

**'Olu 'Olu Ko'olau Inc.
and the
Ko'olau Mountains Watershed Partnership**



**Hawai'i's Thousand Friends
Supplemental Environmental Project**

October 1, 2012 – September 30, 2015

Final Report

Summary

The Ko'olau Mountains Watershed Partnership (KMWP) was awarded \$70,000 through a contract with Hawaii's Thousand Friends and Our Children's Earth Foundation. With these funds, KMWP proposed to survey for and control incipient feral goats in Waimanalo/Hawaii Kai, and to remove invasive weeds and scope watershed protection fences in predominantly native forest at Poamoho and Helemano. All actions have been completed in accordance with the proposed work, as reported herein.

A total of 212 feral goats and 20 wild sheep were removed from the slopes above Makapu'u Point at Waimanalo. A continuing grant from the State of Hawai'i will support removal of the last goats that remain.

Fenceline scoping to assess fenceline routes covered 15,570 linear meters. Biosurveys to identify endangered species in the path of planned fence covered 8,743 meters. Approximately 12,000 invasive trees and tree ferns were removed from the Poamoho and Helemano summit area.

Grants from the State of Hawai'i also supported this work, with weed control at Poamoho and Helemano particularly focused on *Angiopteris evecta* and *Leptospermum scoparium*.

Survey and Control of Incipient Feral Goat Population in Waimanalo/Hawaii Kai

Active control of a growing population of feral goats in the Waimanalo/Hawaii Kai area began in 2013, supported by Hawai'i's Thousand Friends and a grant from the State of Hawai'i Watershed Partnership Program. Early surveys indicated that an incipient population of wild sheep was also present in the area (Figure 1, Figure 2). This was a matter of significant concern because no other wild sheep are present on O'ahu. If the population was allowed to grow and spread along the Ko'olau summit, controlling them could become extremely difficult. Wild sheep such as mouflon are much better jumpers than feral goats and feral sheep, and are less likely to form large groups that are easy to track and control.

The first requirement for control of the animals was for KMWP to obtain rights of entry from all landowners and lessees in order to conduct the work. Agreements were established with Kamehameha Schools, the Department of Hawaiian Homelands, Sea Life Park, and the Oceanic Institute (see map, Figure 3.)

The first hunt was conducted in April of 2013 with staff from KMWP and the State of Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife. The area proved extremely challenging to work in because of its proximity to a beach park, a busy highway, a popular hiking trail, Hawaii Kai neighborhoods, and commercial facilities (Figure 4). Hunts have to be brief and conducted very early or late in the day to avoid becoming a public spectacle. On more than one occasion, hunts had to be terminated early because of FAA and utility company staff needing to access equipment on Kamehame Ridge.

From April 2013 to September 2015, 84 site visits were conducted to scout for and hunt sheep and goats, an average of 2.8 trips per month. A total of 20 wild sheep and 212 goats were removed (Table 1).

As of September 30, 2015, only one goat is known to remain in the area. We will continue to survey for six months after we believe all goats have been removed. It is essential that surveys be continued until we are certain all the animals are gone, to prevent a potential

rebound of the population. Funds have been secured from the Hawai'i Invasive Species Council and the State of Hawai'i Watershed Partnership Program to continue surveys and control into 2016.

Table 1. Waimanalo hunts and animals removed

	Trips	Sheep removed	Goats removed
Aerial survey	1	0	0
Hunt or scout	84	20	212

Figure 1. Feral goats at Waimanalo



Figure 2. Wild sheep at Waimanalo



Figure 3. Land ownership in feral goat range at Waimanalo

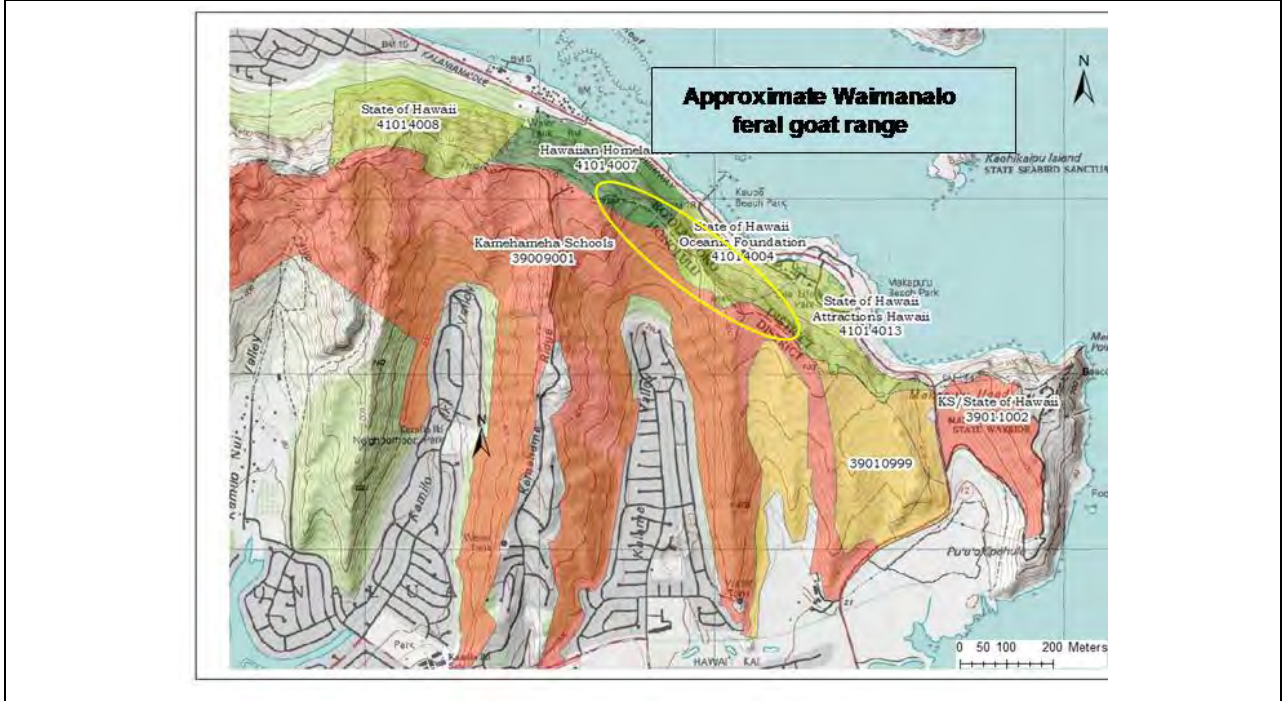


Figure 4. Waimanalo goat range



Watershed Protection Fence Planning: Poamoho and Helemano

Planning and route scoping for the construction of ungulate-proof fences to protect the summit area of Poamoho and Helemano was performed during the project period (Table 2). A total of 12,988 meters were walked to assess potential fenceline routes in the northern section of Poamoho by KMWP, and 5,241 meters in the southern section (Figure 5a; DOFAW surveyed the remaining segment of the southern section.) Independent biosurveys also were performed, walking an additional 9,788 meters looking for endangered species along the northern fenceline and 6,185 along the southern section. In Helemano (Kamehameha Schools land immediately north of the Ewa Forest Reserve TMK), scoping work was performed on two separate units. Where Helemano joins Poamoho 4,200 meters was surveyed to scope the fence route and search for endangered species. Another 10,973 meters were scoped to plan another fence that would connect the northern Poamoho fence with an existing fence managed by the O’ahu Army

Natural Resources Program (Figure 5b.) Working conditions in the area are rugged, steep and wet, involving crossing multiple streams, pushing through thick brush and requiring webbing to ascend and descend in some areas.

The northern section of the Poamoho fence was completed in summer 2015, and the southern section is under construction.

Table 2. Fenceline work, in meters surveyed

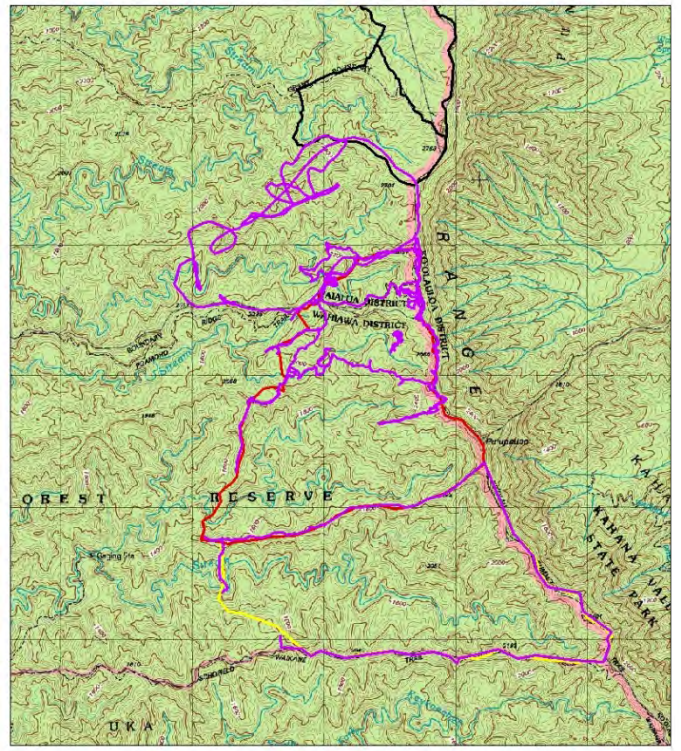
Management unit	Route scoping (m)	Biosurvey (m)
Helemano	10,973	4,200
N. Poamoho	12,988	9,788
S. Poamoho	5,241	6,185
Total	29,202	20,173

Figure 5. Fence planning



- Fence managed by OANRP
- Completed northern Poamoho fence
- In progress southern Poamoho fence

5a. Poamoho completed and in-progress fencing



- Fenceline scoping and biosurvey
- Fence managed by OANRP
- Completed northern Poamoho fence
- In progress southern Poamoho fence

5b. Final fence routes overlain with KMWP fenceline scoping and biosurvey tracks. The purple tracks at the top indicate a planned fence on Kamehameha Schools land that will create a continuous protected area at the Ko'olau summit of ~2,000 acres. OANRP, O'ahu Army Natural Resources Program.

Invasive Weed Removal in KMWP Priority Areas – Poamoho and Helemano

KMWP has surveyed and mapped 16,000 acres of summit areas for invasive weeds in the Ko’olau Mountains. Based on these surveys, KMWP drafted a “KMWP Weed Management Action Plan” to prioritize weed control in predominantly native areas of the Ko’olau. Much of the weed control work in the past two years has focused on areas to be fenced in the high-quality northern Ko’olau forests, which include the Helemano and Poamoho summit areas (Figure 6, Figure 7). Table 3 lists priority weeds identified and controlled at Helemano and Poamoho during the project period.

Table 3. Helemano/Poamoho Weed Control

Scientific Name	Common Name	Number Removed
<i>Angiopteris evecta</i>	mule’s foot fern	9,375
<i>Buddleja asiatica</i>	butterfly bush	3
<i>Cyathea cooperi</i>	Australian tree fern	3
<i>Citharexylum caudatum</i>	fiddlewood	3
<i>Falcataria moluccana</i>	albizia	2
<i>Heliocarpus popayanensis</i>	white moho	8
<i>Leptospermum scoparium</i>	manuka	1,424
<i>Psidium cattleianum</i>	strawberry guava	39
<i>Schefflera actinophylla</i>	octopus tree	2
<i>Spathodea campanulata</i>	African tulip	1
<i>Tibouchina herbacea</i>	cane ti	1,200
<i>Trema orientalis</i>	gunpowder tree	1
TOTAL:		12,061

Particularly intensive work is being conducted to control *Angiopteris evecta* in the future Poamoho Natural Area Reserve, with additional funding provided by the State of Hawai'i. Work on another priority species, manuka (*Leptospermum scoparium*), has also been continuous for more than two years and is paying off. It is expected that by the end of 2015, all the mature manuka at Helemano will have been treated and only maintenance surveys will be needed. Many of the other weed targets are found only as occasional trees that are removed from predominantly native forest areas as they are detected. In the near future, control of strawberry guava will be accelerated. This species forms thick stands and is almost impossible to control where feral pigs are present. Now that the northern fence is completed, the area will soon be cleared of the feral pigs that spread the seeds, and the strawberry guava can be addressed.

Figure 6. Weed control locations at Helemano and Poamoho

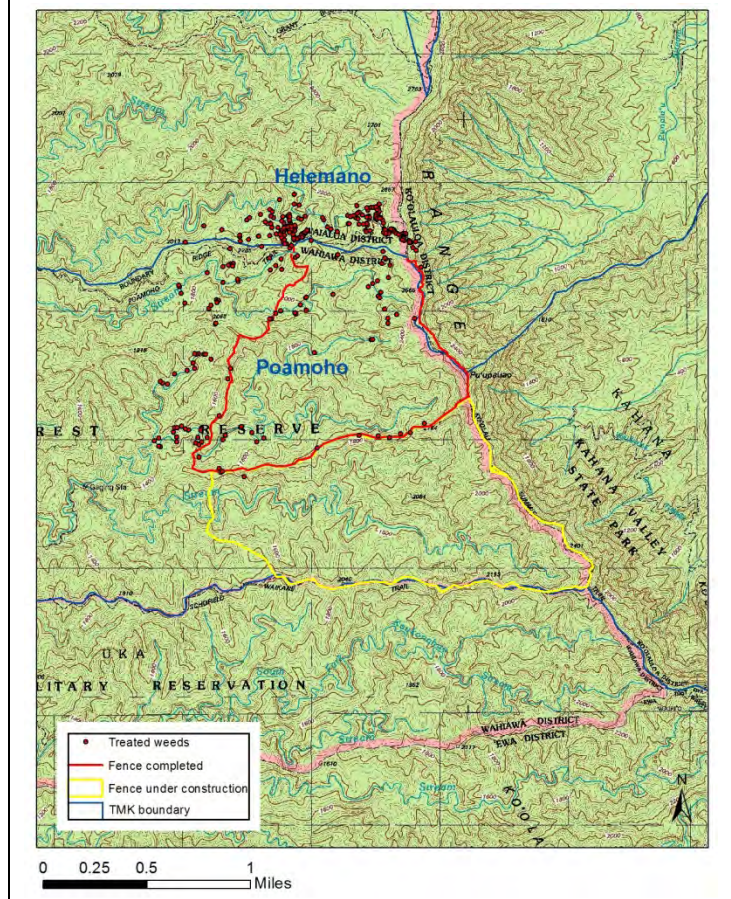


Figure 7. Weed control at Poamoho and Helemano



7a. Taking a GPS point for giant fern (*Angiopteris evecta*) at Poamoho

7b. Cutting manuka (*Leptospermum scoparium*) at Helemano

Environmental benefits

Removing the majority of the goats and sheep from the cliffs at Makapu‘u has greatly reduced the development of deep cuts in the slope that have been growing over the past several years, caused by lines of goats traversing the cliff face. Continued growth of these cuts would likely result in landslides. Employees of the Oceanic Institute reported in 2013 that they had often seen rocks tumbling down the steep slope as goats passed by. The danger of rockfalls caused them to dig a deep ditch separating the hillside from their facilities.

Measuring changes in water turbidity resulting from re-vegetation after animal removal requires a longer scale than the duration of this grant. However, fences have been planned and completed during the project period. The 650 acres at northern Poamoho that is now protected with a fence encloses the headwaters of three streams. It is expected that most of the pigs will be removed in the next year, and all the pigs within two years. Pig activity in stream gulches is a primary cause of soil loss in native forests; soil can be carried long distances onto the reefs, impacting marine life.

The removal of high-threat invasive weeds from the native forests of Poamoho and Helemano is critical to maintaining the health of O‘ahu’s watersheds in a cost-effective way. Where the Hawaiian forest is still healthy and native plants predominate, natives quickly fill in the spaces where invasive plants are removed, particularly when vectors such as feral pigs are also removed. The area will continue to be monitored for priority weed targets and funding will be sought to build on these efforts and continuously increase native species diversity and forest health over time.

Figure 8 shows the native watershed forest of Poamoho.

Figure 8. Watershed forest at Poamoho



Expenditures

Salary & fringe	57,600
Supplies/transportation	5,460
Overhead	6,940
	70,000

‘Oahu ‘Oahu Ko‘olau and the Ko‘olau Mountains Watershed Partnership are grateful to Hawai‘i’s Thousand Friends, the Sierra Club Hawai‘i Chapter, Our Children’s Earth Foundation, and other parties who facilitated this grant and the work performed with the funds.