
Japanese anemone	*Anemone hupehensis*
Mule's foot fern	*Angiopteris evecta*
Night-blooming jasmine	*Cestrum nocturnum*
Palm grass	*Setaria palmifolia*
Silk oak	*Grevillea robusta*
Strawberry guava	*Psidium cattleianum*

Between 2014 and 2019, 145 acres were cleared of strawberry guava and *Clidemia* in a second "pass" through the Lower Hīlea subunit of the Kaiholena unit. In the initial 2014 treatment of an area closest to the core weed infestation, the count of stems controlled totaled 15,725 for *Clidemia*, 27,425 Tibouchina and 1,366 Strawberry guava. In 2019, the repeat treatment of that same control area totaled 4,580 stems of *Clidemia*, 46,041 steams of *Tibouchina* and 2,931 Strawberry guava. The volume of herbicide mix applied (Garlon4/Milestone/Water) was 1050 gallons in 2014 and 1838 gallons in 2019.

A 25-acre core infestation at the pasture's edge has yet to be treated, with contract costs of control projected to be greater than $1,000 per acre. This infestation continues to be the priority weed control area of the Preserve, and 175 acres above the core area were cleared of habitat-modifying weeds in the past five years (Figure 3).

Work in Year 1 will involve continuing to attack the infestation (using herbicide) towards the core, a 25-acre area where *Tectococcus* biocontrol has been established. A 10-acre area in the vicinity of an interpretative loop trail and 22-acres in the vicinity of a remote camp at Maka'ālia subunit at Kaiholena will be surveyed and weeds supressed in an effort to detect and control

incipient populations where rare plant founders are present or outplantings have been established.

A large infestation of *Tibouchina urvilleana* is located in the Kīʻolokū unit. Aerial surveys have been conducted and were followed up with ground surveys. The extent of the infestation is greater than we first anticipated and the discovery of Himalayan ginger at Kīʻolokū and in neighboring Kāhilipali unit prompted immediate control of the priority species. Ginger control will continue to be the priority management goal in this area, with 54 acres controlled in multiple passes since 2006. In 2020 a keg-sized Mule's foot fern and was removed along a forest road in Lower Hīlea subunit at Kaiholena with more than a dozen small individuals pulled in subsequent monitoring visits over the following years. The fern has been located and removed from two other trails that are miles apart.

We strive towards an Integrated Pest Management (IPM) approach to weed control — consisting of manual/mechanical methods, herbicides, and/or biological control. As biological controls are developed and approved for release on our top priority weeds, we will work cooperatively with agencies mandated to monitor these agents. Cultural control (minimizing soil disturbance and new pest plant introductions) is incorporated into routine field operations through gear sanitation protocols. Herbicide use is in full compliance with the State of Hawaiʻi Department of Agriculture (HDOA) Pesticide Enforcement Division, used according to the product label, and recorded in detail for reference and efficacy monitoring. Staff coordinating weed control are certified with the HDOA Pesticide Enforcement Division through a Forestry Applicators' exam and card. We may employ other techniques or tools for weed control as they are developed. Any new application methodology used regularly will be coordinated in full compliance with HDOA.

Staff and visitors will follow strict procedures to prevent the inadvertent introduction of invasive plants while working or hiking in the preserve. Our invasive species prevention protocol calls for inspecting all clothing and equipment for seeds, soils and pests before entering the preserve. We will remain vigilant in our search for incipient populations of invasive plants. Species such as fireweed (*Senecio madagascariensis*), Himalayan raspberry (*Rubus ellipticus*), cat's claw (*Caesalpinia decapetala*), and plume poppy (*Bocconia frutescens*) are found nearby but do not occur on the preserve. *Miconia calvescens,* which has extensively invaded Hilo and Puna up to 3,500 ft elevation, has not been reported in Kaʻū.

Other invasive pests and pathogens (e.g., coqui frogs, gall wasps, *koa* wilt) will be diligently surveyed for so that they can be detected as early as possible and responded to rapidly before they are able to gain a foothold. Rats will be controlled on a site-specific basis, as needed for the protection of rare plants, as described in Program 4.

In 2016 samples taken from a dead *ʻōhiʻa* at Kaiholena confirmed the presence of Rapid ʻŌhiʻa Death on the Preserve. Aerial sketch mapping and UAV surveys suggest that the disease is located in all of the Preserve's units, and in the surrounding Kaʻū Forest. Preserve staff follow

strict bio-sanitization protocols (Appendix 6) to prevent its introduction to uninfected areas, and visitors must undergo vehicle inspection and decontamination using 70% alcohol on blades, boots, and tires with a vehicle wash station provided at the Kaiholena unit. All tools and boots are decontaminated once more before moving to a new forest site. Chain saws are not moved between Preserves, and must be thoroughly cleaned using high pressure air and brushed down with 70% alcohol when moving between lower and upper elevation sites.

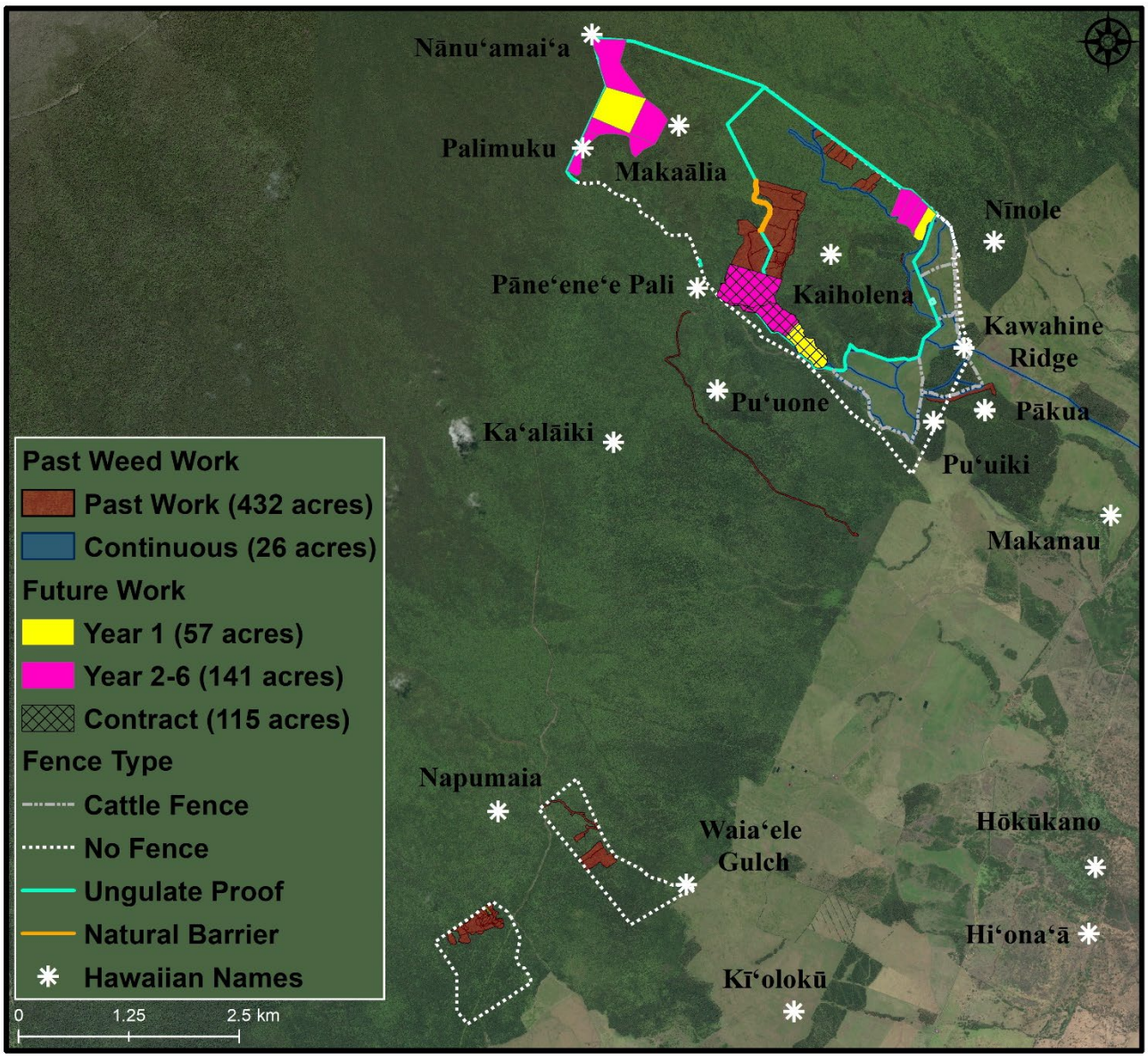


Figure 1 Invasive plant control in Kaʻū Preserve.

Invasive Plant Control Program Activities

Year 1-6 (FY2025 - FY2030)

- Maintain priority weed maps
- Monitor effectiveness of treatments
- Continue adaptive management of weeds and adjust strategies as needed based on monitoring results
- Continue to participate as a member of BIISC
- Continue strict inspection and cleaning procedures to prevent introduction of weed species not currently in the preserve

Year 1 (FY2025)

- Continue priority weed control within 57 acres at Kaiholena and Maka'ālia
- Work with TMA and BIISC to prioritize the most serious invasive weeds and geographic areas

Program 3: Resource Monitoring

Program Goal: To monitor changes in the integrity of the ecosystems in and around the preserve; to determine whether critical threats to those ecosystems are increasing or decreasing; and ultimately to gauge the effectiveness of our conservation strategies.

This program represents an estimated 5% of the overall effort and budget in this long-range management plan.

As an organization, The Nature Conservancy is trying to develop a more consistent and rigorous approach to evaluating the success or failure of our conservation actions. We have established a preliminary framework for assessing the effectiveness of our conservation actions based on the level of critical threats and on several key characteristics of the native ecosystems most greatly affected by them.

At Ka'ū Preserve and vicinity, we monitor critical threats as above by tracking changes in ungulate activity and the extent of habitat-modifying weeds. In particular, we propose to measure the indicators in Table 3 (Figure 4).

Ungulate activity levels will be measured periodically on transects as discussed previously (Figure 4). The number, location, and sampling scheme for these transects will vary based on if pigs are detected in the unit or not. In the unfenced units we will continue annual surveys. Inside the fenced units we will increase survey intervals to better track and remove any ingress. Innovative approaches to real-time ungulate monitoring and removal will be implemented as a best management practice. Data collected on these transects provide an index of ungulate

activity and should indicate the level of success of ungulate removal efforts. In addition, when needed the field staff will create activity maps from field observations showing the presence of ungulate sign whenever it is detected. This information will direct our ungulate removal efforts where they are needed most.

High priority invasive plant species will be mapped opportunistically during all field operations and systematically when needed. Treated populations will be monitored to determine effectiveness of treatments. For example, we have detected and removed several Mule's foot fern (*Angiopteris evecta*) over the years and continue to monitor all trails and roads for new populations.

Ecosystem extent, adjacent land use patterns, and canopy condition will be assessed through analysis of aerial imagery and/or maps produced. Much of this data has been collected by way of an aerial mapping contract for the preserve and along the lower forest edge. The quality of this imagery allows resource managers to see between gaps in the canopy to a resolution of 2 cm, potentially revealing weed populations in areas where field survey would prove to be too costly or too dangerous to attempt. We plan to increase our drone monitoring over the next 6 years and have highlighted several drone monitoring plots that will allow us to document changes across the preserve (Figure 5).

Vegetation understory and diversity will continue to be assessed using ground-based methods and through contracting of field botanists. Twenty-two understory monitoring plots were installed in the Maka'ālia fence unit in 2017, coinciding with pig removal efforts in that unit. We plan to re-read the understory plots every five years.

The spread of a fungus believed to be the cause of Rapid *ʻŌhiʻa* Death into Kaʻū and South Kona forests demands strict bio-sanitization protocols be followed to prevent further harm inadvertently during field activities. Proprietary boots, raingear, and hand tools are restricted to each preserve, and all visitors and staff conduct vehicle and footwear decontamination procedures upon entering the preserves. Infected trees have been confirmed at the lower elevation of Kaʻū preserve. TNC will continue to monitor the condition of the forest through the use of ultra-high resolution drone imagery, documenting changes in forest cover over time. This imagery will be shared with USFS and Three Mountain Alliance to provide vegetation cover data for these remote and infrequently surveyed forest sites (Figure 6).

Over the next six years, we are innovating and increasing our monitoring by adding (funding dependent) a bio-acoustic network in the Kaiholena management unit (Figure 5). The goal of the monitoring is to track seasonal movement patterns of native and non-native birds. Additionally, we will use them to monitor the movement of coqui frogs and other non-native species detectable with sound. After the initial equipment investment, the network will be a value-added component to our regular fence checks. Monitors will be placed on an elevation gradient accessible during regular fence checks.

In 2022, we worked with partners from the East-West Center, Pacific Islands Climate Adaptation Science Center, and the US Forest Service to assess future climate change and drought risks at the preserve. Historic rainfall trends generated by the Pacific Drought Knowledge Exchange show a decrease in rainfall in the wet season and an increase in the dry season (Figure 6). Additionally, we see an increase in drought intensity and length over the last twenty years (Figure 7). Finally, it is predicted that we will see an increase in air temperature and a decrease in rainfall in the future. To assist with climate change adaptive management, a weather station has been installed in the lower portion of the Kaiholena management unit. One of the purposes of the weather station was to accurately track weather patterns and monitor future climate shifts in real-time, assisting with climate-informed management. We will work closely with the Hawai'i Mesonet team to make sure the weather station is maintained and provide near real-time data to our team and surrounding land managers.

Table 3. Planned Monitoring Framework for Ka'ū Preserve and Vicinity

Threat Factors	Indicators
Ungulate activity	Frequency of ungulate sign
Extent of habitat-modifying weeds	Extent of specific weed species
Key Vegetation Attributes	
Extent of ecosystem or natural community	Acres of ecosystem or natural community
Adjacent land use	Percentage of ecosystem boundary adjacent to lands managed for threat reduction or biodiversity conservation
Vegetation canopy condition	Percentage of native canopy cover
Vegetation understory condition	Percentage of native vegetation cover in understory Percentage of native vegetation cover in ground layer
Diversity of indicator plant species	Percentage and frequency of native, indicator plant species in understory and ground layer

Resource Monitoring Program Activities

Year 1 (FY2025)

- Continue ungulate monitoring transects in all four management units
- Continue weed mapping and identification of highest priority weeds
- Establish bio-acoustic monitors
- Collect scheduled drone imagery
- Complete climate station set up

Years 2-6 (FY2026 - FY2030)

- Continue ungulate and weed monitoring
- Continue weed mapping and identification of highest priority weeds
- Analyze threat data and adjust management actions as needed
- Monitor 22 MUM plots in Kaiholena unit before end of year FY2030
- Collect high-resolution aerial imagery to continue to track the spread of ROD and other threats
- Assist with climate station maintenance

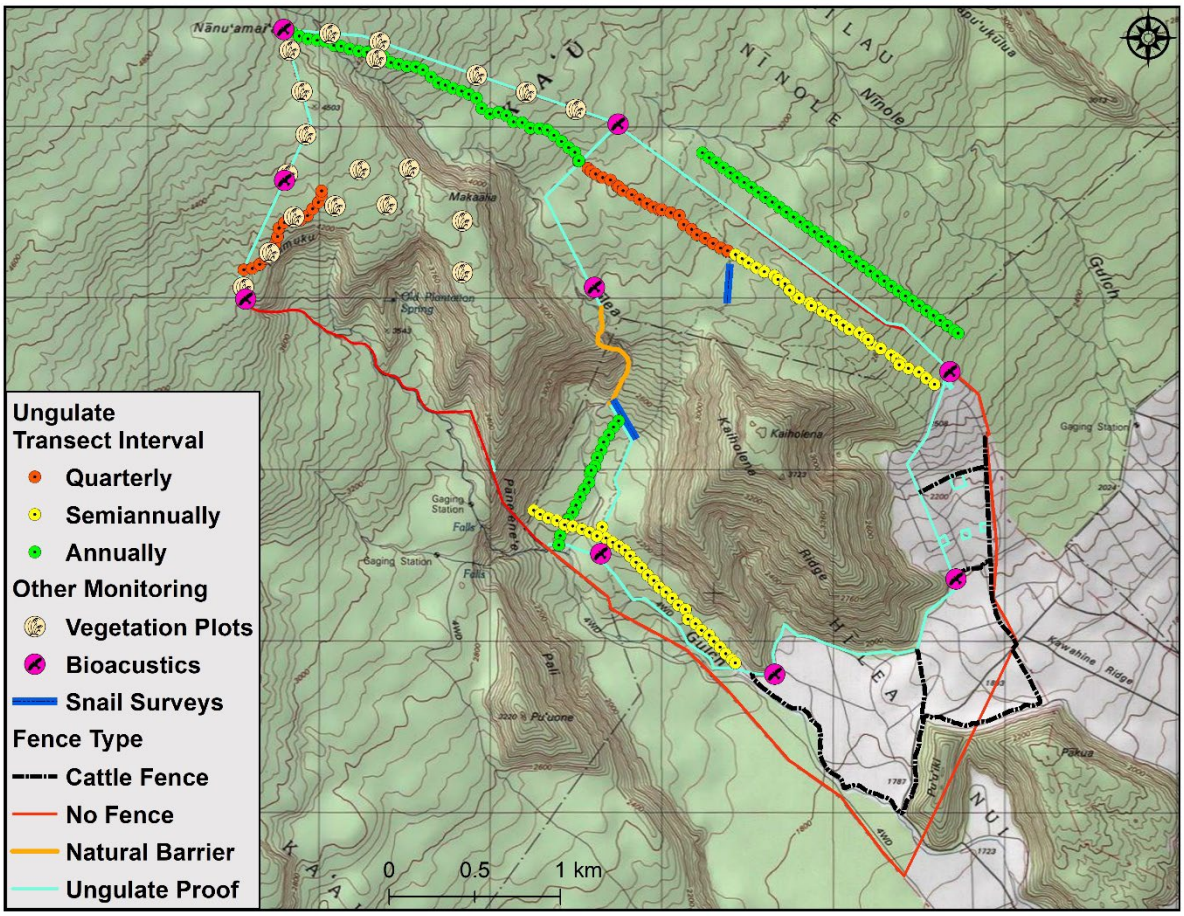


Figure 4. Wildlife monitoring plans for the Kaiholena management unit.

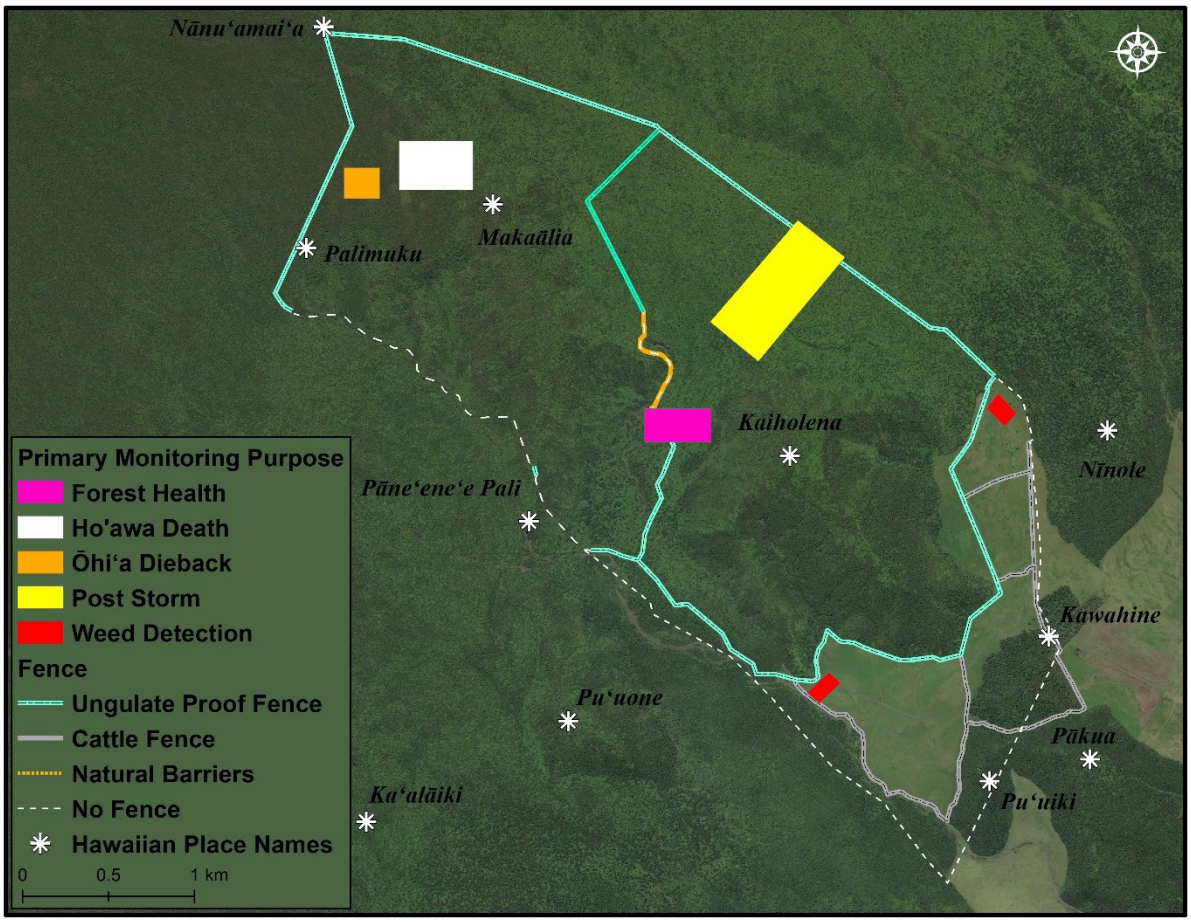


Figure 5: Drone monitoring priority areas for the Kaiholena management unit. Orange *('Ōhi'a* Dieback), to be flown once a year to monitor Ohia dieback in the bog near Maka'ālia remote camp. White (*Hō'awa* Death), to be flown yearly to track *hō'awa* dieback due to an unknown disease. Yellow (Post Storm), will be flown every six months to track damage and recovery post an extreme windstorm in December 2022. Pink (Forest Health) will be flown every six months to monitor for Rapid *'Ōhi'a* Death (ROD). Red (Weed Detection), to be flown every quarter to monitor for new weeds and weed load in the pasture lands adjacent to the forest. In addition to the above priority areas, we will continue to support ROD research flights into the future.

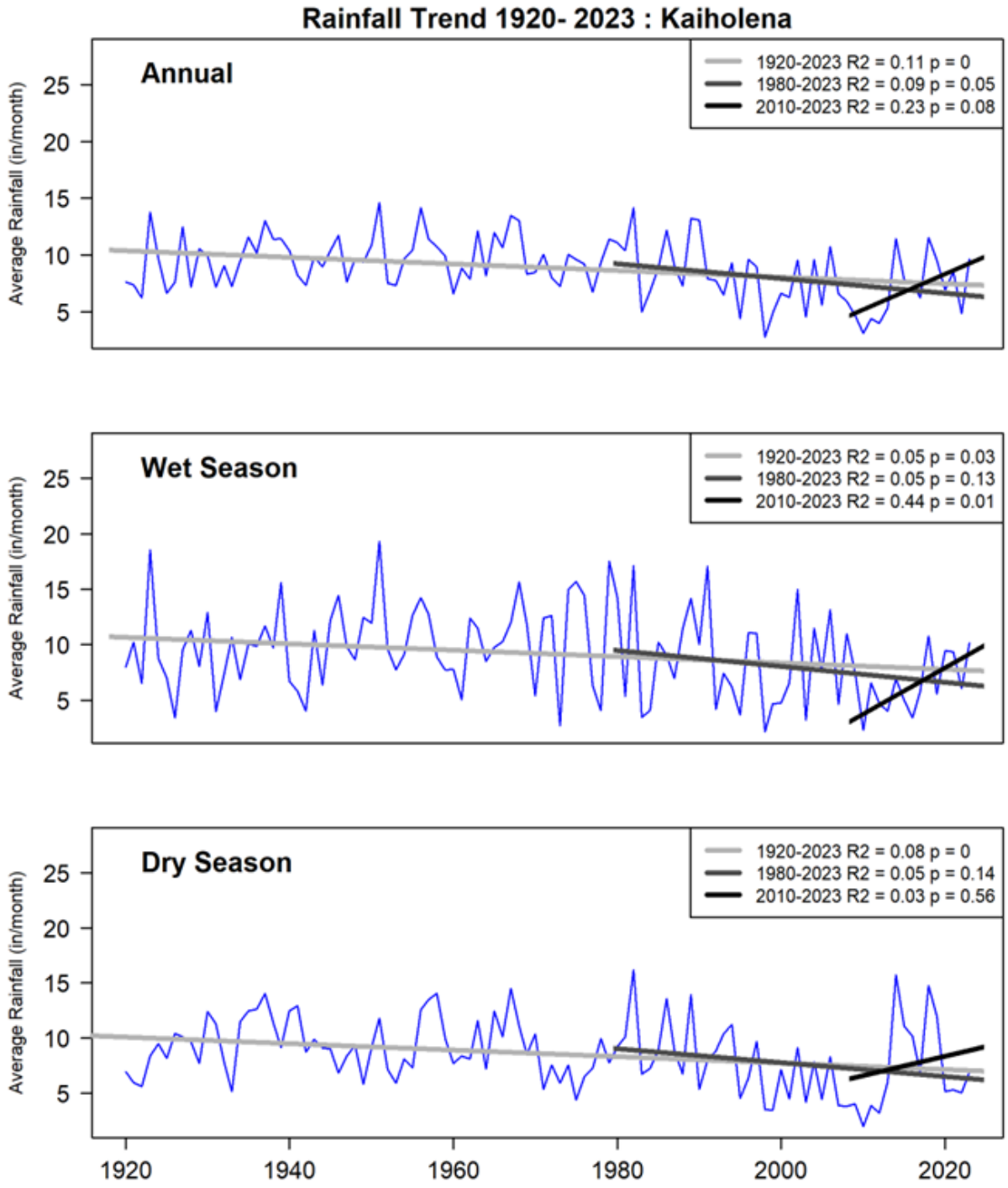


Figure 6: Rainfall time series at Kaiholena (1920-2023) with linear trends. Trendlines with P-value < 0.05 are considered statistically significant.

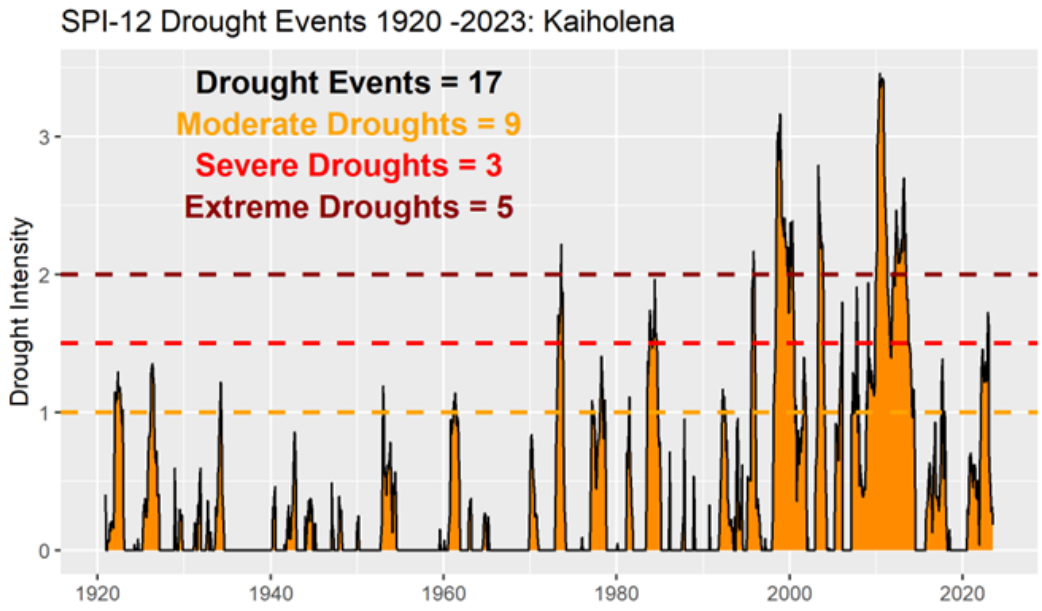


Figure 7: 100-year (1920-2023) SPI time series (reversed axis) at Kaiholena. Dashed lines show, moderate (yellow), severe (red), and extreme (dark red), drought thresholds (Frazier et al. (2016); Lucas et al. (2022)).

Program 4: Rare Species Protection and Enhancement

Program Goal: To prevent the extirpation of rare species in the preserve, and to encourage research, predator control, and captive propagation of rare plant and bird species.

This program represents an estimated 5% of the overall effort and budget in this long range management plan.

TNCH uses data from the U.S. Fish and Wildlife Service, the agency responsible for administering the federal Endangered Species Act, to identify rare and endangered species and those that are listed as “candidate” or “special concern” species. Biological surveys have shown that the preserve protects numerous rare species, many of which are federally listed as endangered (Appendices 2-7). Additional rare species reported from adjacent lands and similar habitats are likely to be found in Ka‘ū Preserve with future surveys.

Protecting ecosystems essential to the majority of the preserve's native plants and animals will be our primary management strategy. Our ungulate and weed control programs are integral to the protection of these ecosystems and rare species. In addition, we will supplement our understanding of the types and ranges of rare plants and animals with surveys to locate other rare species and assess their status, and to document all incidental observations of rare plants, birds, bats, and invertebrates while in the preserve. We will encourage research and provide logistical support to partners interested in specific rare species research and protection efforts.

Rare species protocols will be implemented, with permits secured and seeds delivered to Volcano Rare Plant Nursery (either by TNC, NPS, or by the State for future out planting in the same general area). A portion of the NAPP funds will be used to support the Rare Plant Nursery to offset their expenses in maintaining and propagating any collected seeds.

Fencing will continue to be installed as needed to protect populations of rare plants from ungulates. Rat control will be conducted around known population of endangered plant species.

In FY2019-Present, we focused predator control actions on rats around groves of *hōʻawa* (*Pittosporum spp*) and *loulu* (P*ritchardia lanigera*) at Kaiholena. Five-dozen Goodnature A24 rat traps were deployed within the Makaʻālia fence unit as a grid where concentrations of *hōʻawa* were located. We also deployed traps at the base of reproductive *loulu*. The goal was multi-purpose: (A) knocking down the rat population in small-scale areas through high-density trap deployment (trap grid). The hope was that it could be repeated systematically in adjacent plots to accumulate a larger area, simulating a toxicant drop. (B) A second phase was to test the maintenance of population suppression with low-density trap deployment following the knock-down described in A above over larger areas. (C) A third application was to deploy traps around clusters of epiphytic *Astelia* post-flowering to see if rat control can allow fruit maturity and dispersal. Currently, after 9 years of pig removal, *Astelia* is still not spreading beneath epiphytic clusters within Kaiholena unit. (D) A fourth application was to deploy traps during critical periods to reduce rat populations around rare plants and out-plantings to elevate successful fruit production and seedling survival.

After three years of maintaining a trap grid for population suppression (objectives A and B) we found that the cost (time and money) of maintaining a grid was too high. However, we found traps placed at the base of target trees during critical periods (objective D) reduced rat numbers and increased seed survival of several species. Furthermore, targeted trapping can be maintained during regular fence checks, reducing costs. We plan to continue to trap rats in and around target endangered species, but we will discontinue the trapping grid. We also found that for the A24 traps, the maximum rebaiting interval should be four months, with most rat activity happening in the first month. During trap maintenance, we found that the manufacturer's recommended six-month interval was too long for the bait to flow and C02 cartridges to maintain pressure. Over the next six years, active traps in the field will be re-baited at a quarterly interval. We will also explore mechanical rat traps.

Rare Species Program Activities

Years 1-6 (FY2025 – FY2030)

- Protect and monitor rare plant populations
- Conduct rare plant surveys in upper Kaʻū forest
- Continue implementing rare species protocols
- Rare plant enhancement plans may include small exclosure fences of less than 10 acres around endangered species (see Ungulate Program for fence specifications)

Program 5: Community Outreach

Program Goal: To build Kaʻū community understanding and support for the preservation of Kaʻū's native forests, and enlist volunteer assistance for preserve management.

This program represents an estimated 10% of the overall effort and budget in this long range management plan.

The main objective of our outreach program is to build upon the foundation built with the local community and to continue to increase awareness of Kaʻū Preserve, the Kaʻū watershed and native ecosystems, their importance, threats, and efforts to protect them. More specifically, we seek to encourage and facilitate active participation and community pride among the residents of the Kaʻū District in the effective conservation of this special resource. The key strategies for our public outreach work include a wide variety of programs, including: partnering with organizations on environmental education, employing summer interns, hosting volunteer days, guiding walks in the preserve, attending community meetings, participating in local events, and working with hunting programs.

The focus audience will continue to be the children of Kaʻū (elementary and high school), the adults of the community, and community leaders. Our program hosts Nāʻālehu Elementary School, Kua o ka Lā (Miloliʻi, Kahuku), Volcano School of Arts and Sciences and other students in the forest or brings the forest into the classroom to help children slow down, observe and experience the forest through a new lens. An interpretive nature trail in the Kaiholena unit continues to be a powerful tool for showing people healthy native forest. Field activities will combine a mix of conservation projects and educational opportunities. Conservation projects will include trail construction and maintenance, invasive plant control, fencing, and biological monitoring. Educational activities will address a wide variety of land management, cultural history, and natural history topics.

Community Outreach Program Activities

Year 1-6 (FY2025 – FY2030)

- Continue community outreach and volunteer program
- Continue University of Hawai`i at Hilo and Hilo Community College service workdays
- Continue to work closely with partners in communicating conservation goals to the Kaʻū community
- Facilitate community outreach objectives in line with broader upper Kaʻū forest management plan
- Expand the environmental education program to other Conservancy parcels and to other landowners in the region

Program 6: Watershed Partnerships

Program Goal: To assist the long-term effective management of the native ecosystems of the Kaʻū region by participating in the Three Mountain Alliance, a coordinated partnership of landowners and other partners.

This program represents an estimated 20% of the overall effort and budget in this long-range management plan.

The Three Mountain Alliance comprises four landowners who are responsible for managing nearly 250,000 acres of contiguous lands in the Kaʻū region — the National Park Service, the State of Hawaiʻi, The Nature Conservancy, and Kamehameha Schools. These landowners and additional partners (e.g., U.S. Geological Survey, U.S. Forest Service, U.S. Fish and Wildlife Service) have committed to the need for a coordinated approach to information gathering, management planning, and community outreach. By participating in a watershed partnership, the Conservancy is reducing the threats to Kaʻū Preserve while leveraging funding by having partners.

Because the Conservancy has worked in the Kaʻū forest for almost 15 years, we are able to provide our partners and the community with a unique perspective on the current condition of the forest, the range and habits of invasive ungulates, and technical support in selecting a location and design for fences. We have longstanding relationships with community members and will be able to find consensus among a wide range of stakeholders. Our Geographic Information Systems (GIS) staff has the capacity to provide high-quality maps and our communication team can prepare for public hearings where community members will have the opportunity to share and discuss their concerns.

The Nature Conservancy's goal is to collaborate with our state and federal partners through science input, planning, and community outreach to support a fencing project in the Kaʻū forest. If successful, this project will catalyze conservation throughout the entire forest, but the key will be implementing a plan that will be welcomed by stakeholders in the community.

In 2013, TNC installed a firecam at Puʻu o Keokeo on the upper slopes of Mauna Loa. This site is within HVNP and lies approximately 2.5 miles above the Kona Hema 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 the Kaʻu Forest Reserve and Kipahoehoe NAR. Images of the area are displayed on a video monitor in the preserve office at Honomalino 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, and provides an internet uplink allowing partners at HVNP to monitor the system remotely.

As mentioned in the Ungulate Control Program description above, TNC also intends to increase public access to allow for public hunting. In support of the overall regional management, there would also be increased access to Kaʻū for DOFAW management of the Kaʻū Forest Reserve (e.g., access along the roads to the base of Puʻu One (Kaiholena unit), and access through the Kīʻolokū and Kāhilipali units along the Mountain House Trail or other existing road networks).

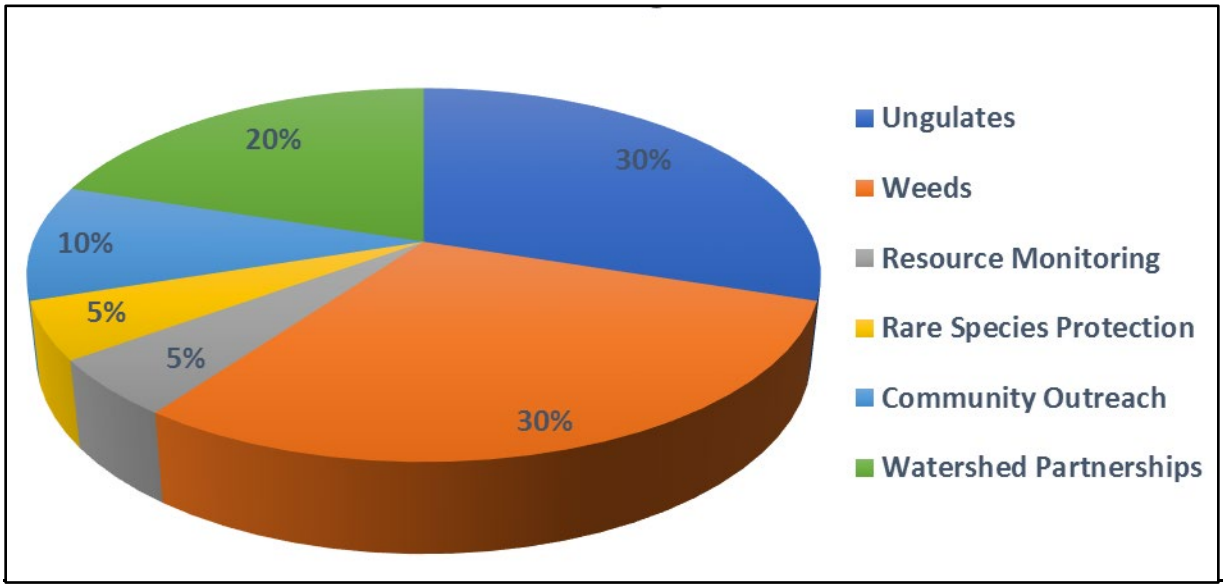
We will continue to support watershed partnership activities. One way we have been aiding the partnership is by maintaining a helicopter landing zone in the lower Kaiholena management unit. In the summer of 2022, working with the partnership, we fenced the LZ to minimize new weeds moved into the LZ by ungulates. Additionally, we continue to maintain and make available our remote camp in the Makaālia portion of the Kaiholena management. This camp allows closer access to the upper Kaʻū Forest Reserve. We are also looking into the feasibility of a second remote camp at the top of the Keaīwa unit that could be used by our staff, as well as watershed partners to accomplish fence and ungulate removal goals in the upper Kaʻū Forest Reserve.

<u>Watershed Partnership Program Activities</u>

<u>Year 1-6</u> (FY2025 – FY2030)

- Support priority management activities developed by the Three Mountain Alliance
- Determine the feasibility of a second remote camp located in the Keaīwa unit
- Promote DOFAW's implementation of a forest access plan for greater public hunting access along lower boundary of Kaʻū Forest Reserve

BUDGET SUMMARY



The table in the next section summarizes the six-year budget for the Kaʻū Preserve NAPP project. Through the NAPP program, the state pays two-thirds of the management costs outlined in this long-range plan and TNC funds (from private and other government sources) the remaining one-third.

The Conservancy's Kaʻū operation maintains a full-time base staff of two. Other part-time, short-term, or year-to-year personnel, in addition to staff overtime, are covered in this budget and will be utilized as project needs warrant. Technical and annual planning support is primarily provided by the Honolulu office of the Conservancy. As budget and needs allow, these support staff members may charge a small portion of their time to this project. The Nature Conservancy's annually negotiated fringe benefits rate will also accrue on all salary costs (in FY24 fringe is 44.86%).

This budget includes project-related supplies, subcontract expenses to conduct fence checks/maintenance and weed/ungulate control, and other miscellaneous project-related costs, including vehicle maintenance expenses both as equipment purchases and equipment leases. The Conservancy routinely provides training for staff to improve job performance, and in addition to these trainings, supervisory staff regularly attend trainings, meetings, and/or conferences on other islands. Travel and training funds are included within this budget to cover airfare, lodging, and training expenses.

An overhead rate is included (subject to slight change each year) to recognize the Conservancy's indirect costs for facilities, accounting, legal, and other administrative support.

Although the Conservancy's overhead rate is currently 22% (the annual rate changes each year per negotiations with DOI), the NAPP program will currently pay only 16%, leaving the remainder as a portion of the Conservancy's one-third match.

Budgetary Constraints: This Kaʻū NAPP budget requests no change in funding over the last LRMP (2019–2024). Costs of management for the 800-acre Maka'ālia unit includes increased helicopter use for remote deployment of staff and materials to support fence maintenance and pig removal, and towards alignment surveys and preparing for fence construction and ungulate control at Keaīwa. Should TNC receive significant private funds in addition to the NAPP funds, we hope to complete additional management activities. This will depend entirely on TNC's statewide priorities and its ability to raise additional funds. We will report on progress on all accomplishments in Kaʻū Preserve and on adjacent lands regardless of funding source.

BUDGET TABLES

Kaʻū Preserve Budget

	FY2025	FY2026	FY2027	FY2028	FY2029	FY2030	TOTAL
Labor & Benefits	116,041	121,843	127,935	134,332	141,049	148,101	789,301
Contractual	21,000	22,000	23,000	24,000	25,000	26,000	141,000
Communications	500	500	500	500	500	500	3,000
Travel	3,000	3,150	3,308	3,473	3,647	3,829	20,406
Supplies	14,500	14,500	14,500	14,500	14,500	14,500	87,000
Other	500	500	500	500	500	500	3,000
Subtotal	*162,796*	*168,661*	*174,819*	*181,285*	*188,074*	*195,203*	*1,070,838*
Overhead	24,887	25,999	27,159	28,369	29,631	30,949	166,993
TOTAL	180,428	188,492	196,902	205,674	214,826	224,379	1,210,699
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Total**
Kaʻū Budget	180,428	188,492	196,902	205,674	214,826	224,379	1,210,699
Private Match (1/3 of total)	60,143	62,831	65,634	68,558	71,609	74,793	403,566
TOTAL NAPP REQUEST (2/3)	120,285	125,661	131,268	137,116	143,218	149,586	807,133

Makaʻālia Fence Maintenance and Ungulate Control Budget

	FY2025	FY2026	FY2027	FY2028	FY2029	FY2030	TOTAL
Labor & Benefits	15,465	16,239	17,050	17,903	18,798	19,738	105,193
Contractual	14,000	7,500	7,500	7,500	7,500	7,500	51,500
Communications	1,200	1,200	1,200	1,200	1,200	1,200	7,200
Travel	-	-	-	-	-	-	-
Supplies	33,000	1,500	1,500	1,500	1,500	1,500	40,500
Other	-	-	-	-	-	-	-
Subtotal	63,665	26,438	27,250	28,103	28,998	29,938	204,393
Overhead	10,186	4,230	4,360	4,496	4,640	4,790	32,703
TOTAL	73,852	30,669	31,610	32,599	33,638	34,728	237,096
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Total**
Kaʻū Budget	73,852	30,669	31,610	32,599	33,638	34,728	237,096
Private Match (1/3 of total)	24,617	10,223	10,537	10,866	11,213	11,576	79,032
TOTAL NAPP REQUEST (2/3)	49,234	20,446	21,074	21,733	22,425	23,152	158,064

Appendices

Appendix 1. Native Natural Communities Of Kaʻū Preserve

Natural Community (common and scientific names)	**Heritage Global Rank***
Koa/ʻŌhiʻa Montane Mesic Forest *Acacia koa/Metrosideros polymorpha* Montane Mesic Forest	G1
Koa/ʻŌhiʻa Montane Wet Forest *Acacia koa/Metrosideros polymorpha* Montane Wet Forest	G3
ʻŌhiʻa Montane Wet Forest *Metrosideros polymorpha* Montane Wet Forest	G3
ʻŌhiʻa Lowland Wet Forest *Metrosideros polymorpha* Lowland Wet Forest	G3

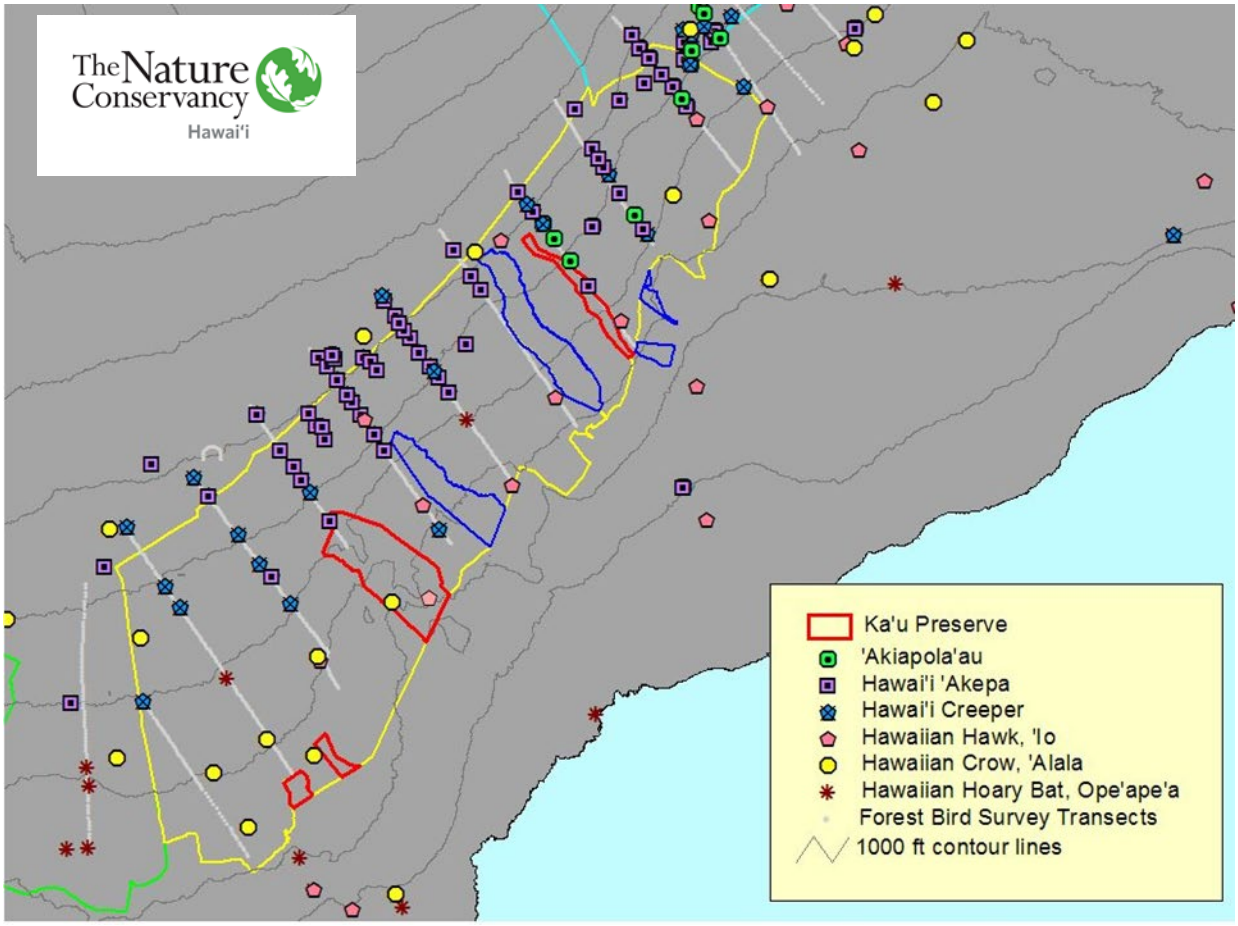
* Key to Heritage Global Ranks:
G1 = Critically imperiled globally (typically 1-5 current occurrences).
G3 = Moderately imperiled globally or restricted in range (typically 21-100 current occurrences).

Appendix 2. Rare Vertebrates in Kaʻū Preserve (5 Endangered, 1 Near Threatened, 1 Threatened)*

Species	**Federal Status***	**Island Distribution**
Buteo solitarius (Hawaiian Hawk, *ʻIo*)	NT	Hawaiʻi
Corvus hawaiiensis (Hawaiian Crow, *ʻAlalā*)	LE	Hawaiʻi
Drepanis coccinea (Scarlet Honeycreeper, *ʻIʼiwi*)	T	Hawaiʻi, Maui, Kauaʻi, Oʻahu, Molokaʻi
Hemignathus munroi (ʻAkiapōlāʻau)	LE	Hawaiʻi
Lasiuris cinereus semotus (Hawaiian hoary bat, *ʻŌpeʻapeʻa*)	LE	Hawaiʻi, Maui, Oʻahu, Kauaʻi
Loxops coccineus coccineus (Hawaiʻi ʻĀkepa)	LE	Hawaiʻi
Oreomystis mana (Hawaiʻi Creeper, *ʻAlawī*)	LE	Hawaiʻi

*Listings Revised 2020

Appendix 3. Map of Rare Animals in Ka'u Preserve Vicinity



Appendix 4. Rare Plants in Vicinity of Ka‘ū Preserve (11 Endangered)

Species	**Federal Status***	**Critical Habitat**
Asplenium peruvianum var *insulare*	LE	
Charpentiera obovata	-	
Clermontia lindseyana	LE	
Cyanea shipmanii	LE	
Cyanea stictophylla	LE	X
Cyanea tritomantha	LE	
Cyrtandra menziesii	SOC	
Eurya sandwicensis	SOC	
Lobelia hypoleuca	-	
Marattia douglasii	-	
Melicope zahlbruckneri	LE	X
Nothocestrum breviflorum	LE	
Phyllostegia floribunda	LE	
Phyllostegia velutina	LE	X
Phyllostegia vestita	SOC	
Pittosporum hawaiiense	LE	
Pritchardia lanigera	LE	
Ranunculus hawaiensis	C	
Strongylodon ruber	SOC	
Stenogyne scrophularioides	-	
Touchardia latifolia	-	
Trematolobelia wimmeri	SOC	

* Key to Federal Status:

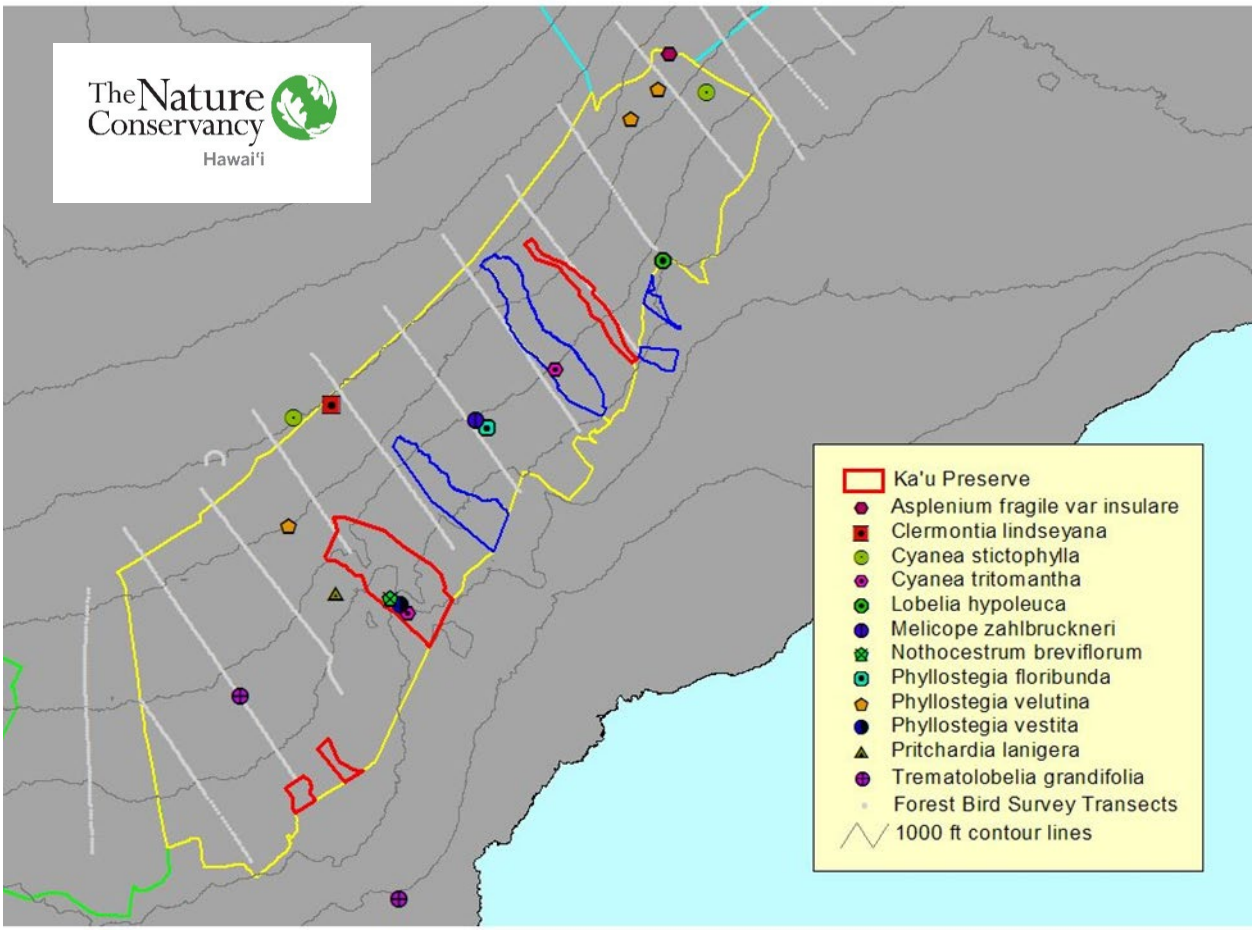
Listed Endangered (LE) = Taxa listed as endangered.

Candidate (C) = Taxa for which substantial information on biological vulnerability and threat(s) support proposals to list them as threatened or endangered.

Species of Concern (SOC) = Taxa for which available information meets the criteria for concern and the possibility to recommend as candidate.

Threatened (T) = Taxa likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Appendix 5. Map of Rare Plants in Vicinity of Kaʻū Preserve



Appendix 6. Native and Alien Plant, Animal and Pathogen Protocols

The purpose of TNC's work at the Kona Hema Preserve is to protect a valuable watershed and important habitat with high conservation value. The contractor will implement precautions to prevent the introduction of alien plants, animals and insects. Boots, equipment and materials will be cleaned and inspected by the contractor for seeds, eggs, larvae, etc., prior to delivery and entry. The contractor will also take precautions to prevent spreading alien plants already found at the Project Area. All materials shall be power washed prior to transport to the Preserve. For contractors arriving from other districts, please perform these tasks prior to transporting your equipment and personal gear to Kona Hema. TNC staff reserve the right to inspect all gear prior to deployment to ensure cleanliness. The vendor will remove all food, refuse, tools, gear, and installation scrap upon completion of work at the Project Area.

Bringing Vehicles, Equipment and Material from Outside the Preserve:

1. Inspect and clean all vehicles, equipment and material (including fill) before bringing to the Preserve. Vehicles and equipment are sanitized using high pressure hoses to clean wheel wells, bumpers, grill, fenders, and side panels behind wheel. If a pressurized hose is not available, then a hose with spray nozzle attachment can be used. The interior of all vehicles will be inspected, cleared of rubbish, all food items removed and vacuumed.

2. For Rapid Ohia Death (ROD), do as above and with the addition of spraying 70% alcohol or fresh-mixed 10% bleach solution in water in wheel wells and tires. All tools, shoes, knives, backpack sprayers for herbicide transmission must be sprayed with 70% alcohol or 10% bleach solution. TNC will not provide alcohol. This process should be repeated upon leaving the Preserve.

3. All vehicles & equipment must be inspected for Little Fire Ants according to procedures listed at www.littlefireants.com/fact%20sheet%203%20-%20lfa%20survey.pdf. Apply a thin coating of peanut butter to the end of four chopsticks and place two on the floor of the cab inside your vehicle and 2 under the hood away from the engine. Apply a thin coating of fruit jelly to one end of the other stick and leave in place for 45 minutes early in the morning with the vehicle our of direct sunlight. Ants of any species must be exterminated prior to entering the Preserve. A fogger treatment under the hood and within the cab is considered an effective treatment.

Supporting Protocols to Minimize Movement of Weeds:

1. Keep work clothes and equipment separate from personal gear used for non-work-related hiking, hunting, and camping outside of the Preserve.
2. Do not throw out vegetables or fruit containing seeds in the forest, bag it out.
3. If the inspection and sanitation of vehicles, equipment, and personnel gear cannot be implemented, then these items shall not be allowed into the field or worksite.

Coqui Frog Protocol

DECONTAMINATE vehicles and equipment coming to the Preserve from infested areas by:

1. Commercial car-wash prior to heading to the Preserve.
2. Hose vehicle with pressurized water (hot water works even better). Especially truck beds, car bumpers and wheel wells, also check under the hood.

ISOLATE vehicles and equipment from the infestation, while parked overnight or in storage, by:

1. Park and store equipment in enclosed, coqui-free garage.

2. Maintain a coqui-free buffer around carports, homes and other structures.