

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

January 13, 2012

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

Land Board Members:

SUBJECT: AUTHORIZATION OF FUNDING FOR THE NATURE CONSERVANCY OF HAWAI'I FOR \$1,201,200 DURING FY13-18 FOR CONTINUED ENROLLMENT IN THE NATURAL AREA PARTNERSHIP PROGRAM AND ACCEPTANCE AND APPROVAL OF THE WAIKAMOI PRESERVE LONG RANGE MANAGEMENT PLAN, TMK 2-3-05-04, MAUI

SUMMARY:

This submittal requests the Board to authorize matching funding for the management of the 5,230-acre Waikamoi Preserve as part of the Natural Area Partnership Program (NAPP). Although Natural Area Partnership agreements are made in perpetuity, funding is authorized on a six-year basis to allow for periodic State and public review. The current contract is scheduled to terminate at the end of this Fiscal Year, and The Nature Conservancy of Hawai'i has prepared a new six-year management plan for Fiscal Years 2013-2018. The Division of Forestry and Wildlife (DOFAW) recommends the authorization of matching funding, in the amount of \$1,201,200, to continue conservation management of the Preserve for Fiscal Years 2013-2018.

DISCUSSION:

Chapter 195-6.5, HRS established the NAPP in 1991 and authorized the Department of Land and Natural Resources (DLNR) to provide State funds on a two-for-one basis with private funds for the management of private lands that are dedicated to conservation. The program seeks to protect, restore, or enhance significant native resources of the state. The 5,230-acre Waikamoi Preserve was established in 1983 through a perpetual conservation easement with the landowner, Haleakalā Ranch Company. The Preserve protects significant watershed, endangered species, and native ecosystem resources. The Long Range Management Plan (LRMP) (Attachment) provides a more detailed description of proposed activities and maps. The Nature Conservancy of Hawai'i will be responsible for the actual implementation of the management plan.

The total budget for Fiscal Years 2013-2018 is \$1,801,800. Continuing as a Preserve under the NAPP, the State would provide 2:1 matching funding for the natural area protection efforts outlined in the FY13-18 LRMP. Total State funding requested for Fiscal Years 2013-2018 is \$1,201,200; The Nature Conservancy will provide the match of \$600,600.

The Preserve is primarily within the Conservation District, in Protective, Limited and Resources Subzones. Conservation District Use Permit SH-2028 permits ongoing watershed and vegetation protection and Site Plan Approval MA-09-07 permits the Axis Deer Fencing Project within the Preserve. The proposed use of conservation management as described within the LRMP continues previously approved activities and is a permitted use within the subzones.

The LRMP was reviewed by Division of Forestry and Wildlife staff and unanimously accepted by the Natural Area Reserves System Commission on November 28, 2011.

CHAPTER 343 – ENVIRONMENTAL ASSESSMENT:

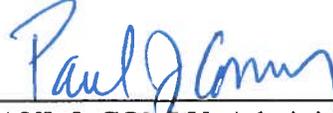
Actions being proposed for reauthorization in the FY 13-18 LRMP are substantively similar to, and relevant to, actions previously considered in the Final Environmental Assessment for Waikamoi Preserve, for which The Nature Conservancy received a “Finding of No Significant Impact” in 2000. Pursuant to Hawaii Administrative Rule § 11-200-13 (Consideration of previously determined and accepted statements), all environmental review obligations under HRS Chapter 343 have been fulfilled and are keeping with the letter and intent of the Administrative Rules regarding the NAP Program.

RECOMMENDATIONS: That the Board:

1. Continue approval of the activities identified in the Waikamoi Preserve FY 2013-2018 Long Range Management Plan as a permitted use within the Conservation District;
2. Authorize the continued funding for the Waikamoi Preserve as part of the Natural Area Partnership Program for Fiscal Years 2013-2018 in the amount requested (\$1,201,200); and
3. Authorize the Chairperson to negotiate and enter into a contract encumbering funds for Waikamoi Preserve Natural Area Partnership Agreement with The Nature Conservancy for Fiscal Years 2013-2018 with the following conditions:
 - a. The long range management plan is accepted for a six-year period.

- b. Funding is authorized for the full six-year period as described in the agreement, subject to annual availability of funding and annual budget procedures and approvals, and approval as to form by the attorney general's office.

Respectfully submitted,



PAUL J. CONRY, Administrator
Division of Forestry and Wildlife

APPROVED FOR SUBMITTAL:



WILLIAM J. AILA, JR., Chairperson

Attachment: Waikamoi Preserve Long Range Management Plan FY 2013-2018

Waikamoi Preserve

East Maui, Hawai'i

Long-Range Management Plan
Fiscal Years 2013-2018



Submitted to the
Department of Land & Natural Resources
Natural Area Partnership Program



Submitted by
The Nature Conservancy of Hawaii

January 2012

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EXECUTIVE SUMMARY

The Nature Conservancy of Hawai'i is an affiliate of The Nature Conservancy, an international private, non-profit organization based in Arlington, Virginia. The Conservancy's mission is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. Since 1980, the Conservancy has directly helped protect more than 200,000 acres of Hawai'i's best natural lands and established a statewide system of 10 preserves totaling almost 36,000 acres. Today, we are taking conservation to a new level in Hawai'i by protecting the larger landscapes and biological systems of which our preserves are a part. Together with other public and private landowners, we are protecting over 1.6 million acres of ecologically important lands through voluntary, cooperative partnerships that allow landowners to share expertise and resources and work across ownership boundaries.

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. Waikamoi Preserve is one of two state-funded Nature Conservancy of Hawai'i (TNCH) preserves on Maui. Approved for NAPP funding in 1992, this Waikamoi long-range management plan follows earlier plans, the most recent covering fiscal years (FY) 2007–2012. Presently, TNCH is seeking reauthorization of NAPP funding for the next six-year period for the programs described within this *Waikamoi Preserve FY2013–FY2018 Long-Range Management Plan*. This plan continues the programs implemented under the previous plans and environmental assessments. Herein, we request \$256,733 annually in matched state funds for the six years spanning FY2013–2018. 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 written reports and an annual inspection. Operational plans are submitted annually (the Conservancy has adopted a July 1–June 30 fiscal year). In addition, a six month semiannual report is sent to DLNR each February. These documents are available upon request to others who are interested.

The first section of this plan is a brief overview of the native natural resources that are protected at Waikamoi 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 FY2013–2018 are also listed.

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

Table 1. Overview of Waikamoi Preserve Accomplishments by Program, FY 2007–2011 (5 years)

	Indicator	Measure of Success
Ungulate Control	Total animal catches	152 pigs (including 54 from Prohunt) 13 deer
	Total snares checked	All groups checked multiple times annually (between 831 and 1190 individual snares)
	Total hunts conducted	225 total hunts, including 67 conducted by Prohunt and 49 community hunts
	Miles of fence inspected, maintained and/or replaced in Waikamoi	19 mi inspected regularly ¹ 5.5 miles of fence replaced
	Miles of fence installed in adjacent East Maui	Supported and helped EMWP build 1 mile of fence in Hāna forest reserve ¹
Invasive Plant Control	Acres and total numbers of priority invasive plants treated or removed	936 acres swept for Himalayan ginger, with all target plants treated For all other priority species see Table 4, Weed Control Estimates
	Total acres mapped with high resolution aerial imagery via Resource Mapping ²	6,100
Resource Monitoring	Frequency of ungulate sign on ungulate transects	From 9% activity in FY07 to 0% in FY10 and FY11
	Acres surveyed for plant infestations	~ 300 annually
Rare Species Protection and Research	Number of new rare taxa locations discovered	17 rare plant species documented in Ko'olau Forest Reserve survey 37 new locations for rare plant species 1 new taxa discovered (<i>Melicope</i> sp. nov) 17 new <i>Cyanea horrida</i> locations
	Number of species outplanted and recovered	6 rare species outplanted
	Number of research projects supported in Waikamoi	3 bird 15 invertebrate 7 vegetation

¹ Including Deer Management Unit fence (3.4 mi) and Waikamoi fences that NPS maintains (7.9 mi)

² Paid wholly with private monies

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² Paid wholly with private monies

Over the next six years TNCH will continue to augment staff with external capacity to carry out effective management at Waikamoi. Beginning in October 2010, TNC began a subaward to Tri-Isle RC&D Council, Inc. to complete a portion of the stewardship activities in the Waikamoi Preserve through the East Maui Watershed Partnership (EMWP). This was partially a response to challenging economic conditions, but primarily an effort to build capacity of partners, streamline operations, and increase efforts toward conservation innovation and technology. The EMWP is directed to conserve and protect 100,000 acres of important forest and watershed lands of East Maui, which include Waikamoi preserve. Through a subaward with EMWP, we are able to consolidate many routine management activities under one field crew while devoting more of our increasingly limited staff time toward infrastructure and technological improvements. As such, TNC seeks to continue to subaward with EMWP (or another contractor if needed) to remove pigs and monitor for their presence, remove and suppress invasive habitat-modifying weeds, and conduct routine fence inspections and maintenance. TNCH will continue to pursue outsourcing opportunities, particularly if they improve efficiency and increase capacity.

We plan to accomplish the following goals over the next six years:

Ungulate Control

- Goal: To protect large native-dominated areas and watershed within and adjacent to Waikamoi Preserve by removing all ungulates and preventing future invasion.

Invasive Plant Control

- Goal: To maintain large native-dominated core areas within Waikamoi Preserve and adjacent areas that are free of habitat-modifying weeds, and prevent the introduction and spread of problem weeds to areas where they are not currently established.

Small Mammal, Invertebrate Pest, and Pathogen Prevention and Control

- Goal: To prevent the introduction of small mammals, non-native insects, mollusks, pathogens, and other pests deemed to be a significant threat, and reduce their negative impact where possible.

Resource Monitoring, Rare Species Protection, and Research

- Goal: Conduct and support monitoring and research to track the status of biological and physical resources of the preserve, especially rare species, while encouraging and assisting with research that increases our understanding and management of the preserve's natural resources.

Community Outreach

- Goal: To build public understanding and support for the preservation of natural areas, and enlist volunteer assistance for preserve management.

Fire, Emergency, and Safety

- Goal: Provide staff with training and equipment that will allow them to assist primary fire and rescue agencies during a fire or emergency on or adjacent to the preserve.

Watershed Partnerships

- Goal: Support the East Maui Watershed Partnership where cooperative management activities mutually benefit Waikamoi Preserve and the EMWP.

RESOURCE SUMMARY

General Setting

The 5,230-acre Waikamoi Preserve was established in 1983 through a perpetual conservation easement with the landowner, Haleakalā Ranch Company. The preserve lies west of the state's 7,500-acre Hanawī Natural Area Reserve (NAR), and its southern boundary runs along Haleakalā National Park (HALE). These managed areas, together with other state and private lands on the northeast slopes of Mt. Haleakalā, represent one of the largest intact native rain forests in the state, comprising more than 100,000-acres (Figure 1). Waikamoi also provides essential watershed for the island of Maui. The East Maui watershed region is the largest single source of harvested surface water in the state with an average harvested flow of 60 billion gallons per year. Active management of Waikamoi Preserve contributes to the protection of the entire 100,000-acre area.

The Conservancy is in the process of finalizing an additional conservation easement over 3,540 acres of East Maui Irrigation Co. Ltd. (EMI) lands adjacent to Waikamoi Preserve. The land is some of the highest quality and weed-free native forest in the state, in addition to being prime forest bird habitat. The parcel is at the center of the 100,000-acre East Maui Watershed Partnership (EMWP) area, and is bordered by the State of Hawai'i Ko'olau Forest Reserve, the Hanawī Natural Area Reserve, Haleakalā National Park, and lies immediately below TNC's Waikamoi Preserve, with which it shares a long seven mile boundary (Figure 1). Ungulate and weed management in this parcel has long been a management priority for Waikamoi preserve and the EMWP, as animals and weeds removed here cannot spread into the preserve. Ample funding for the Waikamoi NAPP program helps to ensure that TNC can devote additionally raised private funds to manage this critical parcel.

Flora and Fauna

Fourteen terrestrial native natural communities are represented in Waikamoi Preserve, two of which are considered rare: *Deschampsia* subalpine mesic grassland and māmane (*Sophora chrysophylla*) subalpine dry forest (Figure 2, Appendix 1), and eight of which are also found in the adjacent Hanawī NAR (including the rare *Deschampsia* subalpine mesic grassland). To date, 38 rare plant species have been reported in the preserve, twelve of which are endemic to East Maui, and eight of which are formally listed as endangered (Appendix 2). In the EMI parcel, there are an additional three species of rare plants that are known not to be found in Waikamoi Preserve, one of which is endangered (Appendix 2).

Thirteen native birds have been historically reported from Waikamoi Preserve and of those, eight are federally listed as endangered: 'ākohekohe (*Palmeria dolei*), Maui parrotbill or kiwikiu (*Pseudonestor xanthophrys*), dark-rumped petrel or u'a'u (*Pterodroma phaeopygia sandwichensis*), Newell's shearwater or a'o (*Puffinus auricularis newellii*), nene goose (*Branta sandvicensis*), Maui 'akepa (*Loxops coccineus ochraceus*), po'ouli (*Melamprosops phaeosoma*), and Maui nukupu'u (*Hemignathus lucidus affinus*). Recent surveys conducted by the Maui Forest Bird Recovery Project have indicated the possibility of increasing numbers of kiwikiu³, and the 'ākohekohe population is thought to be

³ MFBRP 2011. Kiwikiu in Waikamoi Preserve West of Ko'olau Gap, Survey Report September 2009/2010.

stable; however 'akepa, Nukupu'u, and po'ouli haven't been seen in one or two decades. Other more common native birds found in the preserve include 'apapane (*Himatione sanguinea*), 'i'iwi (*Vestiaria coccinea*), 'amakihi (*Hemignathus virens*), pueo (*Asio flammeus sandwichensis*), and 'alauahio (*Paroreomyza montana*). See Appendix 4, Native Birds of Waikamoi Preserve. The endangered Hawaiian hoary bat (*Lasiurus cinereus*) is also found in the preserve. Many of these bird and plant species have been identified on the adjacent EMI parcel. In addition, once officially surveyed, there is high confidence that rare species not found in Waikamoi will be located.

Waikamoi & East Maui Watershed Partnership Fencing Status

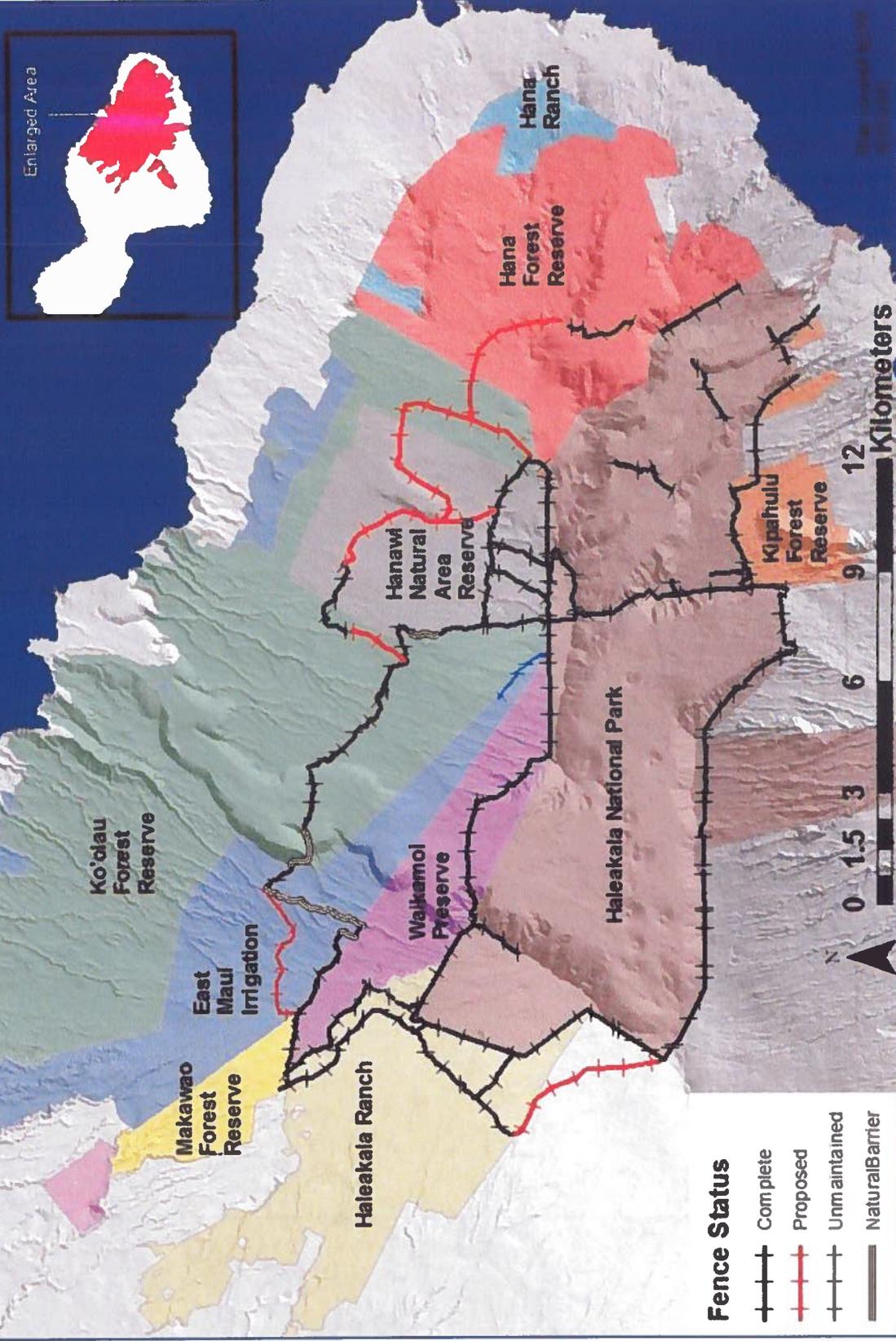
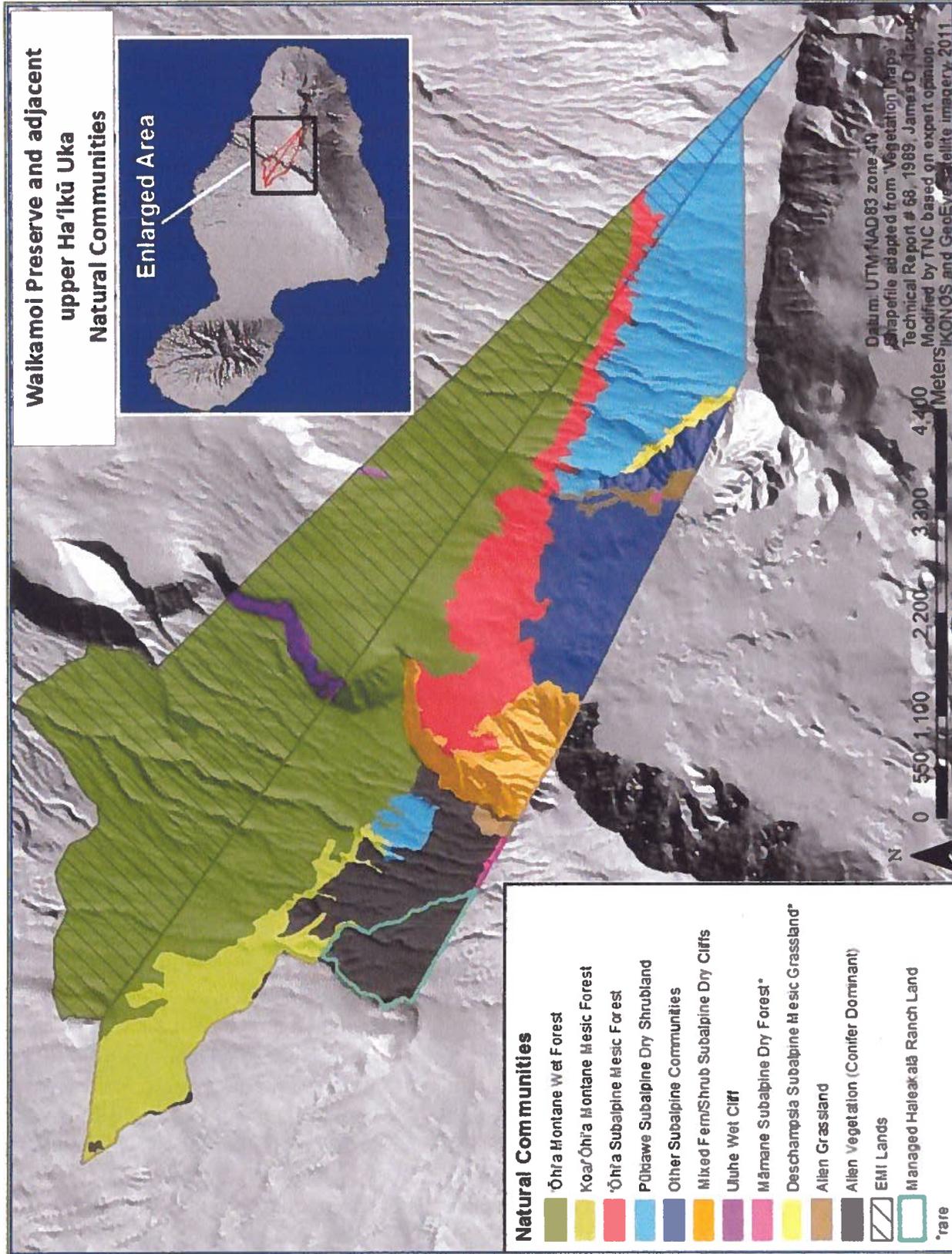
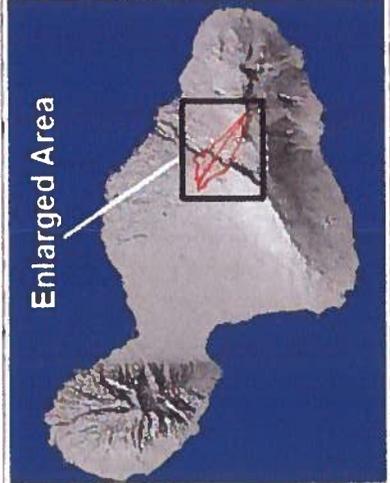


Figure 1. Waikamoi and East Maui Watershed existing and proposed fences



Waikamoi Preserve and adjacent upper Ha'ikū Uka Natural Communities



- Natural Communities**
- Ōhīa Montane Wet Forest
 - Koar'Ōhīa Montane Mesic Forest
 - Ōhīa Subalpine Mesic Forest
 - Pōkiawe Subalpine Dry Shrubland
 - Other Subalpine Communities
 - Mixed Fern/Shrub Subalpine Dry Cliffs
 - Uluhe Wet Cliff
 - Māmane Subalpine Dry Forest*
 - Deschampsia Subalpine Mesic Grassland*
 - Alien Grassland
 - Alien Vegetation (Conifer Dominant)
 - EMI Lands
 - Managed Haleakalā Ranch Land
- *rare

Figure 2. Waikamoi Preserve and adjacent Ha'ikū Uka natural communities

MANAGEMENT

Management Considerations

1. As of May 2011, The Conservancy is seeking to acquire an additional land parcel on East Maui Irrigation (EMI) lands adjacent to Waikamoi Preserve. The conservation easement would bring an additional 3,540 acres of very high quality native habitat that harbors critical forest birds under permanent protection. This would bring legal protection to one of the most remote and pristine remaining private parcels on Maui.
2. Waikamoi Preserve is adjacent to three other large, managed natural areas: Haleakalā National Park (HALE), the state Ko'olau Forest Reserve, and the state Hanawā Natural Area Reserve. In addition, in 1991 we helped initiate the formation of the East Maui Watershed Partnership (EMWP) with the State Department of Land and Natural Resources, East Maui Irrigation Co. (EMI), Haleakalā Ranch Company, County of Maui, Haleakalā National Park, and Hāna Ranch Partners, LLC to implement a unified management plan for the East Maui watershed. Management efforts at Waikamoi will complement the objectives of the EMWP management plan, and TNC often conducts management on adjacent lands, including EMI and State lands, to prevent ungulates and weeds from spreading into Waikamoi. Management activities between the Conservancy and EMWP are coordinated, with staff, equipment, and expertise is frequently shared to maximize management efficiency.
3. A portion of the management activities at Waikamoi Preserve are now outsourced via a subaward to EMWP. This was partially a response to challenging economic conditions, but primarily an effort to build capacity of partners, streamline operations, and increase efforts toward conservation innovation and technology. TNC staff continue to augment and monitor management activities in the preserve and collaborate with the subawardee. In the future and with prior state approval, we may outsource to other qualified entities.
4. The primary strategy for the protection of Waikamoi Preserve is removing ungulates to reduce damage to native vegetation and soils. Ungulate damage in all of the preserve's management units has been reduced to near zero during the last six-year period due to the Conservancy's management activities, including implementing a dog program for hunting and scouting activities in accessible areas of the preserve.
5. With the exception of about 800 acres of an exotic tree plantation (including blackwood acacia, cedar, *Pinus* spp., and other conifers) adjacent to HALE's Hosmer Grove area, Waikamoi's 5,230 acres are dominated by native species. The Conservancy's weed management activities focus on controlling Himalayan ginger (*Hedychium gardnerianum*), invasive pines (*Pinus* spp.), gorse (*Ulex europaeus*), and ash (*Fraxinus uhdei*), and preventing the establishment of new priority weeds moving from adjacent lands (See Table 2). In addition, we are investing in landscape scale weed mapping techniques, and with the aid of this new high resolution photo imagery, we plan to map and control outliers of Miconia, Australian tree fern, strawberry guava, and banana poka before they reach the preserve. These weed species pose the greatest long-term threats to the preserve.

6. A primary management objective is to prevent the introduction of habitat-modifying weed species, pest insects, or plant disease. Special care must be taken to minimize negative side effects of management activities. Therefore, staff follow a strict cleaning protocol for all gear to remove seeds, debris, and insects in order to prevent accidental introduction of pest species to the preserve.
7. Much of Waikamoi is remote and difficult to access. Therefore, most management activities must be carried out by helicopter. Field staff and subcontractors will often fly to one of five remote camps and work for three to five days at a time. This strategy minimizes the inadvertent introduction of destructive alien species by reducing foot traffic from alien-infested areas.
8. We will continue to adapt our management in order to incorporate innovative strategies that are more effective and reduce costs, and that address new or changing threats. Climate change will likely exacerbate invasive species issues and other current threats to the biodiversity. Loss of biodiversity, increases in invasive species, and habitat loss are expected to be the greatest stresses to Hawai'i's native ecosystems resulting from climate change. In addition, longer periods of drought could significantly increase wildfire risk, especially in the conifer-dominated portion of the preserve. The strategies outlined in this plan such as ungulate control and removal of top habitat-modifying weeds should increase ecosystem resilience to climate change impacts.
9. We will continue to pursue new technologies that enhance current management practices. Examples include GPS tracking for feral animals using trained dogs; remote sensing mapping to detect isolated populations of priority invasive plants; new application technologies that provide effective control of priority weeds using target-specific methods and low rates of herbicides; and supporting exploratory research in countries of origin for our priority invasive plants, including collaboration for well-regulated releases of biocontrol agents onto priority alien pest species.
10. We completed a comprehensive East Maui Conservation Action Plan (CAP) in March 2010. The CAP process improved conservation strategies for the site, and adapted management actions to achieve greater conservation impact. Strategies and activities outlined in this long-range plan mirror those in the CAP.

Management Units

Waikamoi is currently managed in six units (Figure 3). The units are defined by topographic boundaries, similarity of natural community types, and threats. Topographic features determine the placement of fences built by the Conservancy and HALE. The Nature Conservancy's fences tie into the HALE fence at Pu'u Nianiau and Waikamoi's easternmost tip, and extend downward in elevation. Cooperative agreements with HALE, Haleakalā Ranch, EMI, the state, and the EMWP allow the Conservancy to work outside the preserve boundaries. All of the partners of the EMWP, including the Conservancy, are collaborating on fencing projects to ensure that the native-dominant core of the East Maui Watershed is protected.

In 2011, the Conservancy adopted a position statement by the Hawai'i Conservation Alliance (HCA) on the important of integrating Native Hawaiian approaches and knowledge systems with

conventional conservation efforts. As such, the TNC Maui program devised Hawaiian names for all management units of Waikamoi, described below.

1. Unit 1A (Pu'u O Kaka'e Unit) is the westernmost portion of the preserve and the lowest in elevation (4,400–6,000 feet). Its western edge abuts Haleakalā Ranch's open pastureland. It is comprised of koa 'ōhi'a (*Acacia koa*/*Metrosideros polymorpha*) montane mesic and 'ōhi'a montane wet forest (Figure 2). This is one of the most accessible units, and has therefore suffered from some fence vandalism in the past six year period. Ungulate management has been limited to hunting rather than trapping, due to accessibility. The unit is now pig free due to the adoption of intense and systematic hunting techniques which employ highly trained hunting dogs outfitted with GPS collars. The unit is entirely fenced except for the eastern boundary, which is formed by the very steep Waikamoi Gulch. Unit 1A contains localized infestations of Himalayan ginger, blackberry (*Rubus* spp.), tropical ash, gorse, eucalyptus, and pasture grasses (*Poaceae* spp.). The mesic aspect of this unit enhances the plant diversity to contain more species of trees, shrubs, vines, herbs, and ferns than found in the other units. Unit 1A also contains a high number of rare plant species.
2. Unit 1B (Pu'u Lu'au Unit) (5,200–6,200 feet elevation) is primarily 'ōhi'a montane wet and koa 'ōhi'a montane mesic forest (Figure 2). Over half of the unit's lower northwest boundary has been fenced on the Waikamoi boundary with the other half protected by fencing on EMI land. This unit contains breeding populations of Maui parrotbill and 'ākohekohe, and has been the site of several forest bird research projects. The upper boundary is bordered by conifers and other alien vegetation, and this unit contains relatively small patches of blackberry, ginger, and eucalyptus.
3. Unit 2 (Honomanū Mauka Unit), below HALE's Hosmer Grove, is dominated by dense stands of conifers except for 100 acres of native-dominant subalpine shrubland at the lower eastern edge (Figure 2). There is also pūkiawe subalpine dry shrubland, koa/'ōhi'a montane mesic, 'ōhi'a montane wet forest, mixed fern-shrub subalpine wet cliffs, and a small patch of rare māmane subalpine dry forest. The native shrubland contains populations of the Hawaiian dark-rumped petrel near the pali edge. Throughout the conifers are many patches of blackwood acacia, and a shrinking population of tropical ash near the western boundary. All of the gorse in this unit has been mapped and treated, with only diminishing seedlings and occasional re-growth remaining (which are routinely treated every 7–8 years). The understory outside the conifer shade is comprised of velvet grass (*Holcus lanatus*) and sweet vernal (*Antoxanthum odoratum*), with other alien grasses, as well as native shrubs and ferns. This is also where blackberry has invaded, likely from historical cattle grazing. However, the gulches that cross this unit are often dominated by native vegetation; some contain populations of the endangered *Geranium arboreum*. The area is highly suitable for restoration should a funding opportunity arise to pay for conifer removal.
4. Unit 3's (Ko'olau Unit) upper area is primarily 'ōhi'a subalpine mesic forest with a small band of subalpine communities along the upper unit boundary. The lower area is predominately 'ōhi'a montane wet forest (Figure 2). This unit contains many rare plants and birds, including populations of the Hawaiian dark-rumped petrel along the pali. A small portion of this unit at the base of the 'Āinahou pali was once used for summer pasture by Haleakalā Ranch, and

contains significant patches of blackberry and pasture grasses. The new conservation easement with EMI will extend Unit 3 down to 3800' elevation; the new addition to this unit will be comprised of 'ōhi'a montane wet forest.

5. Unit 4 (Waikau Unit) is primarily pioneer vegetation on lava flows with subalpine communities and some *Deschampsia* subalpine mesic grassland (Figure 2). The ground is predominately 'ā'ā and pāhoehoe lava (which is relatively rare on Maui). HALE's fence forms Unit 4's north boundary and divides it from the rest of the preserve. Patches of alien grasses and spreading conifers can be found throughout Unit 4.
6. Unit 5 (Hanakauhi Unit) is comprised of 'ōhi'a montane wet forest in its lower portions, and the larger upper portion is pūkiawe subalpine dry shrubland with a small band of 'ōhi'a subalpine mesic dry forest in between (Figure 2). This unit extends from 5,600 feet to nearly 8,600 feet elevation. Management activities have dramatically reduced the formerly heavy impact of goats and pigs resulting in a three-fold increase in shrub cover and a 50% reduction in alien grass cover, recently documented in a vegetation change study conducted by Hughes et al⁴ (Figure 4). This unit contains patches of blackberry in the easternmost areas. The new conservation easement with EMI will extend Unit 5 down to 4,800' elevation; the new addition to this unit will be primarily comprised of 'ōhi'a montane wet forest with small bands of 'ōhi'a subalpine mesic forest and pūkiawe subalpine dry shrubland communities.

⁴ Hughes, et al. 2011. Pacific Science. Under revision.

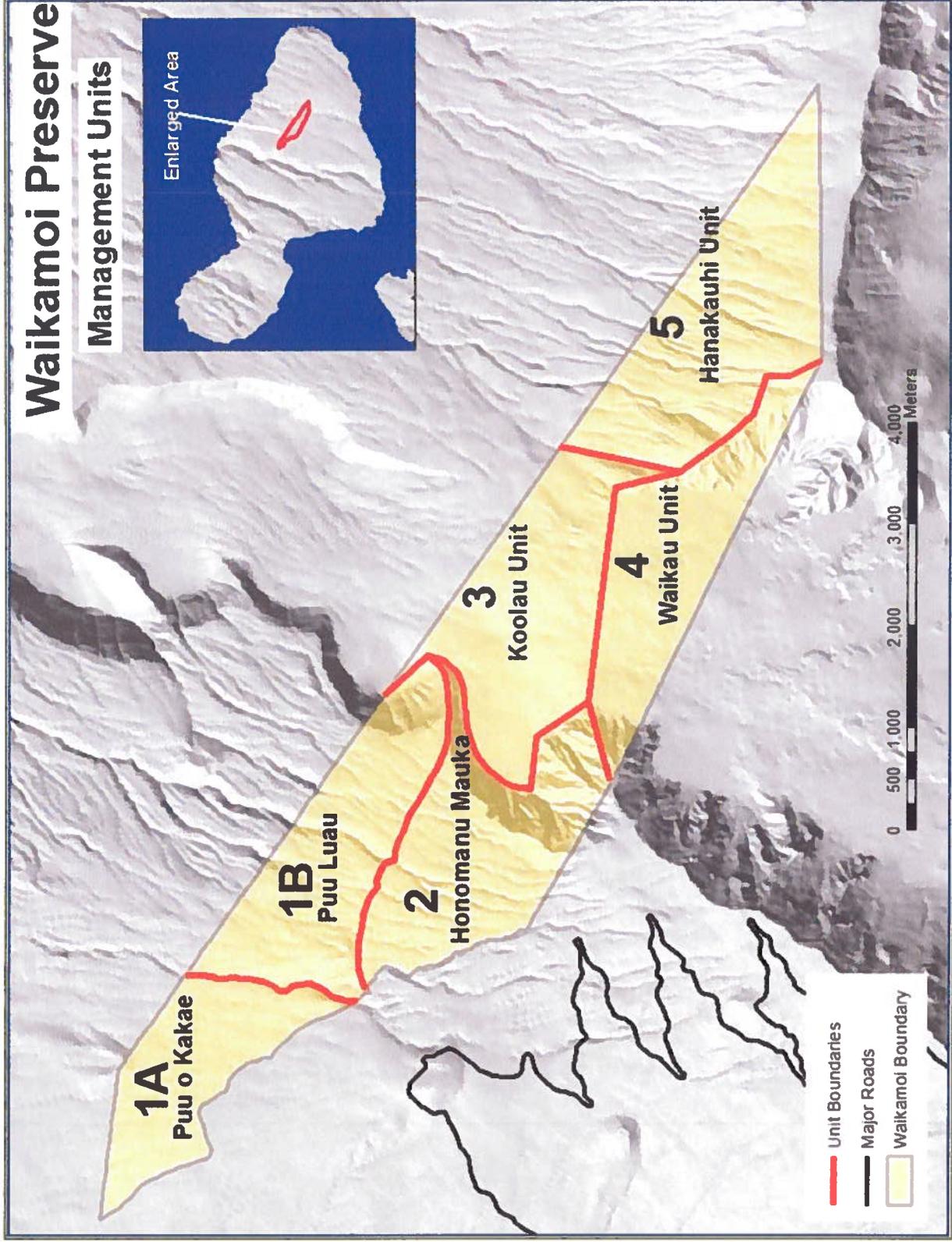


Figure 3. Management Units of Waikamoi Preserve.

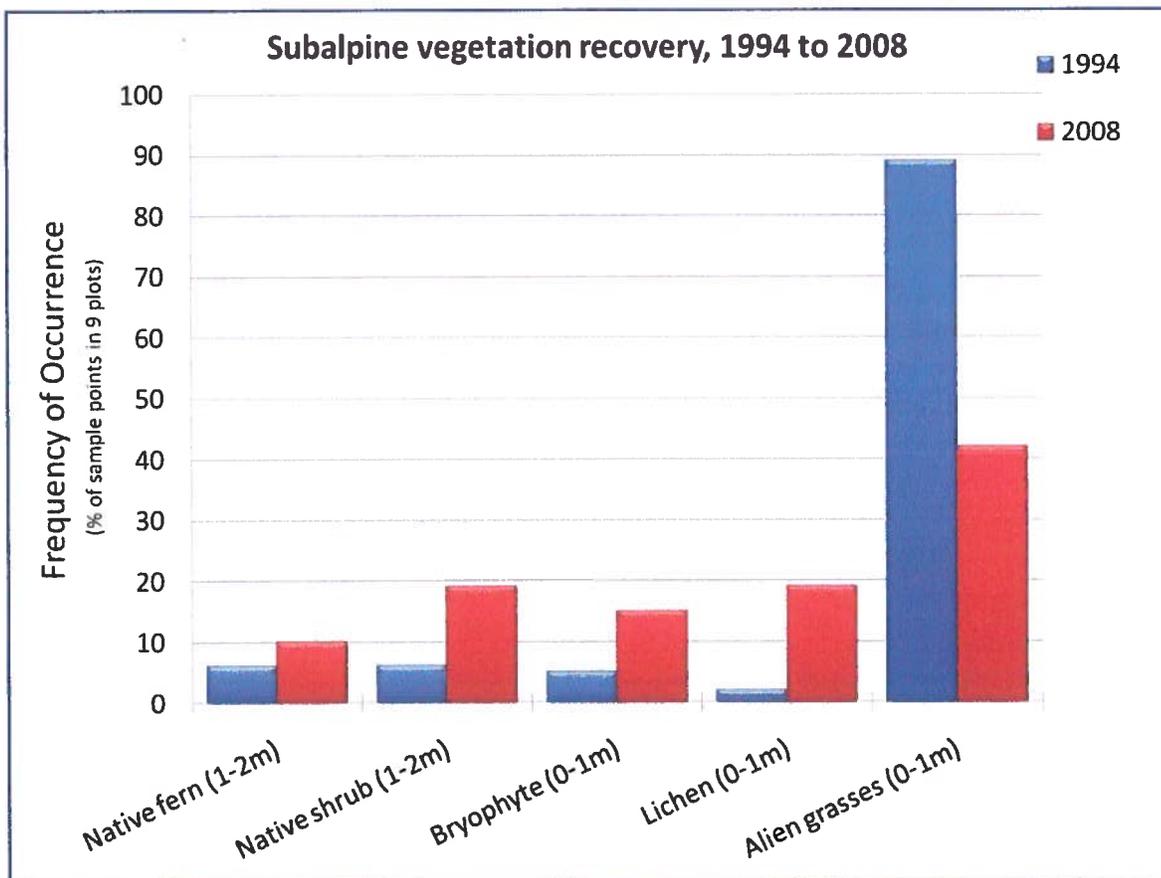


Figure 4. Recovery of native subalpine shrubland habitat documented in Unit 5 in 2008.

Management Programs

Although the following management programs are described separately, they form an integrated management approach. For each program listed in the following section, we have indicated a major goal and described the management methods chosen. Also included are highlights of past and current achievements and key management issues. Finally, key objectives to achieve the goal are listed by year for FY2013–FY2018.

Program 1: Non-Native Species Control

A. Ungulate Control

Program Goal: To protect large native-dominated areas and watershed within and adjacent to Waikamoi Preserve by removing all ungulates and preventing future invasion.

Program Description: The importance of Waikamoi Preserve as a refuge for thirteen native Hawaiian birds, thirty-eight rare plants, and seventeen natural communities cannot be overstated. It is one of the most viable and intact remaining native forests in the state. Ungulate damage is the greatest threat to the preserve and critical East Maui watershed headwaters, and is therefore the focus of the Waikamoi resource management program.

The ungulate control program utilizes a combination of fencing, hunting, and snaring to bring pig populations down to zero as rapidly as possible, and to prevent new populations from becoming established in the preserve. Pigs in particular reproduce at very high rates. Scientific research tells us that seventy percent of the population must be removed annually to maintain lower pig numbers. Snares will continue to be used until an equally effective alternative can be found.

In 2007, TNC and EMWP began implementation of the Forest Recovery Project, a three-year project designed to dramatically reduce ungulates throughout a 12,000 acre focal area that encompasses Waikamoi Preserve and adjacent EMWP lands. The goal was to achieve near-zero damage and activity levels and set up an ongoing “no tolerance” management program that will maintain near-zero damage and activity levels. During the course of the project, TNC and EMWP installed an extensive system of backcountry management infrastructure consisting of trails, camps, transects and helicopter landing zones. This intensive on-the-ground time allowed field staff to become familiar with all management units and greatly facilitates long-term management of the 12,000 acre enclosure.

A large part of the Forest Recovery Project was the hiring of professional conservation company Prohunt to test innovative technologies and methods to improve our ability to protect native forests from ungulate damage⁵. Prohunt began operations in October 2007 and completed operations in March 2008. This project expanded proven methods of on-the-ground conservation, such as fencing and community hunts, plus increased the incorporation of technologies such as GPS (Global Positioning Systems) into all of our field operations, with subsequent data analysis and mapping conducted using GIS (Geographic Information Systems). We also have adopted more precise hunting techniques utilizing systematic ground sweeps with all hunts tracked by GPS units on hunting dogs and hunters. This method allows us to document areas covered and identify hotspots of animal activity and areas that have been missed.

To refine our hunting techniques, we purchased two of Prohunt’s dogs and now have an excellent in-house dog team for removing pigs in accessible units where snaring is not appropriate. The Conservancy’s dog program is a major success factor in our ungulate removal program. In FY09 we implemented a dog program in more accessible areas of the preserve, wherein hunter-dog teams equipped with GPS technology sweep predefined areas systematically and in unison in order to track pigs. The dog program, along with more systematic scouting and adaptive management, has enabled us to bring ungulate numbers in the preserve to near zero. Dogs have also proven useful for detecting weaknesses in fence integrity. We may expand this program in the future to bring dog hunting into more remote areas of the preserve, such as Unit 1B. Effort is also being made to refine and improve our dog handling and training protocols. In FY11 a group of TNC ungulate experts met to evaluate the current status of each island’s dog team to determine the strengths and weaknesses of each team. The goal of the group is to develop dog programs that perform to the highest standards for effective ungulate management. The guidelines and protocols developed by this group will also enable TNC to build similar capacity with private contractors and existing partnerships.

During the past six year period, we replaced 5.5 miles fence and consistently maintain, in cooperation with HALE, 19 miles of fencing in Waikamoi (Figure 5). This includes the 3.4 mile, 8’ high deer fence

⁵ Paid for with private dollars

that established the Deer Management Unit (DMU), which has been maintained and improved. The replacement of an existing cattle fence with 47 inch hogwire split the DMU into two sections to increase hunt efficiency (Figure 5). The DMU provides an essential, protective barrier to deer populations at the western edge of both Waikamoi Preserve and the newly acquired EMI parcel. Also, strategic wing fences were added to increase the effectiveness of existing fences in areas that were determined as possible pig ingress points. Additional fence improvements such as apron and stream curtains were added. Quarterly fence inspections of the entire Waikamoi Preserve boundary ensure that the ungulate fences maintain their integrity.

We now have the lowest levels of pig activity in Waikamoi Preserve ever achieved, with only five pigs removed from the preserve in the last fiscal year. Over the last five years, 152 pigs were removed during from the preserve and some adjacent areas (Figure 6). Axis deer are no longer in Waikamoi Preserve, as the last axis deer was removed in 2004⁶. However, axis deer are still found in the DMU. Thirteen deer were removed from the DMU during the last six years. While the goal is to have the DMU be axis deer-free, deer and other ungulates do get in the unit at times because the area is used for grazing cattle by Haleakalā Ranch. Regular deer hunts are conducted in the unit in an attempt to remove deer from the unit.

We work closely with the EMWP to ensure that management efforts are coordinated and most efficiently implemented. The Conservancy and the EMWP work jointly to establish priorities for management. Management at Waikamoi has greatly benefited from this collaboration. Due to the EMWP's effective management, ungulate ingress into Waikamoi from some portions of adjacent EMI and state lands have been greatly reduced.

In order to monitor the effectiveness of our ungulate control strategies and assess the threat level of ungulates to Waikamoi Preserve, we set up a series of 16 transects in 1989 to measure ungulate activity⁷. We monitor the transects semi-annually for signs of ungulate activity in contiguous 5m X 10m plots along 500m-long transects. This monitoring method is used to gauge the effectiveness of our control strategies and techniques. Trend data indicate that overall pig activity observed has declined from about thirty-three percent in 1988 to less than one percent in 2004 (Figure 6). A TNC study conducted in 2009 revealed dramatic recovery of native vegetation following this large decrease in ungulate activity (Figure 7).

⁶ One axis deer was spotted in Unit 2 by Prohunt in FY09; however no deer or sign was observed following the one incident. It is believed that the deer was pushed out through hunting by staff and Prohunt, and the newly upgraded fencing kept the deer out.

⁷ "Ungulate activity" is determined by monitoring belt transects for presence or absence of ungulate signs (e.g., tracks, scat, wallows, evidence of browsing). For example, if ungulate sign(s) are present in 10 out of 100 transect stations, the activity level is said to be 10%.

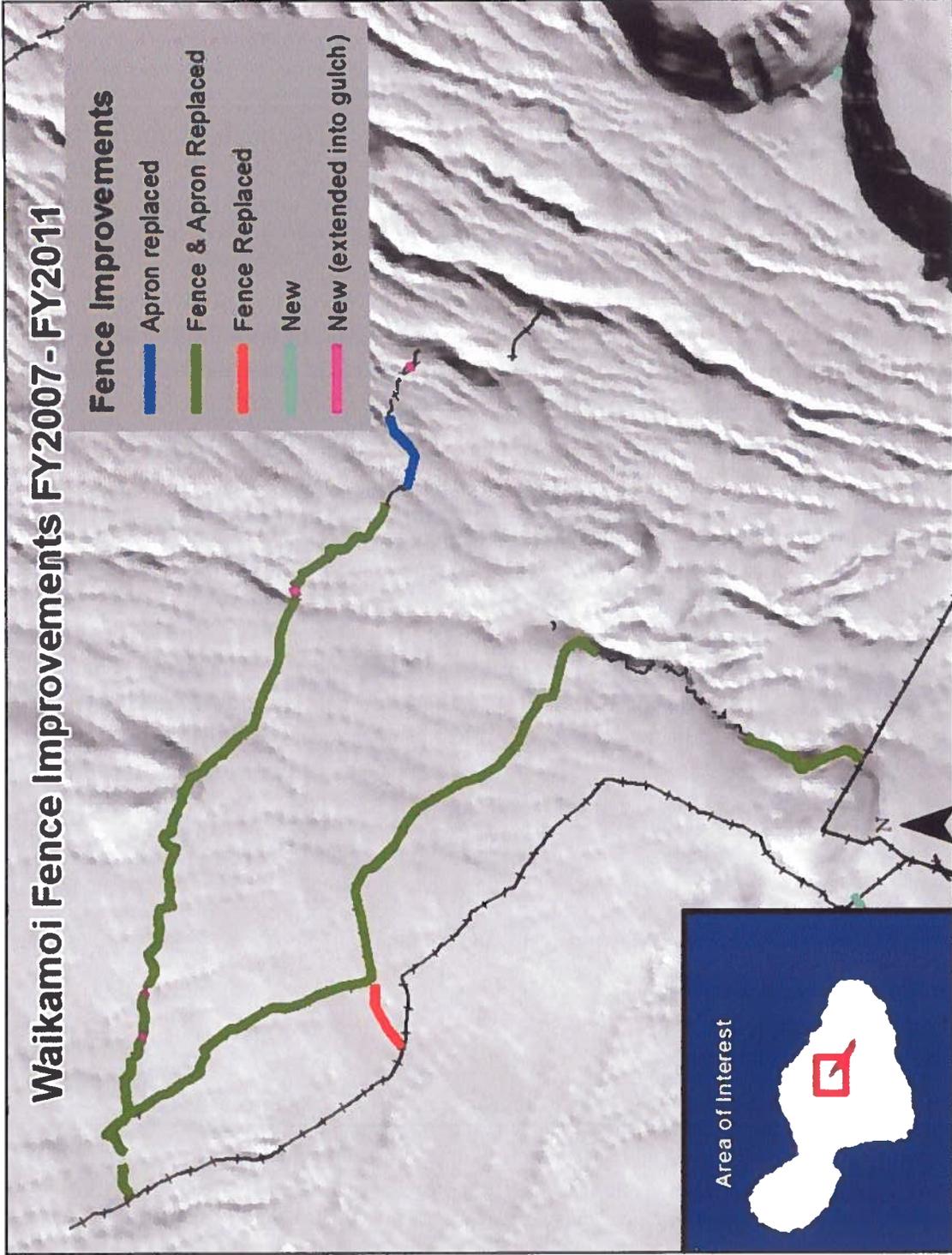


Figure 5. Fencing status of western Waikamoi Preserve

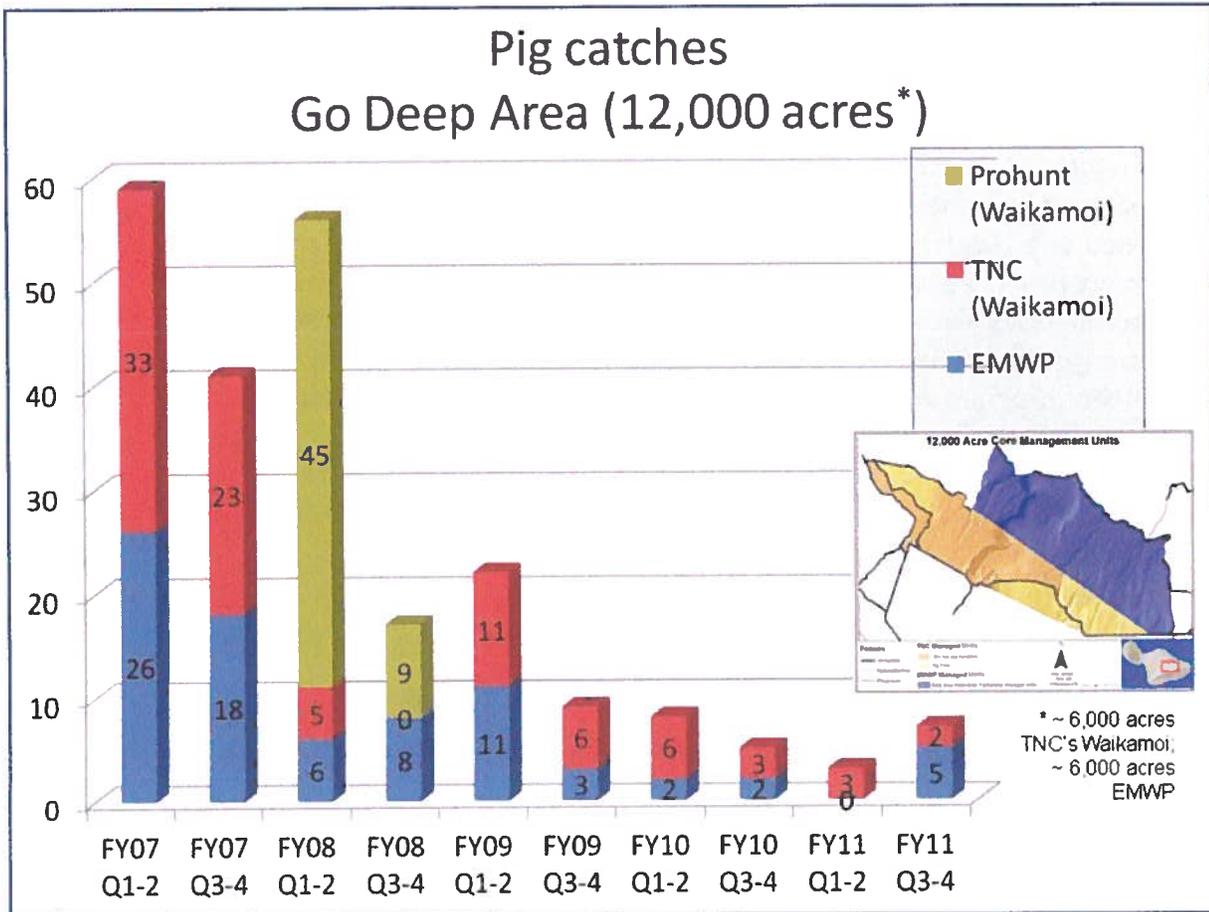


Figure 6. Pig catches during the Forest Recovery Project for the 12,000 acre project area

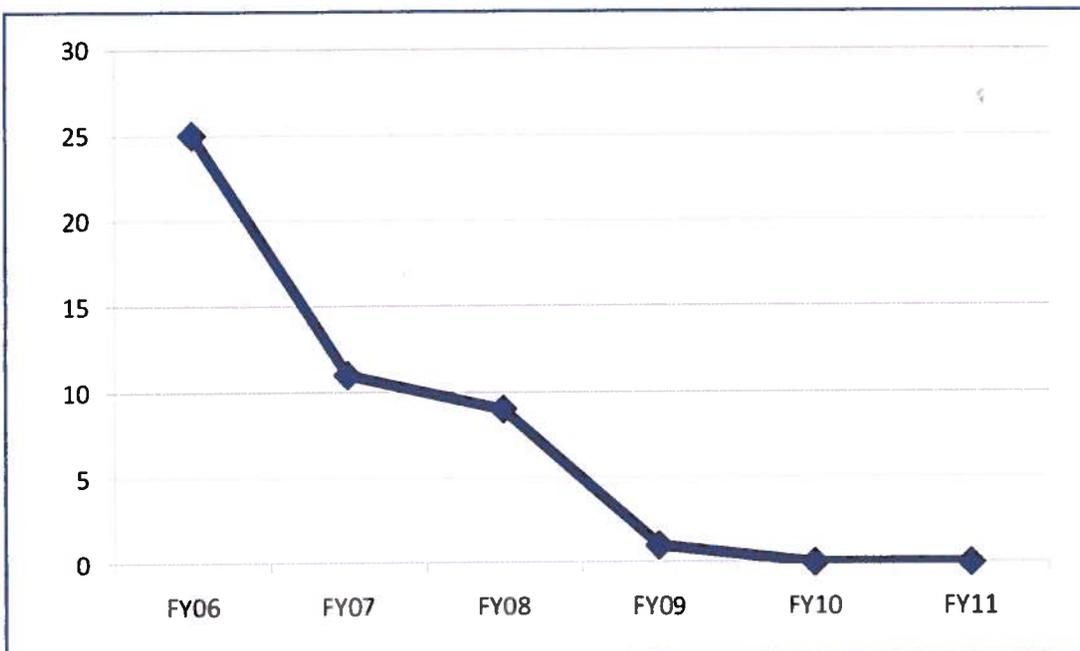


Figure 7. Percent activity on Waikamoi Preserve transects, Units 1A, 1B, and 2

FY13–FY18

The focus of our ungulate control program in FY2013–2018 will be to improve efficiency and reduce costs for maintaining near-zero ungulate activity in Waikamoi Preserve. We will streamline, improve, and refine management activities, such as the dog program, snare positions, and hunt strategies and techniques, so that more effort can be devoted to containing problematic weeds.

The current regime of fencing, hunting, and snaring for ungulate removal has a proven track record. Snaring remains an essential tool in an integrated program for ungulate removal. Fences are checked and maintained on a regular schedule, and will be repaired and replaced incrementally as needed. We may identify new areas that can benefit from strategic fencing or wing extensions. Over the next six years, we will explore new strategies and techniques so that our ungulate control program continues to be as effective, efficient and humane as possible. Notice of any significant changes to the management program will be included in semi-annual progress reporting.

Activities

Years 1–6 (FY2013–2018):

- Inspect all fences on a quarterly basis and make repairs immediately. Inspect fences immediately following storms or other natural or suspected events (e.g., vandalism). Identify new fencing needs and add strategic fences as needed.
- Eliminate ungulates and ingress throughout Waikamoi and at other strategic locations. Regularly check and maintain snares, adding new snares in areas of high pig activity.
- Scout for ungulates routinely and track animal catches. Update pig activity and scout maps annually.
- Annually monitor thirteen 500 meter transects in Units 1A, 1B, and 2 or other strategic sites to track ungulate activity. Continue to refine the monitoring strategy throughout the preserve together with EMWP.
- Prevent invasion of axis deer into Waikamoi Preserve by maintaining deer fence on Haleakalā Ranch and conducting regular deer hunts within the Deer Management Unit.
- Reduce ungulate numbers in the newly acquired EMI parcel using a combination of fencing, hunting, and snaring.*
- Explore ways to improve ungulate fences; work with DOFAW to extend the deer boundary fence.*
- Improve dog program effectiveness, including training, handling, and hunting techniques. Share dog program knowledge with partners as feasible.*
- Test innovative and new monitoring technologies, such as remote game cameras.*

* These activities may go beyond the scope of the NAPP budget due to recent budget cuts, but will be carried out if additional private funds can be raised.

Status of Public Hunting Opportunities

Limited volunteer hunting opportunities are available at Waikamoi. The conservation easement between the Conservancy and Haleakalā Ranch allows Ranch employees to hunt. Public hunters willing to follow Conservancy guidelines will continue to be allowed to hunt in Unit 1A of the preserve on a limited basis (when hunting will not interfere with ongoing management activities, planned guided hikes, and hunting by ranch employees).

This program represents an estimated 43% of the overall effort and budget in this long-range management plan.

B. Invasive Plant Control

Program Goal: To maintain large native-dominated core areas within Waikamoi Preserve and adjacent areas that are free of the highest priority habitat-modifying weeds, and prevent the introduction and spread of problem weeds to areas where they are not currently established.

Program Description: The most important aspects of our invasive plant control program are to minimize current disturbances to intact native communities, reduce infestation size of priority weeds with a focus on outliers, while first surveying for and controlling their outlying populations, and to prevent the introduction of additional invasive plant species. Ungulate removal significantly reduces the introduction and spread of invasive habitat-modifying weeds. We enforce strict procedures to remove weed seeds, mud, and debris from equipment and clothing before people enter the preserve. Helicopter flights originate from areas free of priority weeds, and all equipment and clothing is inspected and cleaned.

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 Hawai'i 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.

Control work is prioritized to target species. As control is achieved at targeted sites for higher priority species, efforts shift to lesser priorities. Our management efforts are guided by the *East Maui Conservation Site Weed Management Plan* (TNC 2009). The highest priority is the containment and localized eradication of Himalayan ginger (*Hedychium gardnerianum*; Figure 8), primarily due to its established range, rate of spread, and aspects of habitat modification.

Treatment of other priorities such as *Fraxinus uhdei*, *Pinus* spp. *Cortaderia jubata*, and *Ulex europeus* during pre-determined intervals can keep these plants in suppression mode (see Figure 9).

Also targeted are known habitat-modifying weeds just beginning to invade Waikamoi, such as *Psidium cattleianum*, *Ilex aquifolium*, *Tibouchina herbacea*, *Cinnamomum camphora*, *Setaria palmifolia*, *Rubus glaucus*, and *Andropogon virginicus*, with the goal of preventing establishment. Included last are potentially future priority weeds moving north through Haleakalā Ranch or adjacent lands but not yet established in Waikamoi, including *Passiflora molissima* (banana poka) and *Morella faya* (faya tree). See Table 2, Priority weed species for management at Waikamoi Preserve.

Table 2. Priority weed species for management at Waikamoi Preserve (in order of priority)

Scientific Name	Common Name
TOP PRIORITY SPECIES	
<i>Hedychium gardnerianum</i>	Himalayan ginger
<i>Ulex europaeus</i>	Gorse
<i>Pinus</i> spp.	Mexican weeping pine, Monterey pine, etc.
<i>Acacia melanoxylon</i>	Blackwood acacia
<i>Fraxinus uhdei</i>	Tropical ash
<i>Cortaderia jubata</i>	Pampas grass
EARLY DETECTION/ RAPID RESPONSE PRIORITY SPECIES	
<i>Psidium cattleianum</i>	Strawberry guava
<i>Ilex aquifolium</i>	English holly
<i>Tibouchina herbacea</i>	Cane tibouchina
<i>Cinnamomun camphora</i>	camphor tree
<i>Rubus glaucus</i>	Climbing/trailing blackberry
<i>Setaria palmifolia</i>	palmgrass
<i>Andropogon virginicus</i>	broomsedge

Table 3. Weed species not yet established in Waikamoi Preserve

Scientific Name	Common Name
<i>Asparagus asparagoides</i>	Bridal veil creeper; smilax
<i>Bocconia frutescens</i>	Tree poppy
<i>Clidemia hirta</i>	Clidemia
<i>Cotoneaster pannosus</i>	Bird berry
<i>Cyathea cooperi</i>	Australian tree fern
<i>Hypericum canariense</i>	St. John's wort
<i>Miconia calvescens</i>	Miconia
<i>Morella faya</i>	Firetree
<i>Paspalum conjugatum</i>	Hilo grass
<i>Passiflora mollissima</i>	Banana poka
<i>Rubus niveus</i>	Mysore raspberry
<i>Senecio madagascarensis</i>	Fireweed

In the past, weed threats were assessed via monitoring of non-native vegetation along five USFWS transects in conjunction with ungulate transect monitoring. Data regarding weed taxa and the overall cumulative percent cover of non-native plants per station were recorded. This data provided an index of species found on transects, however it gave no indication of their extent throughout the preserve and greater watershed. Instead, we have found that aerial and ground surveys provide the best measure of determining the extent of weeds and provide a visual estimate of ecosystem extent and quality.

Although a new weed record for Waikamoi was made in 2009 during survey work in Unit 3, the grass identified as *Phalaris aquatica* is suspected to have moved from an adjacent site near Haleakalā National Park where it was recorded decades before (S. Anderson, pers. comm.). This grass seems to favor habitat that is already dominated by non-native grasses and it is likely to cause minimal impact. The removal or spraying of this grass without damaging native plants is impractical and a poor use of limited resources. Also, a new record for the East Maui Watershed and Waikamoi is the discovery of German ivy (*Delaria odorata*) in Unit 1B. Although seeds of this highly invasive vine are wind-dispersed, it is hoped that it was tracked on site as it was documented on the trail.

In FY09, the Conservancy began contracting with Resource Mapping Hawai'i, Inc., to map our priority target weeds on East Maui utilizing high resolution aerial imagery⁸. Project goals were to obtain and analyze very high resolution multispectral imagery to produce detailed maps of the distribution and abundance of selected invasive plant species in the project area and guide follow-up control of mapped invasive weeds. The project was completed in June 2011, and was not funded through the NAPP program. Analyses of aerial imagery indicated that miconia, Australian tree fern, and Himalayan ginger were identifiable where there were no obstructions from tree canopy; *Clidemia* proved difficult. There is promise for identifying clusters of strawberry guava using the multispectral imagery, but more work needs to be conducted. In the next phases of this project, staff and volunteers can follow-up to treat mapped invasive plant populations, and create thorough and more accurate invasive weed distribution maps.

One result from the Resource Mapping contract may be the early detection of some species. If top targets are found outside of their currently known ranges, a rapid response for containment/suppression will be integrated into management. If this technology proves to be effective we may re-fly the area to gather new and improved data and provide better maps.

Staff from TNC Maui currently chairs the Maui Invasive Species Committee. Duties can include representing MISC at HISC and CGAPS meetings. TNC also attends MISC's miconia and pampas grass operations meetings, which focus exclusively on crew progress, improvements in methodology, and new detections. This move will better inform TNC on the status of such priority weed targets within or approaching the 12,000 acre core area, and may involve future cooperative projects between TNC–EMWP and MISC field crews.

⁸ Paid for with private dollars

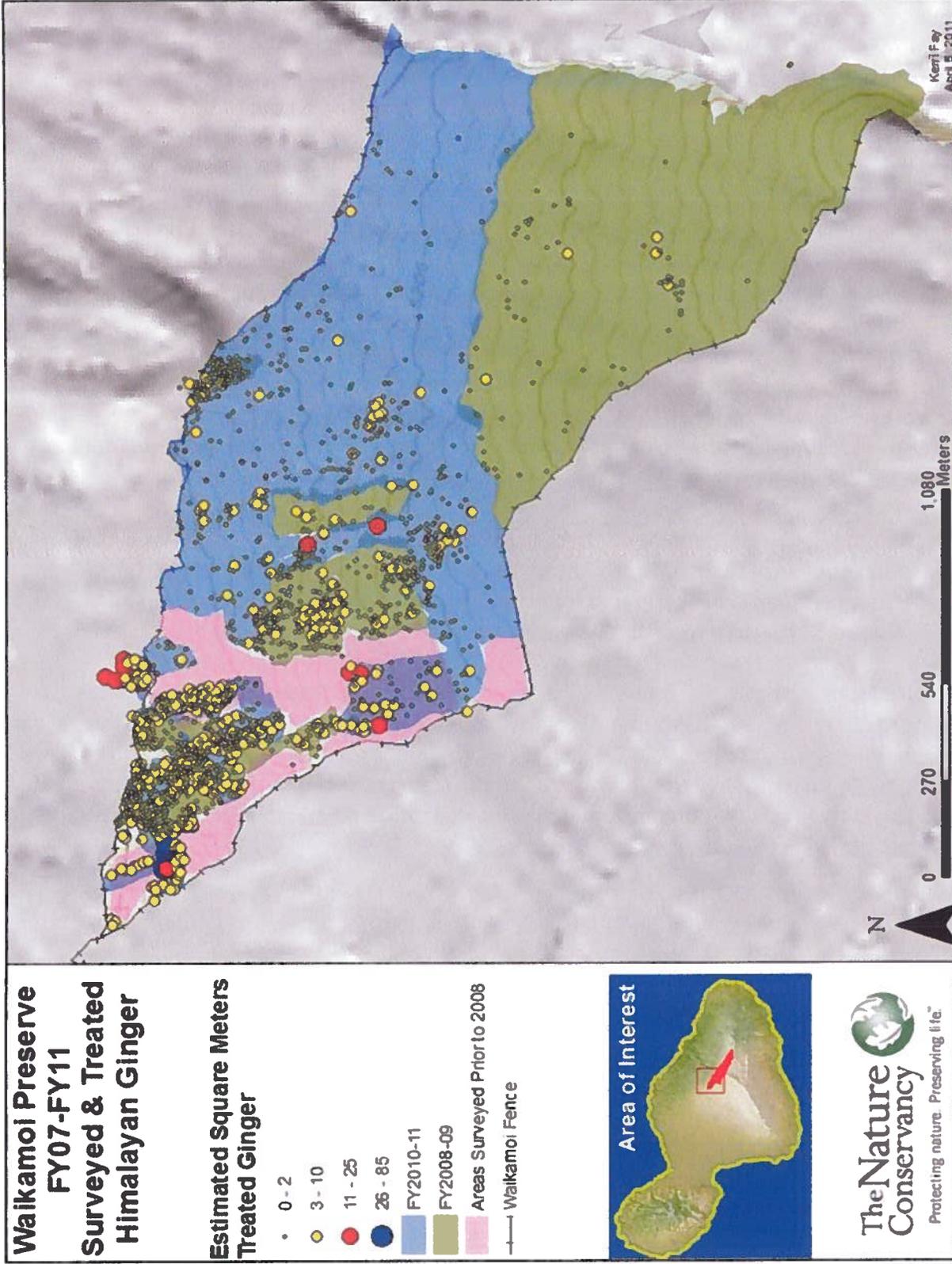


Figure 8. Waikamoi Himalayan ginger control, FY07–FY11

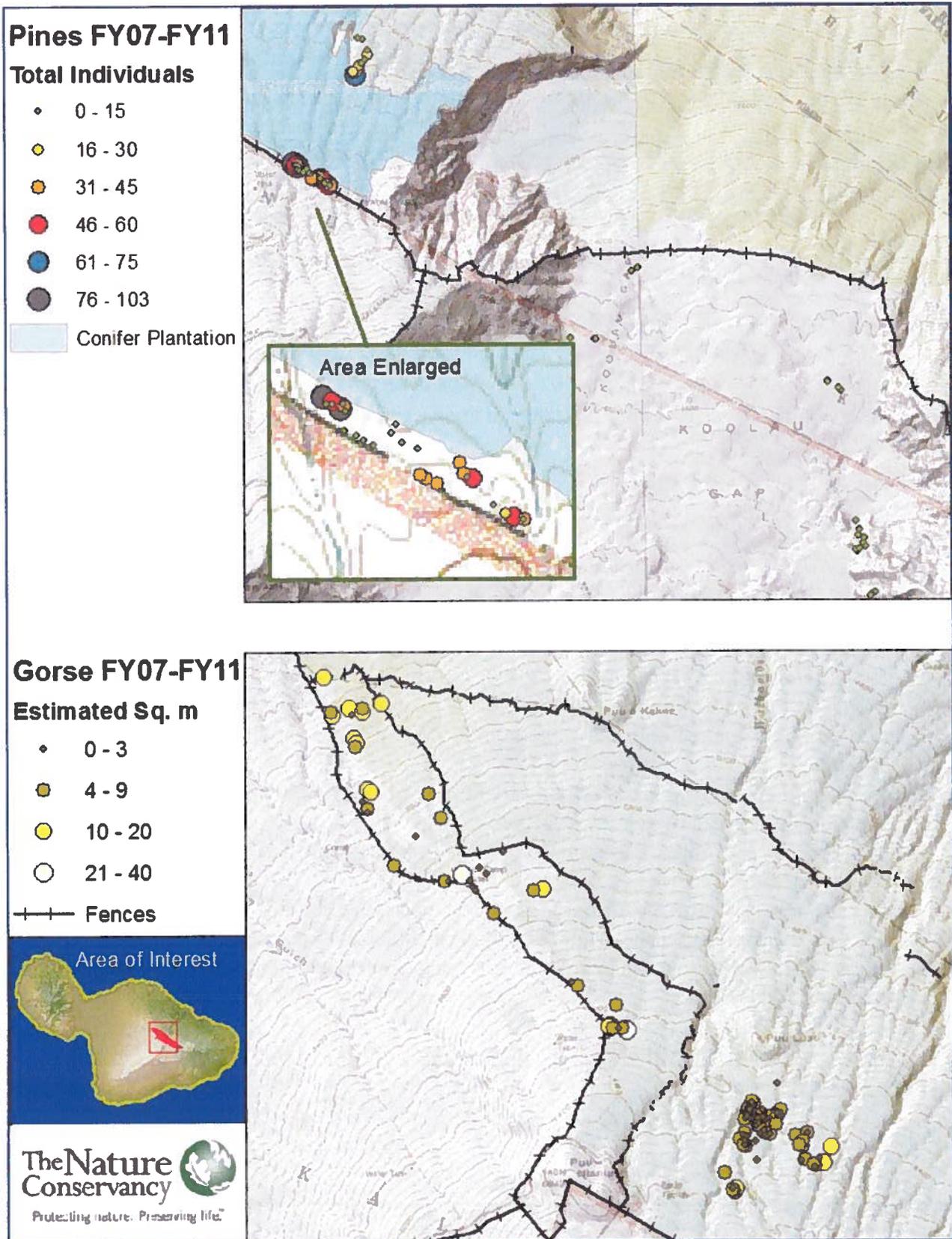


Figure 9. Waikamoi gorse and Pinus spp. control, FY07–FY11

Table 4. Control Estimates (noted in acres or individuals) for six weed targets in Waikamoi Preserve, FY07–FY11

Species	Square meters or number of individuals treated/removed (FY07–FY11)
Himalayan ginger (<i>Hedychium gardnerianum</i>)	936 acres swept with all targets treated
Gorse (<i>Ulex europaeus</i>)	200 acres swept; 27 acres treated
<i>Pinus</i> spp.	~ 5200 individuals removed
Banana poka (<i>Passiflora mollissima</i>)	Annual treatments within 12 acre area
Strawberry guava (<i>Psidium cattleianum</i>)	One pulled above 5000' in Unit 1A
Ash (<i>Fraxinus uhdei</i>)	593 saplings and trees treated
Blackberry (<i>Rubus argutus</i>)	Over 300 individuals

2013–2018

We will continue surveying, mapping, and controlling the most serious habitat-modifying weed species in Waikamoi Preserve. We will work with EMWP, MISC, DOFAW, and Haleakalā Ranch on a coordinated weed approach for adjacent lands of known targets.

Activities

Years 1–6 (FY2013–2018):

- Sweep and control Himalayan ginger throughout the native-dominant areas, focusing on outliers; maintain control of the leading edge of ginger invasion from adjacent EMI lands and the Makawao Forest Reserve.
- Conduct routine weed monitoring and control of habitat-modifying weeds at landing zones, fences, and camp infrastructure.
- Scout for, map, and monitor potential habitat-modifying invasive plants, and monitor efficacy of treatments. Implement other vegetation and/or weed surveys if cost-effective methods are available.
- Prevent other incipient weed establishment by continuing strict inspection and cleaning procedures to prevent their introduction.
- Support the Maui Invasive Species Committee (MISC) in their work to contain serious habitat-modifying weeds.
- Utilize maps generated by Resource Mapping analyses to conduct rapid response removal of top target weeds, especially when identified as outliers. Contract RM to re-fly priority areas to collect ultra-high resolution imagery if technology improvements are made to result in better quality aerial images.*

This program represents an estimated 40% of the overall effort and budget in this long range management plan.

* These activities may go beyond the scope of the NAPP budget due to recent budget cuts, but will be carried out if additional private funds can be raised.

C. Small Mammal, Invertebrate Pest, and Pathogen Prevention and Control

Program Goal: To prevent the introduction of small mammals, non-native insects, mollusks, pathogens, and other pests deemed to be a significant threat, and reduce their negative impact where possible.

Program Description: Non-native insects and small mammal damage is evident throughout Maui's native ecosystems. For example, the non-native argentine ant (*Iridomyrmex humilis*) is currently the greatest threat to the survival of the Haleakalā silversword (*Argyroxiphium sandwicense* ssp. *macrocephalum*); it decimates the native yellow faced bee (*Hylaeus volcanica*) that pollinates the plant. Rats, mice, cats, and mongoose pose a threat to many native birds including the endangered ground nesting nēnē. Prior research and management attempts have shown intensive rat control to exceed realistic budgets in terms of staff and logistics. In addition the long-term impact from maintaining intensive rat trapping can cause significant damage to native plant communities. However, TNC supports a long-term program aiming at protecting larger landscapes from small mammal depredation and has contributed toward trials that may result in the aerial application of rodenticide. We also implement protocols for cleaning and monitoring to prevent the accidental introduction of new alien species.

FY13–FY18

A reduction in NAPP funds precludes a full-scale predator control program. We will follow strict established protocols for cleaning and monitoring to prevent the accidental introduction of new alien species. We will also support partners on developments toward aerial application of rodenticides.

Activities

Years 1–6 (FY2013–FY2018):

- Support viable control programs for small mammals or other pests by our partners.
- Map and respond immediately to control *Vespula* or ant nests when found in preserve. Map significant pest locations and sign as found through routine scouting.
- Support research on *Puccinia rust* or other forest pathogens.

This program represents an estimated 2% of the overall effort and budget in this long range management plan.

Program 2: Resource Monitoring, Rare Species Protection, and Research

Program Goal: Conduct and support monitoring and research to track the status of biological and physical resources of the preserve, especially rare species, while encouraging and assisting with research that increases our understanding and management of the preserve's natural resources.

Program Description: The goal of our resource monitoring program is to track biological and physical resources of the preserve, evaluate changes in these resources over time, and improve efficacy of management responses. The Resource Mapping project will provide detailed maps of the Waikamoi and East Maui Watershed area that will enable resource managers to have a better grasp on the distribution and density of specific native species and non-native target weeds, in addition to ecosystem and natural community distribution and health.

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 - 4). Although protecting essential habitat is our main strategy to their protection, we also inventory the rarest species and take measures to protect them. The Plant Extinction Prevention Program (PEPP), administered through the Pacific Cooperative Studies Unit (PCSU) and coordinated by DOFAW, is actively visiting known locations of rare plants and finding more as mapping and vigor data is being taken. PEPP is focused on target species at Waikamoi, with the intent to collect seed for future propagation of rare plants. Accurate mapping and vigor of these populations is a byproduct of the PEPP work. We work closely with PEPP and support their efforts to protect and restore rare and endangered species found in the preserve.

We also encourage and support independent research aimed at answering important resource and management questions. Key questions include: What is the status of forest birds in Waikamoi, and how can we promote their survival? How do we best control Himalayan ginger in remote areas? How is climate change affecting the biological resources of the preserve, and how can we adapt to climate change?

During the last six year period (FY07–FY12), working with PEPP, populations of the endangered mint *Phyllostegia pilosa*, now only known from this area of Waikamoi, were expanded through outplanting of over 100 seedlings to seven new locations. The rare vine *Shiidea diffusa* and the shrub *Wikstoemia villosa* (previously thought to be extinct) were outplanted within the protective fence in Unit 1A. Dozens of the recently named taxa *Cyanea duvalliorum* were reintroduced (historically found in Waikamoi) to five locations in Waikamoi. Dozens of *Cyanea horrida* plants were outplanted from various Waikamoi founder plants in eight locations to connect the elevational belt of this very rare East Maui endemic (there are less than 40 total *Cyanea horrida* individuals known in the wild). *Plantago princeps* var. *laxifolia* was also outplanted in four locations in Waikamoi. These actions play an important role in the perpetuation of these plants in protected habitat as they make a comeback from near extinction.

New locations of many rare plant species were discovered during routine and opportunistic surveys, as well as dedicated botanical surveys conducted by PEPP (Figure 10). There were dedicated rare plant surveys each in FY08 and FY09. In FY08, the PEPP coordinator surveyed the Ko'olau Forest Reserve (lower EMWP units) between 2700' and 4400' elevation, finding 17 new locations of rare plant species, many endemic to East Maui. New locations documented of a very rare fern *Christella boydiae* greatly expanded its range. In FY09, the PEPP coordinator surveyed the 'Āinahou Bowl area, updating rare plant information since the last such survey in 2003. TNC staff and the PEPP coordinator located over 20 new rare species locations, including four new *Cyanea horrida* populations and three locations of the endangered fern *Asplenium peruviana* var. *insulare*, the rare *Calamagrostis expansa*, the rare *Ranunculus mauiensis*, and other listed plants. See Figure 10. It is worth noting that new rare plant locations found following established transects and areas that are surveyed, thus there are likely to be additional rare plants in unsurveyed areas.

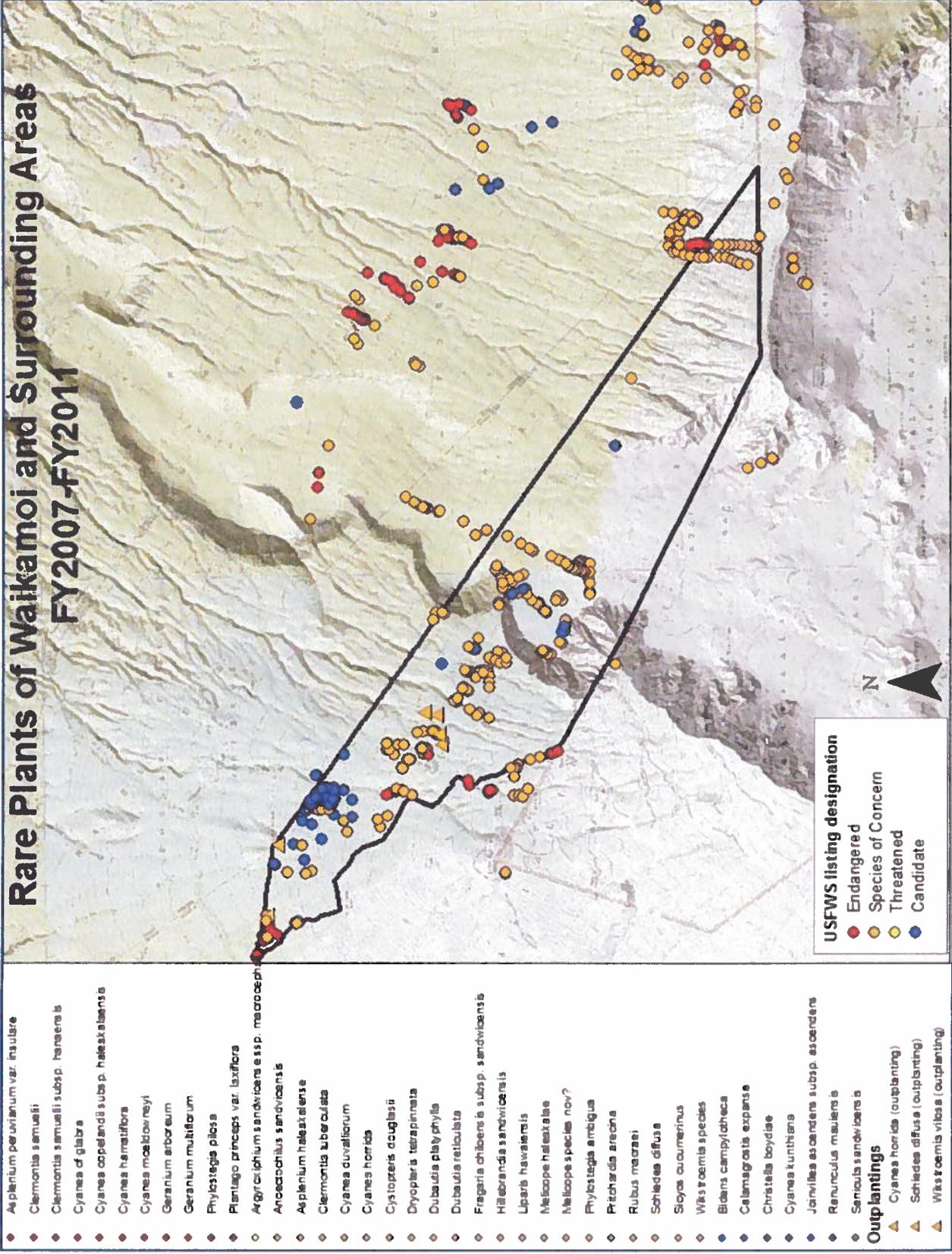


Figure 10. Rare species locations, Waikamoi Preserve and adjacent lands

The Nature Conservancy encourages research that will help us better understand and protect the preserve's resources. While we have no funding to conduct research, we encourage independent research projects that require no supervision. We supported numerous research studies in Waikamoi during from FY07 through FY11 (see Appendix 5) including:

- Maui parrotbill population status and distribution
- Entomological survey, life history and taxa identification
- Distribution, morphology and genetic diversity of *Clermontia* species
- Morphological, behavior and developmental plasticity in Hawaiian spiders *Tetragnatha*, *Theridion*, and *Argyrodes*

In FY 2008, The Maui Forest Bird Recovery Project surveyed western portions of Waikamoi to extrapolate the density of the endangered Maui Parrotbill or kiwikiu. As indicted in Becker et al. 2010⁹, the researchers estimate Waikamoi Preserve to contain a density of 20 parrotbill per square kilometer. Previous surveys had placed the density at less than half that number.

Bird surveys were conducted during various years along the same transects by observers trained in the U.S. Fish and Wildlife Service's Hawai'i Forest Bird Survey methodology. The purpose of these surveys is to document the relative abundance of all bird species in the forest. In the future, we will conduct bird surveys only during the state's routine bird surveys (every five years). The five year interval East Maui Bird census occurred in spring 2011, with TNC staff participation as secondary counters, and support for logistics and access to the Waikamoi transects for the counts.

FY13–FY18

We may employ new passive monitoring technologies such as remote sensing, high resolution aerial photography for vegetation monitoring, and remote photomonitoring for fire, ungulates and/or ungulate traps. Other monitoring tools may be employed as they are developed and become available.

Staff will continue to identify, map (using GPS) and recover rare plant populations during routine management activities. When available, fruit will be collected and given to PEPP for propagation. We will continue to support and assist PEPP with outplanting and monitoring of rare plants, in addition to sharing GIS data on rare plant locations in Waikamoi and on adjacent lands.

We will continue to encourage independent research in Waikamoi by offering necessary application materials to researchers online. Priority research is the Maui Forest Bird Recovery Project's continuing population studies and banding of the westernmost parrotbill populations found in Waikamoi's Units 1A and 1B. Although no Conservancy funding for research is provided to projects, wherever possible, we provide technical guidance and occasional logistical support to approved research.

The MFBRP and others have recommended restoration of high elevation habitat for forest birds.¹⁰ If current temperature trends continue, suitable forest bird habitat with a low risk of avian disease

⁹ Becker, Iknayan, and Berthold. Elepaio 2010.

¹⁰ Hammond et al. 2009. Hawai'i Conservation Conference.

(e.g., malaria, pox) could be reduced by as much as 75%, leading to a dramatic loss of birds. Unfortunately disease moving upslope is not the only threat to native birds posed by climate change¹¹. It is likely that changes in frequency of occurrence and altitudinal location of the trade wind inversion (TWI) will also affect forest bird habitat, possibly resulting in extreme weather events, drought, and fire. Restoring the conifer plantation back to native habitat will give our native forest birds a chance to adapt to climate change through increased available disease-free habitat and ecosystem resilience.

Activities

Years 1–6 (FY2013–FY2018):

- Support MFBRP by providing access and staff resources as available.
- Continue to support PEPP in search and assessment of rare species populations to determine protection needs and to reduce threats.
- Maintain and update current maps of rare species populations. Update database as necessary.
- Review and provide technical guidance to research proposals as necessary.
- Perform occasional in-house rare plant surveys in new areas when possible.*
- Establish and monitor test plots in Unit 2 conifer plantation to better understand the restoration potential for forest bird koa and māmane habitat.*
- Investigate the feasibility of low-cost conifer removal in Unit 2 by consulting with restoration ecologists, biofuel companies, wood product users, and other stakeholders.*

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

* These activities may go beyond the scope of the NAPP budget due to recent budget cuts, but will be carried out if additional private funds can be raised.

¹¹ E.g., Giambelluca et al. 2008; Timm and Diaz 2009; also see Fletcher 2010

Program 3: Community Outreach

Program Goal: To build public understanding and support for the preservation of natural areas, and enlist volunteer assistance for preserve management.

Program Description: Sustaining biologically significant native ecosystems throughout the state requires an educated, empowered and mobilized public and private constituency. Our main goal is to increase conservation and advocacy for these areas through an understanding of the importance, threats, and protection efforts of Waikamoi Preserve and the East Maui watershed. Although no NAPP funds are used for outreach programs, we continue to carry out an outreach program because it is important for raising public awareness and garnering support for conservation programs and their funding. Being an accessible natural area, Waikamoi Preserve also serves as an excellent staging area for our East Maui conservation partners who may not have a site to exemplify the aspects of natural area protection to their outreach clientele.

The major public outreach tool is hiking in the preserve, although we also cultivate one-on-one contacts, present slide shows, and lead hikes and volunteer work trips. The Conservancy-trained hike docents lead small custom hikes for community and school groups, donors, and community leaders. Haleakalā National Park brings visitors twice weekly into Waikamoi on our most actively used trail, the Bird Loop trail, and once per month on the Waikamoi Boardwalk trail. A replacement of the Waikamoi boardwalk in FY06, originally built in 1994, provides access to pristine native forest and increases interpretation opportunities to an otherwise sensitive ecosystem. Routine maintenance on the other trails also helps minimize impacts as well as enhancing interpretive value.

The primary audience of public access to Waikamoi Preserve is the local community and others who can increase our effectiveness in stewardship. We do not engage in any practice or use that is inconsistent with the long-term survival of vulnerable native species or ecosystems. All donations generated by these activities are used in support of our management.

During FY07 and FY08, annual numbers of hikes sharply dropped due to Waikamoi Preserve's closure from visitors while Prohunt was undertaking feral animal management activities. As access opened for hikes into the Preserve, our various partners began ramping up their outreach activities and the number of hikes began to increase in FY09. In FY10 and FY11, we had more visitors to the preserve than in any previous years. Both of these years averaged over 2,000 hikers each, with close to 200 hikes offered along three different interpretive trails. This was largely due to increased requests from our partners at EMWP, MISC, MFBRP, and NPS. In addition, TNC began a new docent hike leader program in FY10 that allowed us to better respond to hike requests from local Maui community groups and schools.

Between FY07 and FY11, monthly volunteer trips to Waikamoi continued although there was a temporary suspension of the program in early FY07. These trips alone average about 100 volunteers within 11 to 12 trips per year, and in FY10 and FY11 the numbers of volunteer trips increased to include local classes from University of Hawai'i Maui College (UHMC), Seabury Hall High School, and the Maui Nui Botanical Gardens. FY10 and FY11 had approximately 18 volunteer trips each year, utilizing over 200 volunteers that put in around 1600 person hours to help manage priority work in the Preserve.

Table 5. Volunteer and interpretation accomplishments, FY07–FY11 (5 years)

	FY07-FY11
Visitors to trails	6,500
Hikes	600
Volunteer trips	75
Total volunteers	650
Volunteer person hours	5,000

Other outreach activities include participation at local community events, such as the East Maui Taro Festival, Ke’anae Ho’olaulea, and Earth Day. There is also consistent interaction with UH Maui College Natural Resources department through field trips or class presentations. In April 2010, the Maui Field Office held a membership event that was attended by TNC board members, donors, and volunteers.

In summer 2009 TNC Maui hosted an intern from Kamehameha Schools Kapili Oihana Internship Program (KOIP). Kamehameha Schools established the KOIP for native Hawaiian college students seeking professional work experience in their field of study. Because of the positive experience during the 2009 internship the Maui Program decided to continue hosting the KOIP internship in 2010 and 2011 and will continue to do so as long as the Maui Program has the staff capacity to mentor these interns. Also in the summer 2009 the Americorps Program provided two interns for a twelve week term. The Americorps interns assisted TNC field staff with the on the ground management activities necessary to meet our conservation goals.

In 2011 TNC Maui will host a new internship program established by The Nature Conservancy’s World Office. This new internship is called the Diversity Internship Program and is aimed to encourage and promote a diverse workforce within the Conservancy.

FY13–FY18

The Nature Conservancy does not officially provide a formal outreach program (e.g., school outreach, commercial hikes). However, we will continue to support the outreach efforts of our partners by providing referral of community member inquiries, and offering advice and materials formerly used in previous programs. Public access to Waikamoi Preserve as a venue for public outreach by appropriate agencies will be utilized as a strategy to highlight the importance of protection efforts. Access shall be upon the availability of TNC docent hike leaders, HALE, MISC, MFBRP, and EMWP similar programs to offer Waikamoi as a venue.

Activities

Years 1–6 (FY2013–FY2018):

- Support outreach efforts of partners such as HALE, MISC, MFBRP, and EMWP by providing access and staff resources as available
- Utilize volunteers as available to further conservation goals and bring environmental awareness to the local community.
- Participate in one or two community events per year to encourage constituents to support our work, such as East Maui Taro Festival in Hāna.
- Coordinate and periodically train docents to accommodate special community hikes.

This program represents an estimated 3% of the overall effort and budget in this long range management plan.

Program 4: Fire, Emergency, and Safety

Program Goal: Provide staff with training and equipment that will allow them to assist primary fire and rescue agencies during a fire or emergency on or adjacent to the preserve.

Program Description: All staff are trained in basic first aid and CPR. Other training may include advanced wilderness first aid, fire suppression and pre-suppression, helicopter safety, and hunter's education. Field staff are provided with first aid kits and required to use proper personal protective equipment (PPE) when conducting field work. Waikamoi Preserve's fire plan enables an immediate multi-agency response to wildfires within and adjacent to Waikamoi Preserve.

Activities:

Years 1–6 (FY2013–FY2018):

- Update the TNC *Wildland Fire Management Plan FY2014*.
- Provide emergency training opportunities for staff including but not limited to maintaining current First Aid and CPR certifications.
- Conduct annual first aid kit inventory and resupply.
- Maintain fire suppression training for key staff.
- Purchase equipment as needed to allow immediate response to fire threats.*
- Respond to emergencies or fire threats.*
- Maintain and improve access roads in high risk areas of preserve.*
- Maintain and improve fire cameras.*

This program represents an estimated 2% of the overall effort and budget in this long range management plan.

* These activities may go beyond the scope of the NAPP budget due to recent budget cuts, but will be carried out if additional private funds can be raised.

Program 5. Watershed and Invasive Species Partnerships

Program Goal: Support the East Maui Watershed Partnership and the Maui Invasive Species Committee (MISC) where cooperative management activities mutually benefit Waikamoi Preserve and the partners.

Program Description: The EMWP provides protection for about 100,000 acres on East Maui and is administered by a coordinator and field crew. Activities include fencing, ungulate removal, invasive plant removal, and resource monitoring programs for all of East Maui's native forests. TNC's Maui Field Office helped to form and has actively participated in Partnership activities from the beginning in 1991. As a partner, we helped set management priorities, fundraise and administer projects. Initially, we supervised and trained EMWP crews in ungulate and weed removal, monitoring techniques, fence building, and a wide array of safety procedures including rappelling, helicopter travel, and wilderness survival. We continue to work closely with EMWP, as they have been awarded a subcontract to conduct management activities for Waikamoi Preserve. We meet regularly with EMWP staff and crew to discuss priorities, strategies, and management actions and techniques. The Program Director serves on the Executive Committee as the supervisor for the EMWP Program Manager; staff will continue to provide the EMWP with guidance and training, and we will participate in management activities on partnership lands as needed.

Activities

Years 1–6 (FY2013–FY2018):

- Participate and provide leadership to the EMWP.
- Support EMWP and MISC in accomplishing fundraising and resource management priorities.
- Provide EMWP and MISC access to Waikamoi to accomplish outreach and volunteer activities on a mutually cooperative basis.

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

BUDGET SUMMARY

The table in the next section summarizes the six-year budget for the Waikamoi 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 Waikamoi NAPP budget currently represents approximately 40% of the overall operation at the Conservancy’s Waikamoi Preserve and adjacent management efforts in the East Maui Watershed. Continued management at our current level will be contingent upon TNC’s ability to fundraise for the remaining 60% from other sources.

**Waikamoi Preserve
FY2013–FY2018 Budget Allocations**

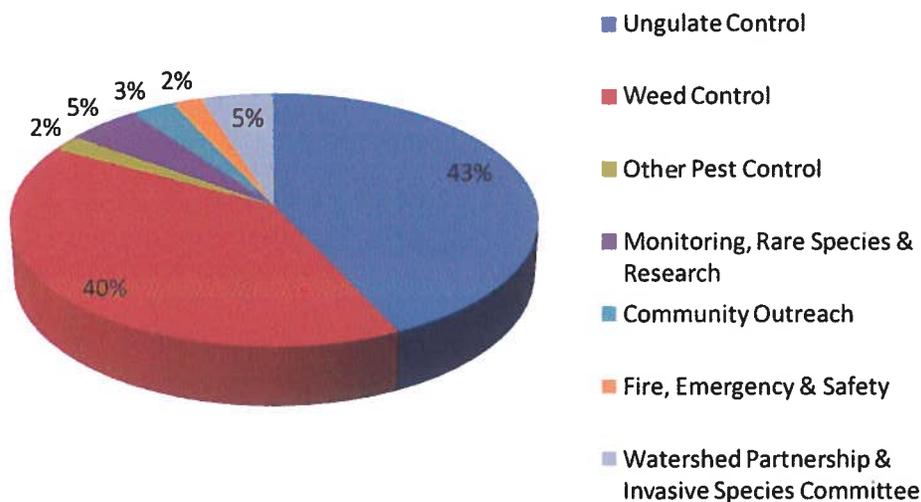


Figure 11. Waikamoi NAPP Budget/Effort by Program, FY13–FY18

The Conservancy’s Maui operation maintains a full time base staff of six. These staff also periodically work on Lana’i and Molokai whose programs are supervised by the Maui Nui office. An estimated 2.75 FTE of Maui base personnel costs for managing Waikamoi Preserve are funded by the Waikamoi NAPP budget. However, this number may fluctuate depending on the use of contractors vs. staff to complete deliverables. 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 also included, and other island support staff 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.

This budget includes NAPP renewal costs such as an Environmental Assessment, project-related supplies, subcontract/subaward expenses for management practices to conduct fence checks/maintenance and ungulate/weed removal, and other miscellaneous project-related costs including vehicle expenses both as equipment purchases and equipment leases. Note that the

contractual line item includes some helicopter time. The Conservancy routinely provides trainings for staff to improve job performance, and in addition to these trainings, supervisory staff regularly attend meetings in Honolulu. Travel and training funds are included within this budget to cover airfare, board and 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. The NAPP program will pay only 10% of the Conservancy's overhead rate of 22.53%, leaving the remainder as a portion of the Conservancy's one-third match.

Budgetary Constraints: The Waikamoi NAPP project has seen a reduction in funding of 35% over the past 10 years. This FY2013-FY2018 plan represents a 9% decrease from the last LRMP as requested. It is TNC's hope to devote any additional privately raised dollars toward adjacent land, particularly the 3,540 acre EMI parcel and the Hana Forest Reserve fence. These management activities on adjacent lands are key to acting as buffers to Waikamoi Preserve. With this reduction in funds over the years, we have had to scale back and/or cut various programs like community outreach, predator control, and resource and threat monitoring programs. We have identified objectives above that will not be covered by NAPP funds. However, should TNC receive significant private funds in addition to the NAPP funds, we hope to complete these specific management activities. We will report on progress on all accomplishments in Waikamoi Preserve and on adjacent lands regardless of funding source.

BUDGET TABLE

	FY 2013	2014	2015	2016	2017	2018	TOTAL
Labor and Fringe	131,000	131,000	131,000	131,000	131,000	131,000	786,000
Contractual	131,000	131,000	131,000	131,000	131,000	131,000	786,000
Communications	0	0	0	0	0	0	0
Travel	1000	1000	1000	1000	1000	1000	6,000
Supplies	10,000	10,000	10,000	10,000	10,000	10,000	60,000
Other	0	0	0	0	0	0	0
Subtotal	273,000	273,000	273,000	273,000	273,000	273,000	1,638,000
Overhead @ current negotiated rate	27,300	27,300	27,300	27,300	27,300	27,300	163,800
TOTAL	300,300	300,300	300,300	300,300	300,300	300,300	1,801,800
Waikamoi budget Match (1/3 of total)	100,100	100,100	100,100	100,100	100,100	100,100	600,600
TOTAL NAPP	200,200	200,200	200,200	200,200	200,200	200,200	1,201,200
REQUEST (2/3)							

Appendices

Appendix 1. Native Natural Communities Of Waikamoi Preserve

NATURAL COMMUNITY NAME	GLOBAL RANK
Lowland	
Uluhe (<i>Dicranopteris linearis</i>) Lowland Wet Shrubland	G4
Montane	
'Ākala (<i>Rubus hawaiiensis</i>) Montane Wet Shrubland #	G3
<i>Carex</i> Montane Wet Grassland #	G3
Koa/'Ōhi'a (<i>Acacia koa</i> / <i>Metrosideros polymorpha</i>) Montane Wet Forest #	G3
Mixed Fern/Mixed Shrub Montane Wet Shrubland #	G3
'Ōhi'a /Hāpu'u (<i>Metrosideros polymorpha</i> / <i>Cibotium</i> spp.) Montane Wet Forest	G3
'Ōhi'a (<i>Metrosideros polymorpha</i>)/Mixed Shrub Montane Wet Forest #	G3
'Ōhi'a /'Ōlapa (<i>Metrosideros polymorpha</i> / <i>Cheirodendron</i> spp.) Montane Wet Forest	G3
'Ōhi'a /Uluhe (<i>Metrosideros polymorpha</i> / <i>Dicranopteris</i>) Montane Wet Forest #	G3
Subalpine	
<i>Deschampsia nubigena</i> Subalpine Mesic Grassland* #	G2
Māmane (<i>Sophora chrysophylla</i>) Subalpine Dry Forest*	G2
'Ōhi'a (<i>Metrosideros polymorpha</i>) Subalpine Mesic Forest #	G3
Pūkiawe (<i>Styphelia tameiameia</i>) Mixed Subalpine Dry Shrubland	G3
Multizonal	
Pioneer Vegetation on Lava Flow	G3
Subterranean Communities	
Uncharacterized Montane Lava Tube*	GU
Uncharacterized Subalpine Lava Tube*	G1G2
Aquatic Communities	
Hawaiian Intermittent Stream	G4

* Rare natural community # Also known from Hanawh NAR

Key to Global Ranks as defined by Heritage Program:

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

G3 = Restricted range (typically 21-100 current occurrences).

G4 = Apparently secure globally (> 100 occurrences).

GU = Natural community rank uncertain (rank uncertain, provisionally considered rare).

Appendix 2. Rare Native Plants of Waikamoi Preserve

SCIENTIFIC NAME	COMMON NAME	PEPP target/ Rare On Island ¹²	Single Island Endemic (SIE) or Single Mountain SME (SME)	FEDERAL STATUS
<i>Anoetochilus sandwicensis</i>	honohono			SOC
<i>Asplenium fragile</i> var. <i>insulare</i>		ROI		LE
<i>Asplenium haleakalense</i>				SOC
<i>Bidens campylotheca</i> ssp. <i>pentamera</i> +	ko'oko'olau, koko'olau		SIE	C
<i>Calamagrostis expansa</i> #				C
<i>Clermontia tuberculata</i> *	'ōhā, hāhā, 'ōhā wai		SME	SOC
<i>Cyanea duvallorium</i>	hāhā	Yes	SME	SOC
<i>Cyanea horrida</i> * #	holokea	Yes	SME	SOC
<i>Cyanea kunthiana</i> +	'ōhā, hāhā, 'ōhā wai		SIE	C
<i>Cystopteris douglasii</i>				SOC
<i>Diplazium molokaiense</i>		Yes		LE
<i>Dryopteris tetrapinnata</i>	i'o nui		SME	SOC
<i>Dubautia platyphylla</i>	kupaoa		SME	SOC
<i>Dubautia reticulata</i>	naenae		SME	SOC
<i>Fragaria chiloensis</i> subsp. <i>sandwicensis</i>				SOC
<i>Geranium arboreum</i> *	hinahina, nohoanu	Yes	SME	LE
<i>Geranium multiflorum</i> * #	hinahina, nohoanu		SME	LE
<i>Hillebrandia sandwicensis</i>	pua maka nui			SOC
<i>Lagenifera maviensis</i>	hōwaiaulu			SOC
<i>Liparis hawaiiensis</i>	awapuhia kanaloa			SOC
<i>Melicope balloui</i> *	alani		SME	LE
<i>Melicope haleakalae</i> *	alani		SME	SOC
<i>Microlepia strigosa</i> var. <i>mauiensis</i>	palapalai			SOC
<i>Peperomia subpetiolata</i> *	'ala'ala wai nui	Yes	SME	C
<i>Phyllostegia ambigua</i>				SOC
<i>Phyllostegia bracteata</i> + #		Yes	SIE	C

¹² PEPP targets have 50 or less individuals state-wide; ROI is Rare on Island - less than 50 for one island but more than 50 State-wide.

SCIENTIFIC NAME	COMMON NAME	PEPP target/ Rare On Island ¹²	Single Island Endemic (SIE) or Single Mountain SME (SME)	FEDERAL STATUS
<i>Phyllostegia pilosa</i>		Yes	SME	LE
<i>Plantago princeps</i> var. <i>laxifolia</i>	ale	Yes		LE
<i>Platanthera holochila</i> #		Yes		LE
<i>Ranunculus hawaiiensis</i>	makou	Yes		C
<i>Ranunculus mauiensis</i>	makou	Yes		C
<i>Rubus macraei</i>	'ākala, 'ākalakala			SOC
<i>Sanicula sandwicensis</i>		ROI		SOC
<i>Santalum haleakalae</i> var. <i>haleakalae</i> *	'iliahi		SME	SOC
<i>Sicyos cucumerinus</i>	'ānunu, kūpala			SOC
<i>Sisyrinchium acre</i>	mau'u la'ili, mau'u ho'ula 'ili			SOC
<i>Schiedea diffusa</i> subsp. <i>diffusa</i>		Yes	SIE	SOC
<i>Wikstroemia villosa</i> +	'akia	Yes	SIE	SOC

+ Known only from Maui * Known only from East Maui # Also known from Hanawi NAR

Key to Federal Status:

- LE = Taxa formally listed as endangered
- LT = Taxa formally listed as threatened
- C = Persisting in cultivation
- SOC = Species of Concern

Additional rare native plants found only in on adjacent EMI lands¹³:

SCIENTIFIC NAME	COMMON NAME	Single Island Endemic (SIE) or Single Mountain SME (SME)	FEDERAL STATUS
<i>Cyanea hamatiflora</i>	hāhā	SIE	E
<i>Pritchardia arecina</i>	loulu	SME	SOC
<i>Joinvillea ascendens</i>	'ohe		C

¹³ Additional rare species are likely to be discovered once a formal survey of the area is completed.

Appendix 3. Native Birds of Waikamoi Preserve

SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS	AUDUBON STATUS [*]
<i>Hemignathus lucidus affinis</i> ^{◇*}	Maui nukupu'u	Listed endangered; last seen 1996	
<i>Loxops coccineus ochraceus</i> *	Maui 'ākepa	Listed endangered; Last seen 1995 ¹	
<i>Melamprosops phaeosoma</i> ^{†*}	po'ouli	Listed endangered; Last seen 2004 ²	
<i>Palmeria dolei</i>	'ākohekohe, crested honeycreeper	Endangered	
<i>Pseudonestor xanthophrys</i>	kiwikiu, Maui parrotbill	Endangered	
<i>Pterodroma phaeopygia sandwichensis</i>	'ua'u, Hawaiian petrel	Endangered	
<i>Branta sandvicensis</i>	nēnē, Hawaiian goose	Endangered	
<i>Puffinus auricularis newelli</i> ³	'a'o, Newell's shearwater	Threatened	
<i>Paroreomyza montana</i>	'alauahio	--	
<i>Vestiaria coccinea</i>	'i'iwi	--	
<i>Asio flammeus sandwichensis</i>	pueo	--	
<i>Himatione sanguinea</i>	'apapane	--	--
<i>Hemignathus virens</i>	'amakihi	--	--

◇ Known in adjacent areas; thought to occur in Waikamoi

† Unconfirmed sighting; known from adjacent Hanawā NAR

1 Natural Diversity Database and Forest Bird Survey data

2 Gorreson et al., 2009

3 Possibly in Waikamoi Preserve (see Wood and Bily 2008)

* Audubon and the American Bird Conservancy analyzed the most recent scientific and citizen data nationwide to determine the species that are most in need of immediate conservation help (Watchlist 2007)

 Red—Species in this category are declining rapidly and/or have very small populations or limited ranges, and face major conservation threats. These typically are species of global conservation concern.

 Orange—this category includes species that are either declining or rare. These typically are species of national conservation concern.

Appendix 4. Summary of Supported Research In Waikamoi Preserve

Research Topic	Research Team	Year
Study to determine non-target arthropod take during field trials using agricultural pest fruit fly lures and baits	Luc LeBlanc, CTAHR, UH	FY2007
Genetics of the endemic flightless moth <i>Schrankia</i>	Matt Medeiros, UC Berkeley	FY2007
Genetics of the endemic cricket <i>Caconemobius</i>	Dr. Fred Stone, Bishop Museum Hawai'i	FY2007
Taxonomy and genetic diversity of Hawaiian sandalwood (<i>Santalum haleakalae</i>)	Dr. Danica Harbaugh, UC Berkeley	FY2008
Taxonomy of <i>Astelia</i>	Joanne Birch, UH	FY2008
Diversity and radiation of <i>Hyposmocoma</i> moths	Dr. Patrick Schmitz, UH	FY2008-2009
Morphological, behavior and developmental plasticity in Hawaiian spiders <i>Tetragnatha</i> , <i>Theridion</i> , and <i>Argyrodes</i>	Rebecca Carter, Kelly Kaban, Rosemary Gillespie, UC Berkeley	FY2006-2010
Species radiation in the bark lice <i>Ptycta</i>	Emilie Bess, University of Illinois	FY2008
Maui parrotbill (<i>Osuedonestor xanthophrys</i>) distribution and density study	Maui Forest Bird Recovery Project	FY2005 - current
Density of <i>Vespula</i> wasps in Waikamoi	Dr. David Holway, UC San Diego	FY2009
Native vegetation recovery 15 years after feral animal removal in Waikamoi Preserve's subalpine shrubland	TNC and Guy Hughes, National Parks Service	FY2009
Systematics and species diversity of the leafhopper <i>Nesophrosyne</i>	Gordon Bennett, UC Berkeley	FY2009
Distribution, morphology and genetic diversity of <i>Clermontia</i> species	Jennifer Johansen, UH Hilo Moore DNA Project	FY2009
Genetics and diversity of picture-wing <i>Drosophila</i>	Karl Maganacca, Cornell University	FY2009
Genetic diversity of native tree roaches <i>Balta</i>	Robin Rice, Bishop Museum Hawai'i	FY2010
Population status and distribution of endemic Tephritid flies	Forest and Kim Starr, USGS	FY2010-FY2011
Presence of threatened Newell's shearwaters (<i>Puffinus newelli</i>) in Waikamoi Preserve	TNC and Hawai'i DOFAW	FY2011
Surveys and Biotic Inventories of Waikamoi Preserve (Rare Plant Surveys)	National Tropical Botanic Gardens, Kauai and TNC Staff	FY07, FY08, FY10
Study of Available Invertebrate Diet for Maui Parrot bill	Hawai'i Cooperative Studies Unit, Robert Peck, Paul Banko	FY11

Appendix 5. Summary of Organization and Event Participation in Public Outreach

- American Association for the Advancement of Science
- American Birding Association
- Brazilian Capoeira School of Maui
- Carden Academy
- Catherine Blaine and Garfield High School (Seattle, WA)
- Chinese Ministry of Environment Student Tour
- Christ the King School
- County of Maui, Environmental Coordinator
- County of Maui, County Council members
- East Maui Taro Festival
- Emmanuel Lutheran School
- Friends of Moku'ula
- Gustavus Adolphus College (MN)
- Hālau Kekua O Kala`au`alailiahi
- Hālau Nā Lei Kaumaka O Uka
- Haleakalā National Park
- Haleakalā Waldorf School
- Hāna High School
- Hāna School and Public Library
- Hawai'i Nature Center at Īao
- Hawaiian Canoe Club
- Hawai'i East-West Center
- Hawai'i Environmental Educators Association
- Hawai'i Outdoor Circle
- Hawai'i Association of Watershed PartnershipsHui Mālama Enhanced Learning Center
- Hula Grill Restaurant
- Ka 'Aha Hula 'O Hālauaola (International Year of Hula Conference)
- Kalama Intermediate School
- Kamehameha Schools
- Kapalua Ritz Carlton Hotel
- Kaua'i Invasive Species Committee
- Kaunoa Senior Center
- Ke'anae Community Association
- Keiki Hula Hua ka'i
- King Kekaulike High School
- Konohiki
- Kula Kaia Puna
- Lahainaluna High School
- Lokelani Intermediate
- Maui Adventist
- Maui Aids Foundation
- Maui Association of Landscape Professionals
- Maui Chapter of Kiwanis International
- Maui Chinese Martial Arts Academy
- Maui Early Childhood Educators
- Maui High School
- Maui Invasive Species CommitteeMaui Nui Botanical Garden's Earth Day
- Maui Police Department
- Maui Waiena School
- Montessori
- Nā Ala Hele National Trails Day
- National Biological Information Infrastructure Conference
- Pacific Disaster Center
- Pacific Whale Foundation
- Pukalani Elementary
- Pūnana Leo o Maui Preschool
- Saint Anthony's
- Seabury Hall
- St. Ann's Youth Group
- Trinity Western University of British Columbia
- University of Hawai'i-Maui College
- Upcountry Homeschoolers
- Upcountry Rotary Club
- Upcountry Youth Center
- US Fish and Wildlife Service
- US Forest Service
- US Geological Survey
- Waimalu Elementary School
- Westminster School (MA)
- Women In Conservation
- 'Oahu Crow Tribe of Indian Guides of America
- Youth Vision 2000