Moʻomomi Preserve

Molokaʻi, Hawaiʻi

DRAFT Long-Range Management Plan
Fiscal Years 2013–2018

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

The Nature Conservancy
Protecting nature. Preserving life.™

Submitted by
The Nature Conservancy of Hawaiʻi

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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. On Moloka‘i, the Conservancy manages three NAPP Preserves: Mo‘omomi (921 acres), Kamakou (2774 acres), and Pelekunu (5,759 acres), and is the main coordinator/manager of the East Moloka‘i Watershed Partnership (EMoWP) which is directly responsible for management programs in Kamalō (3,566 acres), Kapualei (1,680 acres), and Kawela (5,500 acres). Mo‘omomi was approved for NAPP funding in 1995. This long-range management plan updates the previous long range plan (FY 2007–2012). This plan was prepared in compliance with the Natural Area Partnership agreement between the State and The Nature Conservancy of Hawai‘i. The FY 2013–2018 plan documents management programs to be undertaken during the next six years at Mo‘omomi Preserve.

The state Department of Land and Natural Resources (DLNR), which administers the NAP program, 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 Mo‘omomi 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–FY2018 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 Mo‘omomi Preserve Accomplishments by Programs, FY 2007–FY 2011 (5 Years)

	Indicator	Measure of Success
Ungulate Control	Number of deer monitoring surveys	3
Predator Control	Predators Controlled	696
	Shearwater Burrows	399
	Number of shearwater surveys and banding	8
Invasive Plant Control	Acres kiawe removed	5.1
Monitoring and Research	Number of rare plant surveys	5
Rare Species Protection	Number of outplanting locations/total plants outplanted	3/526
Community Outreach	Access allowed	2200 people
	Field Trips Completed	51
	Number of volunteers	587

RESOURCE SUMMARY

General Setting

Mo‘omomi Preserve (Figure 1) was established in June of 1988 to protect the most intact coastal sand dune ecosystem in the main Hawaiian Islands. Mo‘omomi also contains significant archaeological, paleontological, and cultural resources. The 921 acre preserve is located along the northwest shore of Moloka‘i. Elevation runs from sea level to about 690 feet with annual rainfall estimated at 20 inches throughout the preserve. The westernmost coastline of the preserve is characterized by sea cliffs; the remainder of the two-mile long coastline consists of windswept sand beaches, a prominent foredune (parallels the beach), and rows of unconsolidated upper sand dunes just inland of the beach. The upper dune area of the preserve is known as Keonelele, “the flying sands”. Portions of the preserve dunes are lithified (sand dunes that become solidified) and are distinct in geological appearance and native strand.

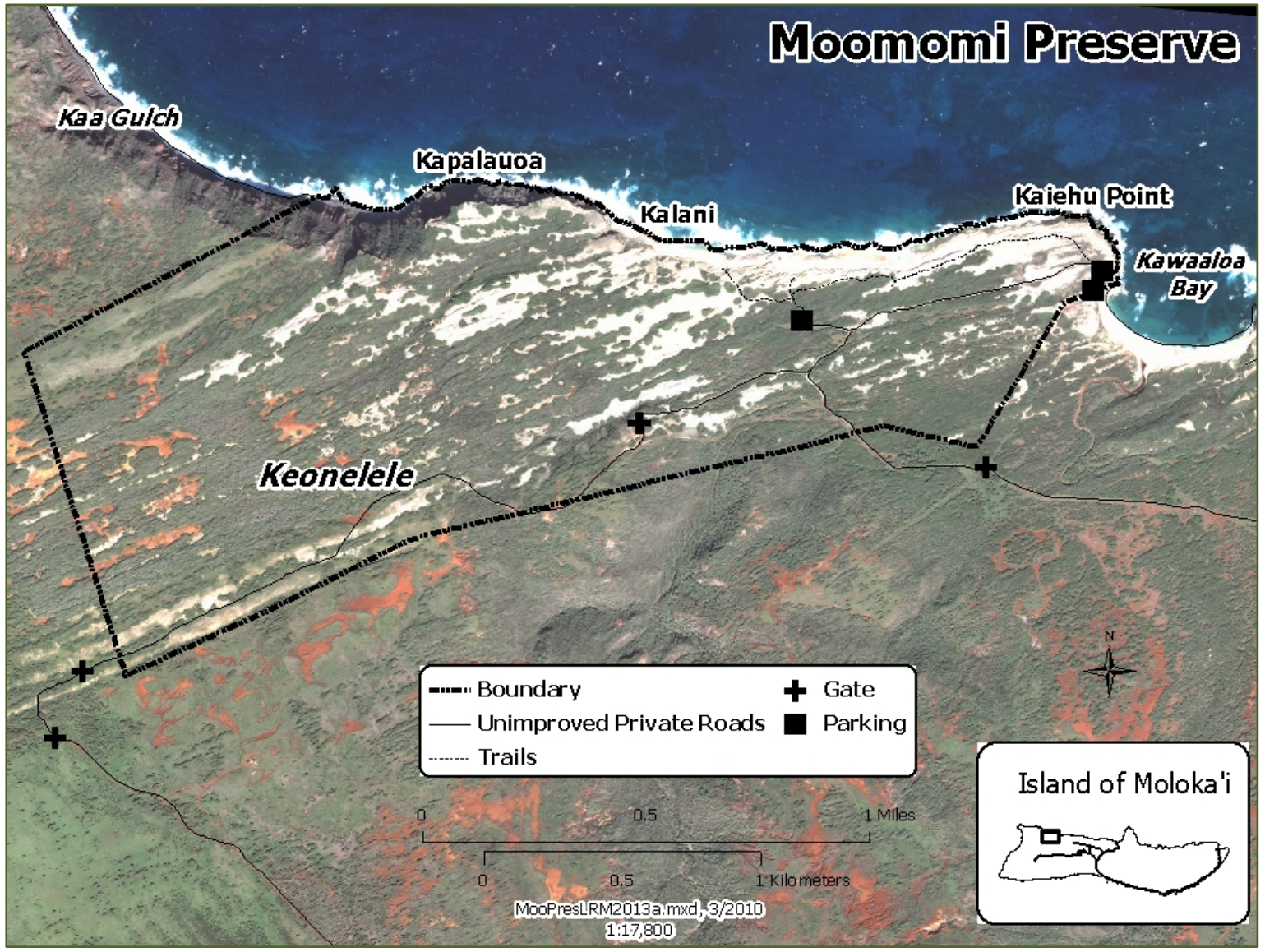

Figure 1. Mo‘omomi Preserve

Flora and Fauna

Mo‘omomi Preserve’s rich coastal dune ecosystem contains seven native-dominated natural communities (see Figure 2 and Appendix 1). The vegetation on the sea cliffs is primarily comprised of nehe (*Melanthera integrifolia*) and hinahina (*Heliotropium* spp.) coastal dry dwarf-shrublands. The area just inland of the beach contains communities dominated by the native grass ‘aki‘aki (*Sporobolus virginicus*), and the native shrubs naupaka (*Scaevola sericea*), ‘ilima (*Sida fallax*), and nehe. Non-native species, especially kiawe, become dominant immediately behind the native vegetation band, extending upslope. Some native communities persist inland, including the rare *Tetramolopium rockii* and ‘akoko (*Chamaesyce skottsbergii* var. *skottsbergii*) coastal dry dwarf-shrublands.

Eight of the 38 native plant taxa reported from the preserve are rare. Three of the eight rare plant taxa are endemic to western Moloka‘i (*Gnaphalium sandwicensium* var. *molokaiense, Tetramolopium rockii* var. *rockii,* and *Tetramolopium rockii* var. *calcisabulorum*), and five are federally listed as endangered (*Centaurium sebaeoides*, *Chamaesyce skottsbergii* var. *skottsbergii*, and *Marsilea villosa, Tetramolopium rockii* var. *calcisabulorum* and *Tetramolopium rockii* var. *rockii*; Appendix 2). Although *Marsilea villosa* has not been reported from the preserve since the 1970s, populations of this fern have been rediscovered just west of the preserve. One occurrence of *Sesbania tomentosa* (federally listed as endangered) has been detected just inside of the preserve’s east boundary. The majority of known populations occur outside of the preserve to the east. *Chamaesyce skottsbergii* var. *vaccinoides* was reported southeast of Mo‘omomi sand dunes in 1928. *Schiedea globosa* was reported near the preserve in 1915.

In September 1999, a native wedge-tailed shearwater nest (*Puffinus pacificus*) was sighted in the sand dunes of the naupaka coastal dry shrubland. This was the first observation of the species nesting in the preserve since the Conservancy began management in 1988. Since the first sighting in 1999, we have observed a steady increase in the amount of active ground nests in the preserve, indicating that the area provides suitable nesting grounds.

Green sea turtles (*Chelonia mydas*, honu), listed as threatened by the state and federal governments, frequent the coastline of Mo‘omomi Preserve. Mo‘omomi provides some of the most significant nesting sites in the main Hawaiian Islands for the turtles. Laysan albatrosses (*Phoebastria immutabilis*, mōlī) and monk seals (*Monachus schauinslandi*, ‘īlio-holo-i-ka-uaua) also visit the area, and may someday become established at Mo‘omomi. See Appendix 2.

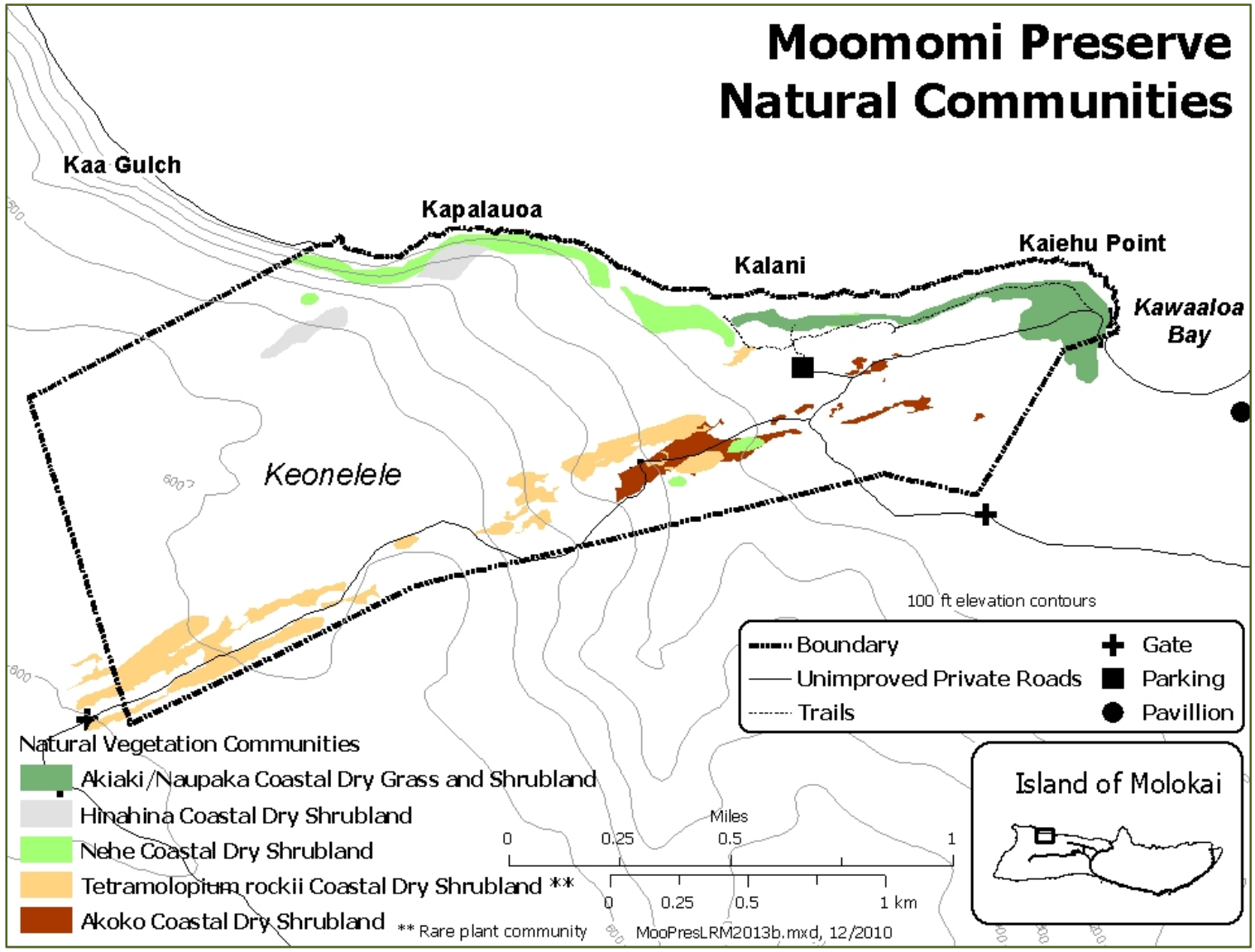

Figure 2. Mo‘omomi Preserve natural communities

MANAGEMENT

Management Considerations

1. In 1988 the Conservancy purchased 921 acres from Molokaʻi Ranch, Ltd., now known as Molokaʻi Properties, Ltd. (MPL), to establish Moʻomomi Preserve. The preserve lands are surrounded by MPL properties (Figure 3). An easement, which is part of the deed, allows the Conservancy access to the preserve on all existing roads. MPL and the Conservancy also have a Fencing Agreement that states that the MPL is responsible for repairing fence breaks and removing any livestock that escape from MPL lands into the preserve within 48 hours. This agreement also recognizes that the fence is not the legal boundary between MPL and Conservancy lands. In 2010, MPL began leasing the paddocks adjacent to the upper parts of the preserve; therefore, regular fence checks for cattle intrusion have been reinstated by the preserve staff.

2. Our primary management activities for protecting the preserve's native plants, animals, and natural communities are to reduce feral and domestic ungulate damage, control predation on nesting sea birds, and limit the spread of non-native, habitat-modifying plants. The removal of kiawe (*Prosopis pallida*) allows for "passive restoration" of the native coastal strand, primarily with ʻakiʻaki grass.

3. Wedge-tailed shearwater ground nesting activity on the preserve has increased the need for control of predators such as cats, dogs, and mongoose.

4. The Conservancy has allowed vehicular access to the preserve via a pass-key system, because of the cultural subsistence gathering that has been practiced since ancient times. The coastal and ocean resources gathered at Moʻomomi include: fish, *limu*, crab, lobster, octopus, and salt. These resources are important to community members, especially to the neighboring Hoʻolehua Hawaiian Homesteaders (see Figure 3). One of our primary goals is to work with the community, principally with Hui Mālama O Moʻomomi, a traditional subsistence fisheries organization, to determine the access level suitable to maintain sustainable harvesting practices and to prevent impacts to the native coastal strand.

5. Our priority is to protect Moʻomomi's biological significance. However, Moʻomomi is known for its beauty, wild setting, and cultural significance. This management plan considers the need to protect all of these aspects of Moʻomomi while allowing visitation by the public via the pass-key system and interpretive field trips.

6. The main preserve road ends at the coast in the northeastern corner (Kaiehu Point) of the preserve (Figure 1). This road is used by visitors and for management. In addition, a traditional foot trail begins east of the preserve and parallels much of the preserve coastline. The road also has a branch that accesses the higher elevation (southern side) of

the preserve and is for management use only. The southern branch can also be accessed through MPL's Keonelele paddock, off the Maunaloa Highway (Figure 3). TNC has an access easement with MPL.

7. Rich paleontological resources and archaeological sites are scattered throughout the preserve. Staff and hike docents are trained in the appropriate treatment and protection of historic sites, and the adequate supervision of public access to areas containing visible surface archaeological sites. Because Mo'omomi was an important burial site, human bones are sometimes uncovered by the wind. We notify the State Historical Preservation Division and work with them on re-interring the bones.

8. The Moloka'i Land Trust has been subcontracted to fulfill kiawe removal, weed and predator control deliverables. The Land Trust's Mokio Preserve is the adjacent area to the west of Mo'omomi Preserve (Figure 3). The Land Trust also conducts archaeological surveys and management.

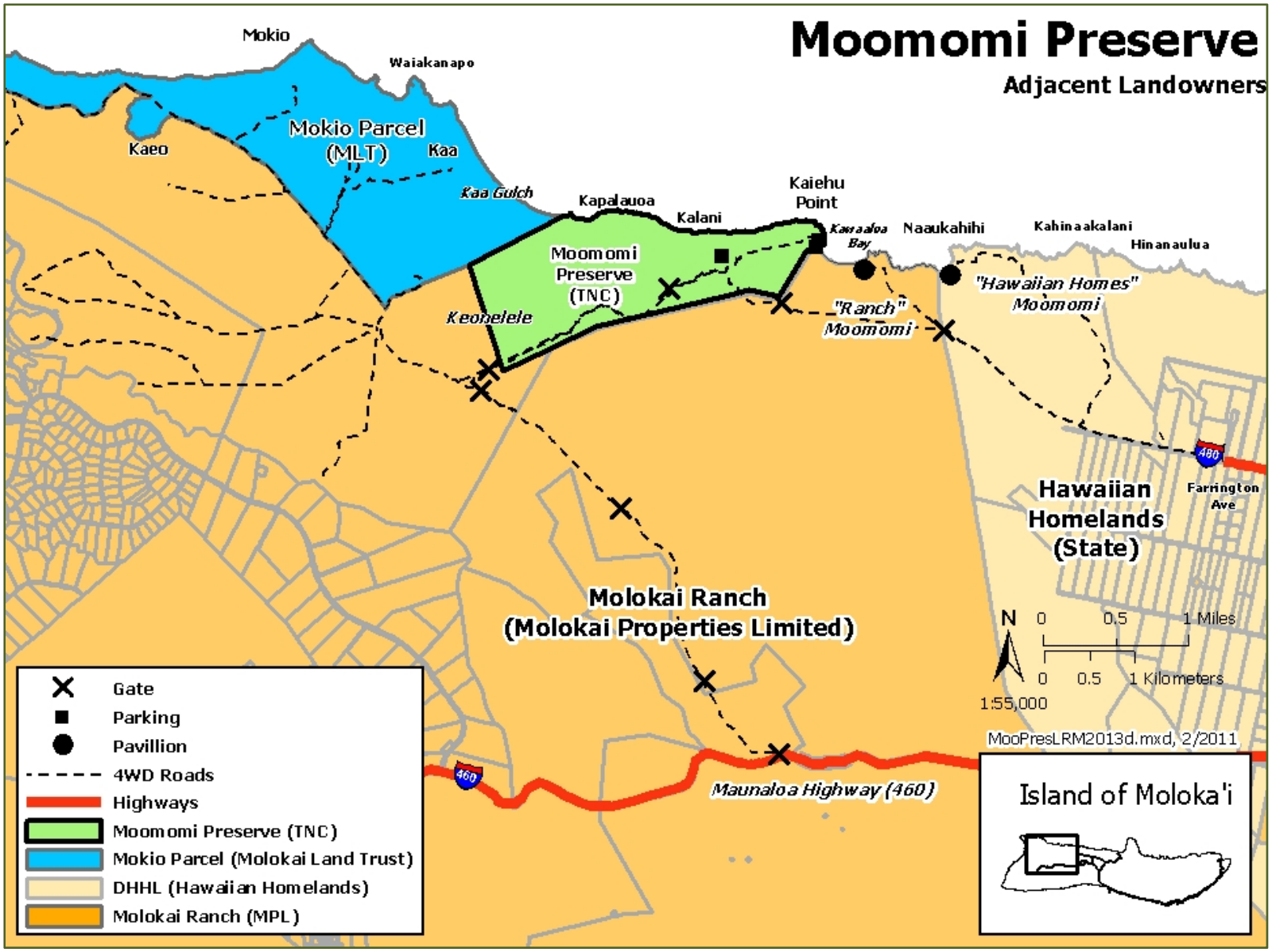

Figure 3. Mo‘omomi Preserve and adjacent landowners

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

Cattle Ingress Prevention

Program Goal: Keep cattle in adjacent pastures from entering the preserve.

Program Description: Mo‘omomi contains rare plants, natural communities, and other resources susceptible to damage caused by cattle. In the previous long range plan, MPL diminished their cattle operations, and so cattle did not threaten the preserve. Regular fence checks and maintenance were not necessary. MPL is now leasing adjacent paddocks. Cattle have breached the fence in the recent past and caused severe damage to the native strand. TNC will conduct regular fence checks and will immediately contact MPL when cattle intrusion is detected.

Activities

Years 1–6 (FY2013–FY2018):

- Conduct monthly fence checks and contact MPL immediately if breach is detected.
- Document impacts and MPL/cattle lessee actions.
- Conduct removal action if cattle not removed in 48 hours.

Status of Public Hunting Opportunities: Due to safety concerns, MPL’s adjacent cattle operations, and the Conservancy’s limited resources for administration and enforcement, the Conservancy does not have a public hunting program at Mo‘omomi Preserve. We are aware that hunters may occasionally enter the preserve without permission; we discourage this for the first three reasons stated above. In the event we determine that major control work needs to be conducted on feral ungulates, the Conservancy will pursue management in the best interest of resources and community at large.

This program represents an estimated 9% of the overall effort and budget in this long range management plan.

Predator Control

Program Goal**:** To protect native seabird colonies from predation.

Program Description: On September 26, 1999, a wedge-tailed shearwater nest was sighted on the east end of Mo‘omomi Preserve. Since the nesting was detected, TNC implemented regular predator control to reduce predation on this native seabird population. See Table 2.

TNC will continue year-round predator control and will assess/adjust trap locations annually. In 2008, we began trapping outside our preserve with the permission of the neighboring landowners. TNC will explore other methods and strategies to prevent predation.

Table 2. Trapping by calendar year, 2007–2011 (5 years)

	2007	2008	2009	2010	2011
Number cats trapped	29	36	18	23	6
Number mongoose trapped	119	81	90	87	12
Number rats trapped	16	0	0	1	0
Max number traps	34	28	22	20	20
Trap nights	10496	8087	6512	6979	2075

Activities

Years 1–6 (FY2013–FY2018):

- Evaluate the threat level of predators to all targets (including nesting seabirds) and assess suitability of management activities.
- Develop predator control plan in year 1 for years 2–6.

Year 1 (FY2013):

- Conduct weekly predator control twice a week from July through November 2012 and March to June 2013. Conduct opportunistic predator control during the interim rainy months (December–February), weather and road conditions permitting.
- Monitor seabird activity in October to determine the success of control activities and assess the need for predator control in the following year.

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

Invasive Plant Control

Program Goal: Reclaim at least three acres of native strand through weed removal in priority areas.

Program Description: Management work at Mo‘omomi is currently focused on kiawe (*Prosopis pallida)* removal and the removal of other weeds such as non-native grasses and a variety of herbaceous species that invade former kiawe removal areas (Table 3). Stands of kiawe have invaded large portions of the sand dune areas, displacing native vegetation, creating a fire hazard, and serving as a staging area for seabird predators. Kiawe removal has resulted in “passive restoration” (natural regeneration) of the native coastal strand.

Table 3. Herbaceous weeds and non-native grasses of Mo‘omomi Preserve

Common Name	Scientific Name
Golden crownbeard	*Verbesina encelioides*
Nettle-leaved goosefoot	*Chenopodium murale*
Australian saltbush	*Atriplex semibaccata*
Milkweed	*Reichardia tingitana*
Sow thistle	*Sonchus oleraceus*
Scarlet pimpernel	*Anagallis arvensis*
Yellow alder	*Turnera ulmifolia*
Glossy nightshade	*Solanum americanum*
Cherry tomato	*Solanum lycopersicum*
Pigweed	*Portulaca oleracea*
Bristly foxtail grass	*Setaria verticillata*
Buffel grass	*Cenchrus ciliaris*
Bermuda grass	*Cynodon dactylon*
Beach wiregrass	*Dactyloctenium aegyptium*

The kiawe control strategy involves removal of kiawe stands adjacent to native communities and those encroaching upon relatively intact native communities. Workers cut kiawe stands, treat the cut stumps with herbicide, and then chip the cut wood to reduce the litter biomass. Wood chips are then spread over the removal area. Regular alien grass and weed control are completed to prevent an alien seed bank from establishing. See Table 4 and Figure 4.

Table 4. Kiawe removal, FY07–11 (5 years)

Fiscal Year	2007	2008	2009	2010*	2011*
Acres of Kiawe removed	**0.89**	**0.62**	**0.63**	**2.36***	**0.58***

*Capacity building with Moloka‘i Land Trust

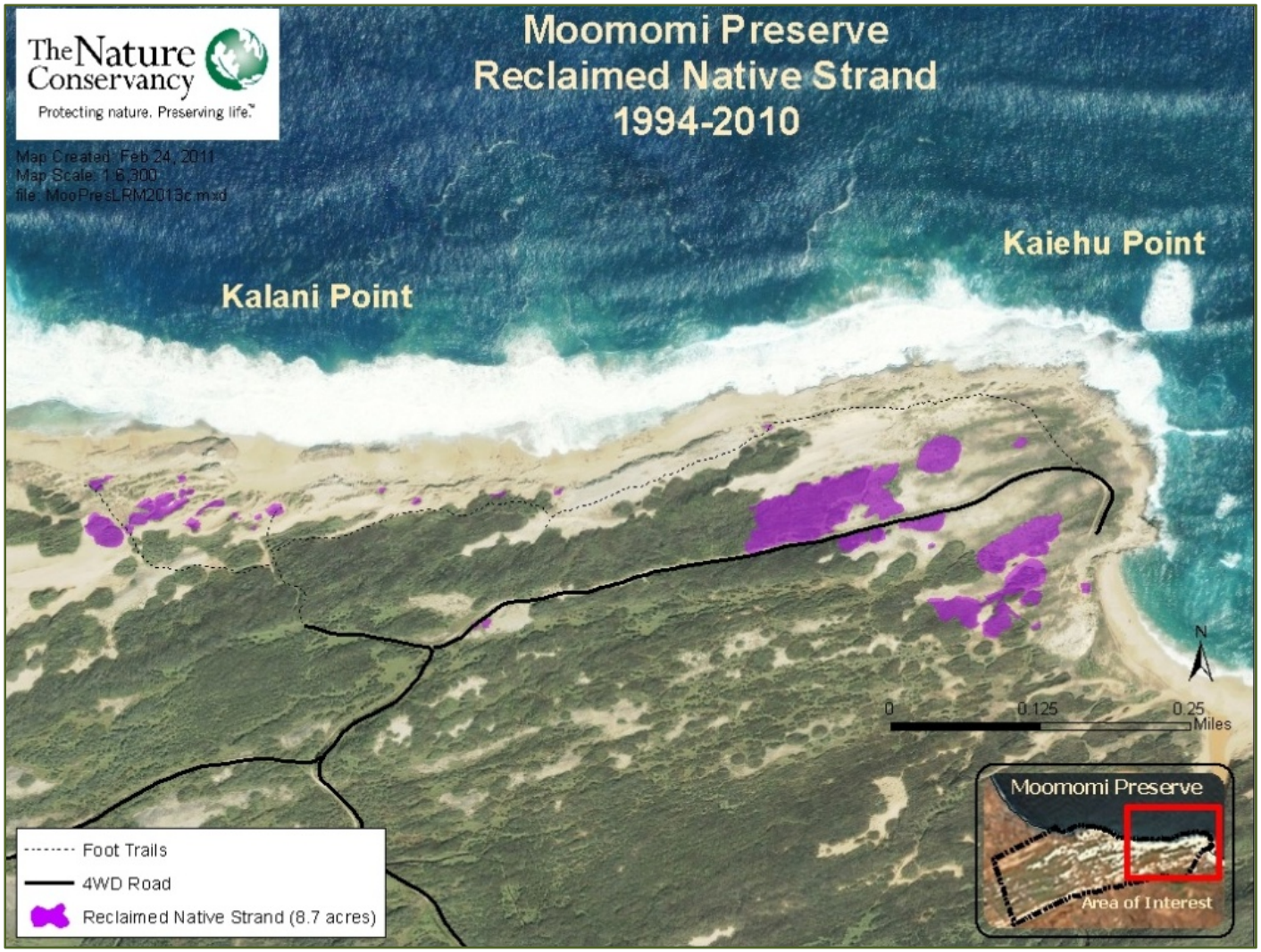

Figure 4. Past kiawe removal (FY1994–2010)

Herbicide use is in full compliance with the State of Hawaii Department of Agriculture (HDOA) Pesticide Enforcement Division, and is used according to the product label and recorded in detail for reference and efficacy monitoring. Weed control staff are certified through the HDOA Pesticide Enforcement Division.

Kiawe removal will continue to be the focus for the next six years. Staff will also notify MoMISC if a new invasive weed species is detected on or adjacent to the preserve.

Activities

Years 1–6 (FY2013–FY2018):

- Annually remove .5 acres of kiawe stands adjacent to native communities.
- Control non-native grasses and herbaceous species in intact native areas and in reclaimed kiawe removal areas.
- If new invasive species are detected, notify MoMISC to develop strategy and conduct removal if warranted.

This program represents an estimated 28% of the overall effort and budget in this long range management plan

Program 2: 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 will help with the understanding of the biological elements of the preserve and with the management of the preserve's natural resources.

Threat Monitoring

Prior to 2008, the effects of deer presence and TNC's herbaceous weed removal program on native vegetation had not yet been tested in the Mo'omomi Preserve. In 2008, two sites in the Mo'omomi Preserve were selected for the trials: Keonelele, higher in elevation, with higher deer presence and low native vegetation dominance, and Kaiehu point, near sea level, lower in deer presence, and high native vegetation dominance. Fenced versus unfenced areas were monitored, with both areas further split into weed controlled versus uncontrolled. Preliminary results suggest that deer may preferentially graze on the nonnative buffel grass (*Cenchrus ciliaris*) in unfenced areas, and that deer may browse on naupaka (*Scaevola sericea*), a native succulent, particularly in times of drought.

Based on our exclosure summary and incidental observations, for the next six years, TNC will focus our monitoring efforts towards deer impacts in the Kaiehu to Kalani coastal areas during drought and dry periods.

Activities

Years 1–6 (FY2013–FY2018):

- Develop and implement monitoring for deer impacts to coastal areas.

Resource Monitoring

Landscape vegetation monitoring

Photopoints are photographs taken at the same location in the same direction over time. This type of monitoring is a simple but effective way of demonstrating impacts of management as well as tracking landscape changes visually over time.

Photopoints will be taken for kiawe removal activities to document succession and recolonization of former kiawe plots. See below for example:

Sept 2006	Oct 24, 2006 (T zero)	+9 months	+21 months
Before kiawe removal	Cleared and chipped	Some native recolonization.	Estimated 75% of plot covered by native growth

Wedge-Tailed Shearwaters

‘Ua‘u kani, or wedge-tailed shearwaters, are seabirds that spend their life out at sea feeding on fish, squid, and crustaceans, returning to shore in March to construct sand burrows for nesting. They mate in April and young will fledge from the nest by mid-November. Parents leave the nest two to three weeks before their young fledge. At this time, young birds that are not yet capable of flight are highly vulnerable to predation.

On September 26, 1999, a wedge-tailed shearwater nest was sighted on the east end of Mo‘omomi Preserve, the first observed nesting since the Conservancy began management. Later that year, a protection plan was developed to determine primary threats to shearwater nesting success and implementation began. The plan focused on three threat reduction strategies:

- Predator control (Section B of “Non-native species control”)
- Kiawe removal to restore habitat (Section C of “Non-native species control”)
- Public education to minimize disturbance (signage is put up in nesting areas and pass-key users are informed of the nesting and locations and asked to avoid these areas)

Since implementation of these strategies, the number of nest sites and the population has increased (Figure 6). The presence of the wedge-tailed shearwater population is an indicator of

good seabird habitat. Establishment of suitable habitat may allow for more species of seabirds to utilize the preserve for nesting grounds in the future.

Monitoring the viability of the shearwater colony provides us both with feedback on threat control success and information about the colony itself. For example, banding allows tracking of the bird's life history and may help to get information on migratory patterns of founding members and later recruits to the colony. Adult bird banding takes place in April; fledglings are banded in October. All banding is conducted in cooperation with the state Division of Forestry and Wildlife (DoFAW) and the Maui Nui Seabird Recovery Project. Staff also conducts an annual nest count in August to evaluate the effects of predator trapping.

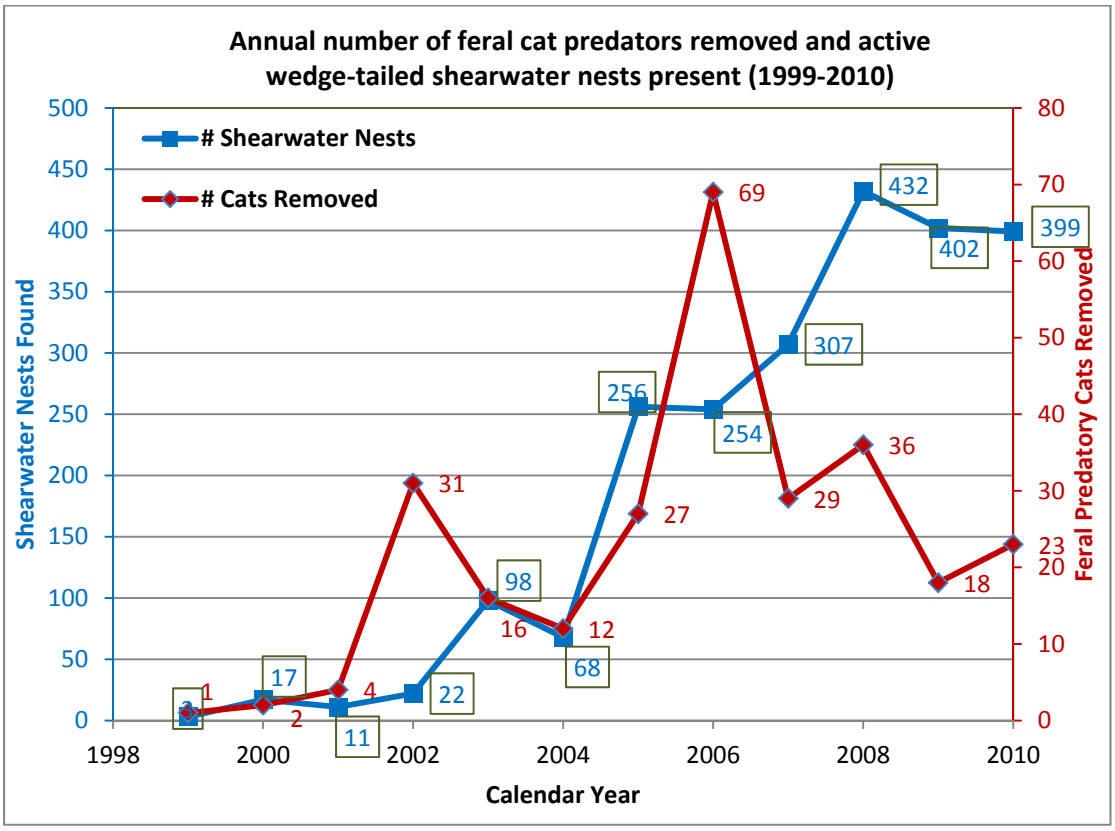

Figure 5. Wedge-tailed shearwaters nests and feral cats removed, 1999-2010.

Activities

Years 1–6 (FY2013–FY2018):

- Conduct annual photomonitoring of at least one kiawe removal plot.
- Conduct annual nest count of wedge-tailed shearwater burrows.
- Assist the State Maui District DOFAW and Maui Nui Seabird Recovery Project with seabird nesting surveys and banding twice a year (April and October).

Rare Species Protection and Research

Green Sea Turtles

Green sea turtle nesting along Kawa‘aloa Bay is monitored by volunteers on a daily basis during the nesting season from May to November. The bay is located just outside of the preserve in MPL property. We keep MPL informed of volunteer activities during the nesting season. Records are kept of the location of all nesting attempts and hatches are confirmed by tracks to the beach. Volunteers coordinate turtle monitoring and provide the Conservancy with a report of nesting activity annually.

To protect the green sea turtles and prevent humans from disturbing their nesting grounds, the pass-key system giving fishermen access to the preserve prohibits all visitors/users of the preserve from visiting the Kaiehu Point area (above Kawa‘aloa Bay where most turtles nest) at night during their nesting season to prevent artificial lights from disorienting or disturbing the turtles while in the water or nesting on shore. This rule is consistent with Hui Mālama O Mo‘omomi’s management plan for Moloka‘i's northwestern waters. From May 1 through August 31, to protect moi spawning, no fishing passes are given out from 10 days before the full moon until three days after. In addition, the Conservancy conducts beach cleanups at Kawa‘aloa (adjacent to the preserve) and in the preserve below Kalani Point with volunteers. Beach debris, especially nets, can hinder female turtles from traversing the beach during the nesting season.

All reports of monk seals are conveyed to State of Hawai‘i Division of Aquatic Resources and any report of Laysan albatross sightings will be conveyed to the State Division of Forestry and Wildlife.

Rare plants

Rare plant species work in Mo‘omomi preserve is three-fold:

1. Passive restoration – Expanding potential rare plant habitat through kiawe removal (see Invasive Plant Control section)
2. Active restoration through propagation and outplanting
3. Surveying natural occurrences of rare plant populations and rare plant communities.

Garnett Rare Plant Exclosure

The Garnett rare plant exclosure is an example of active restoration. In November 2010, a 279’ x 66’ deer proof exclosure was constructed near the main preserve entrance for the introduction of dune and dry forest rare species. The project is regularly maintained through the leadership of Bill Garnett.

In FY2010, almost 500 plants of ten coastal dune and dry forest species were outplanted into the exclosure, including the rare yellow-seeded wiliwili known from the area, the endangered *Sesbania tomentosa* (‘ohai) and *Achyranthes splendens* var *rotundata* (kulu‘i). Plans are to later introduce other rare plant species known historically from the area.

Rare plant survey

Staff conduct rare plant surveys of all rare plant populations using the Rare Plant Restoration Group's "Rare Plant Field Data Form." In the next long-range cycle, we will survey rare plant species/populations on a rotational basis (see below). Surveys will focus on one of the following species annually: *Tetramalopium*, *Gnaphalium*, *Gnaphalium, Solanum*/*Sesbania,* ʻAkoko (*Chamaesyce skottsbergii* var *skottsbergii*), and may include a survey of adjacent lands for rare plant species. Rare plant communities will be mapped that contain multiple rare species with populations over 1000 individuals.

Other Research

The Conservancy encourages research that will help us better understand and thereby, protect the preserve's resources. Conservancy funding for research is limited however, when possible, we provide logistical assistance to approved research projects. See Appendix 3 for a detailed listing of research undertaken at all Molokai Preserves, including Moʻomomi Preserve. All monitoring of rare species viability will be reported in the rare species section.

Activities

Years 1–6 (FY2013–FY2018):

- Maintain turtle nesting monitoring under the direction of the National Marine Fisheries Service (NMFS) and the State Division of Aquatic Resources (DAR) and with the help of volunteers.
- Conduct at least one beach cleanup at Kawaʻaloa Bay and within the preserve in April prior to turtle nesting season to protect turtles and other marine life utilizing the coastal community. Conduct additional beach clean ups if necessary.
- Survey annually for rare plant species/communities.
- Report rare animal species sightings to relevant authorities.
- Collaborate with partners to develop and implement a plan to reintroduce rare native plants to Moʻomomi Preserve.
- Provide logistical assistance to approved research when possible.

This program represents an estimated 14% of the overall effort and budget in this long range management plan.

Program 3: Community Outreach Program

Program Goal: To build community support and awareness concerning the conservation of native natural resources, and to implement effective conservation practices that are also culturally sensitive.

Program Description: The Conservancy's Molokaʻi community outreach programs goes far beyond the boundaries of any single conservation site; therefore there is considerable overlap in our community outreach program among the three preserves and other projects. We have taken a multi-faceted, comprehensive approach that help bring awareness and engagement to the community about the importance of preserving Molokaʻi's natural resources and the Conservancy's role in managing those resources. We work with a variety of conservation partners, schools, community groups, government and private funders, employment training organizations and programs, and individual volunteers and volunteer groups.

Outreach Programs

A. Passkey Access System

The "Passkey" system is designed to provide access on the preserve's main northern roads for sustainable fishing and gathering. The coastal and marine areas of Moʻomomi have resources that are important to community members, especially the adjacent Hoʻolehua homesteaders. The system is updated as needed to allow for fairness and to ensure the resources remain sustainable. The Conservancy consults with Hui Malama O Moʻomomi, who are the local experts on subsistence gathering and sustainability and regularly conduct marine resource monitoring. The Hui also conducts education outreach to help the community become aware of sustainable gathering practices.

B. Community Outreach/Public Awareness Activities

1. Monthly Preserve Hikes are conducted from March to October. No hikes are conducted from November to February as the seasonal winter rains make the roads impassable and unsafe. School field trips are conducted as requested. Guided hikes are typically performed by experienced volunteers and occasionally by TNC staff.

Table 5. Moʻomomi preserve hikes, 2007–2011 (5 years)

Year	Number of Hikes	Persons Reached	Volunteer Hours
2007	35	76	336.5
2008	34	119	316
2009	30	96	367
2010	23	94	306
2011	4	65	48

The Moloka`i Earth Day Celebration occurs annually in April to coincide with the National Earth Day, and has become the Conservancy's biggest public awareness event. The event engages local conservation and cultural agencies, organizations, and groups

who bring awareness and engagement to their projects on Molokaʻi through interactive exhibits. The event attracts about 1,000–1,200 community members annually.

2. Volunteer/Internships – Hike docents and turtle monitors directly help with learning programs at Moʻomomi. Volunteers also assist with administrative needs and events like Earth Day. Interns are recruited as available and or needed. Past interns were recruited from AmeriCorp, Alu Like, Kamehameha Schools and the Youth Conservation Corp.

3. Volunteer service trips – Staff collaborate with on and off-island volunteer and school groups ranging from 5–30 participants who want to learn about Hawaii's conservation effort by engaging in actual management activities. Management activities include weed control, beach cleanups, road maintenance, or native seed collecting. Trips often include an interpretive hike through the preserve to bring awareness of the area's natural history and biological diversity.

4. *Nature's Newsflash* is a semiannual publication that updates the community of the Conservancy's activities on Molokaʻi. The newsflash also recognizes community members who volunteer and or contribute to the Molokaʻi program. It is bulk mailed to every address on Molokaʻi.

C. Partners:
   1. Molokaʻi Advisory Council – gives advice on controversial issues and helps support and advocate decisions. MAC is made up of long-time, local community leaders and cultural practitioners.

   2. Hui Malama O Moʻomomi – Local marine subsistence/sustainability grassroots organization, assisting with management on the state's Hawaiian Homelands. The Hui provides guidance to the pass-key system in regards to marine subsistence gathering and sustainability practices.

   3. Molokaʻi Land Trust – MLT is a conservation/cultural land trust committed to protecting land, rural lifestyle, natural areas, cultural practices and ancient sites. MLT's Mokio Preserve is adjacent to the Moʻomomi Preserve on the west boundary. Mokio has similar coastal beach strands and the land trust is implementing similar management practices.

   4. Molokaʻi/Maui Invasive Species Committee (MoMISC) – MoMISC's goal is to prevent incipient invasive pests from becoming established or widespread on Molokaʻi. MoMISC's island-wide activities are to detect, respond and eliminate incipient invasive pests. MoMISC's outreach and awareness activities are critical to the detection and reporting of new invasive species by the public. TNC facilitates the quarterly committee meetings that decide how best to eliminate key pests.

   5. Molokaʻi Fire Task Force – TNC facilitates the Task Force meetings that bring community resources to the aid of the County Fire Department and State Division of Forestry and

Wildlife for wildland fires. TNC helped form the Task Force in 2003 through the "LAS-local action strategy", administered by the Molokaʻi Lanai Soil and Water Conservation District as part of the national Coral Reef Task Force Program.

6. East Molokaʻi Watershed Partnership (EMoWP) – The EMoWP conducts watershed management on the East Molokaʻi slopes. The EMoWP is mentioned in this plan because TNC Molokaʻi Programs is the coordinator.

7. Moʻomomi Coastal Forest Restoration Project (Bill Garnett) – This project is focused on bringing back rare coastal plants that historically occurred at Moʻomomi. A single yellow seeded wiliwili (*Erythrina sandwichensis*) tree that previously occurred on location was the catalyst of this project.

8. Papahana Kuaola Lelekamanu (Penny Martin) – Papahana Kuaola Lelekamanu has been TNC's main environmental and cultural educator partner, helping to lead school field trips at Moʻomomi.

9. Kualapuʻu Ranch – Initially involved with clearing the area of kiawe for the Moʻomomi Coastal Forest Restoration project, the ranch also donates staff time and equipment to improve the main access road after the seasonal winter rains.

10. Molokaʻi Properties Limited (MPL) – Formerly known as Molokaʻi Ranch, MPL's lands are adjacent to the south and east boundaries of the preserve. TNC communicates regularly on matters of trespassing, cattle leases, cattle intrusion, and access easement and locked gates. MPL has a very limited staff due to the 2009 shutdown of its major operations. TNC also has a perpetual conservation easement with MPL on the Kamakou Preserve lands.

Activities

Years 1–6 (FY2013–FY2018):

- Maintain Passkey system and update as needed.
- Conduct monthly and special community group hikes at Moʻomomi Preserve.
- Coordinate and lead volunteer and school group service trips as requested.
- Produce and distribute the semiannual *Nature's Newsflash*.
- Coordinate and organize annual Molokaʻi Earth Day Celebration Event.
- Maintain and develop docent and volunteer programs and conduct training sessions as needed.
- Support partner activities including MoMISC, Molokaʻi Fire Task Force, Hui Malama O Moʻomomi and Molokaʻi Land Trust.

This program represents an estimated 23% 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 is 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.

Main access to the preserve is via dirt roads that also serve as fire breaks. Roads and trails are maintained to provide safe access to and within the preserve. Kualapuʻu Ranch donates their equipment and staff time to maintain the main road after the rainy season. TNC is part of and helps to facilitate the Molokaʻi Fire Task Force (MFTF). MFTF is made up of agencies and organizations that bring knowledge and resources to aid the fire authorities (DOFAW and County of Maui Fire Department) in wildland fire prevention, pre-suppression and suppression activities. Moʻomomi Preserve's fire plans are embedded within The Nature Conservancy's *Molokaʻi Wildland Fire Plans*.

Activities

Years 1–6 (FY2013–FY2018):

- Annual update of the TNC Molokaʻi Wildland Fire Management Plan.
- Provide emergency training opportunities for staff including but not limited to keeping First Aid and CPR certifications current.
- Conduct annual first aid kit inventory and resupply.
- Update staff fire suppression training.
- Purchase equipment as needed to allow immediate response to fire threats.
- Respond to emergencies or fire threats.
- Maintain preserve roads as needed (Kualapuʻu Ranch).

This program represents an estimated 6% 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 Mo‘omomi Preserve NAPP project. Through the NAPP program, the state pays two-thirds of the management costs outlined in this long-range plan and TNC funds (from private and other government sources) the remaining one-third.

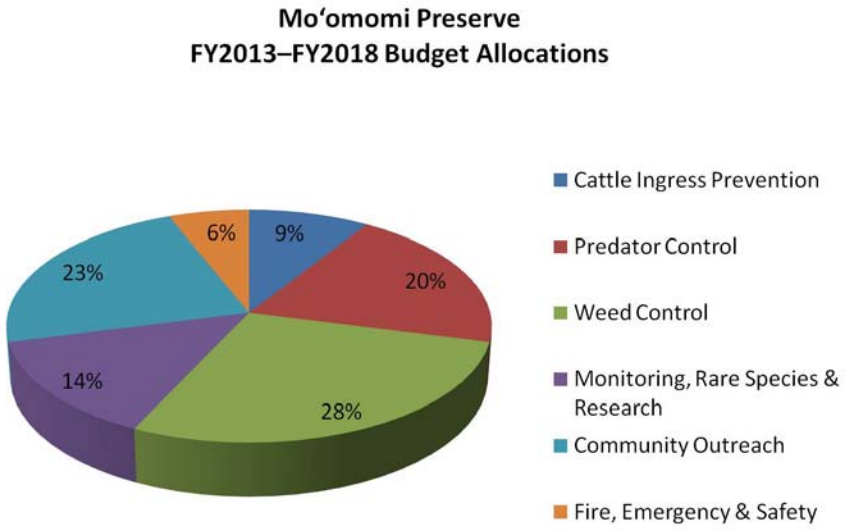

Figure 6. Mo‘omomi NAPP Budget/Effort by Program, FY13–FY18

The Conservancy’s Molokai operation maintains a full time base staff of four. 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. The Moloka‘i Program is now part of Maui Nui and reports to the Maui Program Director; consequently, technical and annual planning support is provided by both the Honolulu and Maui offices of the Conservancy. As budget and needs allow, these support staff members may charge a small portion of their time to this project. The Nature Conservancy's annually negotiated fringe benefits rate will also accrue on all salary costs.

This budget includes NAPP renewal costs such as an Environmental Assessment, project related supplies/materials, subcontract expenses to conduct kiawe removal, priority weed removal, and predator trapping, and other miscellaneous project related costs including vehicle expenses both as equipment purchases and equipment leases. The Conservancy routinely provides trainings for staff to improve job performance, and in addition to these trainings, supervisory staff will attend regular 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. Although the Conservancy’s overhead rate is currently 22.53 (the annual rate changes each

year per negotiations with DOI), the NAPP program will currently pay only 10%, leaving the remainder as a portion of the Conservancy's one-third match.

Budgetary Constraints: This Mo‘omomi NAPP budget represents a significant reduction in funding since the last LRMP (2007–2012). As such, TNC has modified deliverables in some areas to accommodate the lower funding amount. In some cases, TNC may decide to input additional private funds to improve or expand on deliverable outputs identified in this plan. This will depend entirely on TNC’s statewide priorities and its ability to raise additional funds. We will report on progress on all accomplishments in Mo‘omomi Preserve and on adjacent lands regardless of funding source.

BUDGET TABLE

	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	TOTAL
Labor & Benefits	31,517	31,517	31,517	31,517	31,517	31,517	189,102
Contractual	30,000	30,000	30,000	30,000	30,000	30,000	180,000
Communications	0	0	0	0	0	0	0
Travel	500	500	500	500	500	500	3,000
Supplies	3,000	3,000	3,000	3,000	3,000	3,000	18,000
Other	600	600	600	600	600	600	3,600
Subtotal	*65,617*	*65,617*	*65,617*	*65,617*	*65,617*	*65,617*	*393,702*
Overhead	6,562	6,562	6,562	6,562	6,562	6,562	39,370
TOTAL	72,179	72,179	72,179	72,179	72,179	72,179	433,072
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Total**
Mo'omomi Budget	72,179	72,179	72,179	72,179	72,179	72,179	433,072
Private Match (1/3 of total)	24,060	24,060	24,060	24,060	24,060	24,060	144,357
TOTAL NAPP REQUEST (2/3)	**48,119**	**48,119**	**48,119**	**48,119**	**48,119**	**48,119**	**288,715**

Appendices

Appendix 1. Native natural communities of Mo‘omomi Preserve[1]

Native Natural Community	Global Rank (a)
‘Aki‘aki *(Sporobolus virginicus)* Coastal Dry Grassland	G4
‘Akoko (*Chamaesyce skottsbergii var. skottsbergii*) Coastal Dry Dwarf-Shrubland*	G2T2*
Hinahina (*Heliotropium anomalum*) Coastal Dry Dwarf-Shrubland	G3
‘Ilima (*Sida fallax*) Coastal Dry Dwarf-Shrubland	G3
Naupaka Kahakai (*Scaevola sericea*) Coastal Dry Shrubland	G4
Nehe (*Melanthera spp*) Coastal Dry Dwarf-Shrubland	G3
Tetramolopium rockii Coastal Dry Dwarf-Shrubland[1]	G1

[1]Rare natural community

* Currently, this community type is not tracked by NatureServe; the global ranking of the community dominated by this rare variety of ‘akoko (*Chamaesyce skottsbergii* var. *skottsbergii*) was inferred from the global ranking of the species (see Appendix 2).

(a) Key to Global Ranks as defined by NatureServe.org:

G1 = **Critically imperiled**: Very high risk of extinction due to extreme rarity (typically 1-5 populations).

G2 = **Imperiled**: High risk of extinction or elimination due to restricted range, few populations, steep declines, or other factors.

G3 = **Vulnerable:** Moderate risk of extinction or elimination due to restricted range, relatively few populations, recent and widespread declines, or other factors.

G4 = **Apparently Secure:** Uncommon but not rare; some cause for long-term concern due to declines or other factors.

[1] Last Updated: Feb 22, 2011

Appendix 2. Rare Species of Moʻomomi Preserve[2]

Plants

Scientific Name	Hawaiian/Common Name	Global Rank (a)	Status (b)
Centaurium sebaeoides	ʻāwiwi	G2	LE
Chamaesyce skottsbergii var. *skottsbergii*	ʻakoko, koko, kōkōmālei	G2T2	LE
Gnaphalium sandwicensium var. *molokaiense*	ʻenaʻena	G3T1	C
Marsilea villosa[1]	ʻihiʻihi, ʻihi lāʻau	G1	LE
Sesbania tomentosa[2]	ʻohai	G2	LE
Solanum nelsonii	popolo	G2	C
Tetramolopium rockii var. *calcisabulorum*	pamakani	G1T1	LT
Tetramolopium rockii var. *rockii*	pamakani	G1T1	LT

Animals

Chelonia mydas	honu, green sea turtle	G3	LT
Eretmochelys imbricata[3]	Hawksbill sea turtle	G3	LE
Monachus schauinslandi	Hawaiian monk seal	G2	LE
Phoebastria immutabilis	Laysan albatross	G3	N/A

Invertebrates

Nesoprosopis anthricina[4]	Yellow-faced bee	GH	N/A
Nesoprosopis assimulans[4]	Yellow-faced bee	GH	N/A
Nesoprosopis hilaris[4]	Yellow-faced bee	GH	N/A
Nesoprosopis longiceps[4]	Yellow-faced bee	GH	N/A

[1] Reported in preserve in 1970s; may still occur in preserve.
[2] Known from just outside the preserve.
[3] Based on historical accounts by residents, occurrence not confirmed.
[4] Source: Magnaca, Karl. Report to The Nature Conservancy, Aug. 1999.

(a) Key to Global Ranks as defined by NatureServe.org:
G1 = **Critically imperiled**: Very high risk of extinction due to extreme rarity (typically 1-5 populations).
G2 = **Imperiled**: High risk of extinction or elimination due to restricted range, few populations, steep declines, or other factors.
G3 = **Vulnerable:** Moderate risk of extinction or elimination due to restricted range, relatively few populations, recent and widespread declines, or other factors.
GH = **Possibly Extinct**, little known about species, still some hope of rediscovery
T1 = Subspecies or variety critically imperiled globally.
T2 = Subspecies or variety imperiled globally (typically 6-20 current occurrences).
(b) Key to Status (Federal):
LE = Taxa formally listed as endangered under Endangered Species Act.
LT = Taxa formally listed as threatened under Endangered Species Act.
C = Taxa proposed for listing as threatened or endangered under Endangered Species Act.

[2] Last Updated: Feb 10, 2011

Appendix 3. Research conducted at The Nature Conservancy's Molokai Preserves, July 1994–June 2011

Ongoing Projects

Biodiversity Survey of Freshwater Algae of the Hawaiian Islands

Alison Sherwood, UH Mānoa, Botany Dept.

Part of a National Science Foundation project to inventory freshwater algae of the Hawaiian Islands. Areas surveyed on Molokaʻi include Hālawa Valley, Pelekunu and Kamakou Preserves. First study to inventory freshwater algae in Hawaiʻi in over 50 years. Kamakou Preserve collections began in May 2010. Specimens being analyzed to determine species.

Lineage diversification in the Hawaiian flowering plant genus *Astelia* (Astelicaceae)

Joanne L. Birch PhD Candidate, UH Mānoa, Botany Dept.

Research began June 22, 2007. Sudy of the evolutionary relationships of Hawaiian *Astelia* sp.

Role of orb web-building in the adaptive radiation of the Hawaiian Tetragnatha (Tetragnathiadae) and Cyclosa (Araneidae) spider.

Dr. Todd Blackledge, University of California, Berkeley. Blackledge_todd@hotmail.com

Research began Aug. 7-9, 2000. Kamakou Preserve. Collected *Tetragnatha* sp. And *Cyclosa* sp. and made photo vouchers of webs. Collections to be deposited in the Essig Museum of Entomology, University of California, Berkeley. Holotype material to be deposited at Bishop Museum. Initial results supports the hypothesis that evolutionary diversification of web building has been an important contributor to the speciation of Hawaiian *Tetragnatha*. Continued study will determine the factors contributing to the biodiversity of Hawaiian spiders and how they function in Hawaiian ecosystems.

Evolutionary relationships and ecology of the endemic Hawaiian tephritid flies in the genus *Trupanea*.

Dr. Johnathan Brown, *Grinnell College*. brownj@grinnell.edu

Research began in May 2002. Last visit was October 21-22, 2010. Kamakou Preserve. Collections will be deposited at Bishop Museum. The goals are to understand the evolution of host plant use, including any role that host switching has had on speciation, and the rate of evolution in behavioral and morphological characters that distinguish species of flies. The seed predators' hosts include endemic Hawaiian plants from at least 3 radiations: the silversword alliance (*Dubautia, Agyroxiphium*), *Bidens*, and *Artemisia.* Dimorphism identified on the wings of the *Trupanea* and a difference in diet, indicate that there may be a Molokaʻi endemic species which infests seed heads of *Dubautia plantaginea*. DNA comparison pending.

Microhabitat selection and morphological constraint in the insect visual system

Butler-Higa, Marguerite and Jeffrey Scales, University of Hawaiʻi at Mānoa

Study began April 5, 2011, looking at morphological differences in the eye structure of *Megalagrion* damselflies.

Color variation and species distributions of *Megalagrion* damselflies.

Idelle Cooper, Zoology Dept, Michigan State University

Study began in Sept 2010. Collections of *M. calliphya* and *M. hawaiiense*, indicate that color morphs of the same species vary between different islands in the main Hawaiian islands.

Understanding the way that organic matter moves from the organic litter layer to the underlying mineral soil.

Oliver Chadwick, University of California

Research began June 19, 2007 and is an extension of soil studies being conducted by Peter Vitousek.

A study of Aquatic insects as indicators of stream health in Pelekunu Valley.
Dr. Ron Englund, Bishop Museum.

Research initiated May 24-25, 2000 and is expected to continue annually. Pelekunu Preserve. Collections of aquatic insects as a part of Pelekunu stream monitoring effort in conjunction with TNCH and State Dept. of Aquatic Resources (DAR). Final deposition of collected specimen at Bishop Museum.

Vespula project
Megalagrion damselfly survey
David Foote (Hawai'i Volcanoes National Park).

Vespula research began August 1998.
Megalagrion damselfly surveys were conducted in August 2005 and August 2006.

Hawai'i Forest Bird Interagency Database Project.
Dr. Scott Fretz, et. al., Hawai'i Department of Land and Natural Resources, Division of Fish and Wildlife.

Research conducted March 9 to April 2, 2004. Kamakou and Pelekunu Preserves. Forest Bird surveys are conducted on each of the five main islands on a five year rotation basis in key native forest bird habitat including those lands being actively managed to enhance forest bird habitat. Data is entered into a centralized database and analyzed for trends. Web site information is available at http://biology.usgs.gov/pierc/HFBIDSite/HFBIDPHome.htm

Origin and stabilization mechanisms of organic nitrogen forms in soil.
Dr. Georg Guggenberger, Martin Luther University Halle-Wittenberg, Germany

Research began June 19, 2007 and is an extension of soil studies being conducted by Peter Vitousek.

Mark and recapture of *Partulina redfieldi* and *Perdicella helena* (tree snails) at Kamakou Preserve.
Dr. Mike Hadfield, Department of Zoology, University of Hawai'i.

Research began January 1984 and is in progress. Last visit May 2006 Kamakou Preserve. Long-term monitoring of populations of *P. redfieldi* on and at the base of five trees has occurred for 20 years and is critical to major conservation planning for the entire group. Monitoring results guide management actions.

Captive breeding of *Partulina redfieldii* and release at Kamakou Preserve.
Dr. Mike Hadfield, Department of Zoology, University of Hawai'i.

Research began January 1984 and is in progress.

Collecting Hawaiian *Omiodes* moths from TNCH Moloka'i Preserves
William Haines, Graduate student , University of Hawai'i at Mānoa

Collections began July 2005, Last visit was December 31, 2005. The objective of this project is to relocate populations of presumed extinct species of *Omiodes* moths, as well as those species considered "species of concern". This project will result in a rigorous assessment of the taxonomic and conservation status of this genus in Hawai'i. If surviving populations of extinct *Omiodes* are discovered, further steps can be taken towards determining population health and developing a management plan for Hawaiian leafroller moths.

Reproductive biology, ecology, and genetics of Hawaiian violets

Chris Havran, Graduate Student, *Ohio University Dept. of Environmental and Plant Biology*

Research began July 2006 and is ongoing. The study is looking at environmental characterization, reproductive characterization, physiological characterization, and ecological genomics.

Reconstructing the patterns of host-plant utilization in the evolutionary history of *Nesosydne* planthoppers.

Gerald Luke Hasty, University of California, Berkeley, Ph.D. program.

Research began March 24-27, 2001. Kamakou Preserve. Collections will be deposited at the Bernice P. Bishop Museum or E.O. Essig Museum, Berkeley, CA. Diversification in host-plant use in Nesosydne planthoppers was important for the proliferation of species found in Hawai‘i.

Prostostelids of Hawai‘i

Drs. Don Hemmes; Fred Spiegel

Research began January 3, 2007. Report pending.

Succinea caduca sampling at Mo‘omomi Preserve

Dr. Brenden Holland and Dr. Robert Cowie, Center for Conservation Research and Training
University of Hawai‘i, Mānoa bholland@hawaii.edu

Collections occurred on March 10, 2005. As part of an ongoing NSF-funded evolutionary biology study of the endemic succineid land snail fauna of the Hawaiian Islands. Collections will be deposited in the Malacology Collection at the Bishop Museum.

Taxonomy and ecology of Hawaiian Rotifera: a contribution to the biodiversity and zoogeography of oceanic islands.

Dr. Christian D. Jersabek, Academy of Natural Sciences. Jerswabek@acnatsci.org

Research began March 5-6, 2001. Kamakou Preserve. Assess the biodiversity of freshwater invertebrates (micrometazoa) in wetland ecosystems that are currently considered to be at special risk.

Evolutionary biology, genetics, ecology, and behavior of Hawaiian Drosophilidae.

Dr. Ken Kaneshiro, University of Hawai‘i. kykaneshi@hawaii.edu

Research began 1963 and is in progress. On March 1999 trip, *D. differens* was collected at a higher elevation than previously collected. Until now, this unique Moloka‘i species had not been seen in over 15 years. Combined with other data from the Big Island, this significant finding indicates that some *Drosophila* species may be “moving” upland, perhaps in response to environmental changes.

Reproductive Biology of Solanum nelsonii in the Mo‘omomi Preserve, Hawai‘i.

Emi Kuroiwa, University of Illinois at Chicago

Research began March 23, 2011, looking breeding systems, pollination and population structure in *Solanum nelsonii* at Mo‘omomi Preserve.

A Comparative Approach to the Evolutionary Biology of Hawaiian Insects: Population Genetic and Phylogenetic Studies

Rick LaPoint,UC Berkeley

Research began Jan 10, 2011, studying speciation in leafhoppers and flys, with potentially 5 new

species discovered in the genus *Campsicnemus*.

Taxonomic studies of Hawaiian predatory ground beetles (Carabidae).
James Lieberr, Cornell University & Dan Polhemus, U.S. National Museum of Natural History, Smithsonian Institution.

Research initiated in Spring 1991. Last visit on May 10-16, 2005. Hawai'i hosts about 350 native Carabid beetle species exclusive to the islands – 55 species are exclusive to Moloka'i. Species distributions on Moloka'i exist in two natural areas including Kawela-Pu'u Kolekole and Wailau-Kainalu. Speciation has occurred repeatedly between these areas and this study will investigate how these species behave in their natural habitats. Voucher specimen will be deposited at Cornell University, Bishop Museum, or the Smithsonian.

Hawaiian Monk Seal Foraging and Epidemiology Study
Charles Littnan, Ph.D.Research Ecologist Hawaiian Monk Seal Research Program
Pacific Islands Fisheries Science Center, NOAA Fisheries

Research began April 12, 2004. Last research conducted September 18- 22, 2005 Mo'omomi Preserve. Flipper tag, health screen, seals to get a better idea of population size and health of seals in the main Hawaiian Islands.

Collecting Hylaeus yellow-faced bees in Kamakou and Mo'omomi Preserves to determine which species are extant.
***Karl Magnacca, Cornell University*.**

Research began in March 1999. Kamakou and Mo'omomi Preserve. Collections are deposited at the Cornell University Insect Collection and the Bishop Museum. Conduct phylogenetic studies using molecular and morphological methods, and determine feeding preferences by examination of pollen in larval provisions. Conservation aspect of study is to determine extant species of Nesoprosopis and their distribution in protected areas. Collected in June, August 1999, June 2001. Identification of 4 species of *Hylaeus* being considered for ESA listing at Mo'omomi as of 2011.

The Utility of DNA Barcoding in Hawaiian Insects.
Karl Magnacca and Donald Price, University of Hawai'i-Hilo,

Began field work Dec 14-16, 2010. Research to see if the Hawaiian *Drosophila* (fruit flies) can be identified using various processes of DNA/mitochondrial analysis. Collections in and around Kamakou Preserve in Dec 2010 resulted in 2 new island records: *D. odontophallus* and *D. orphnopeza*, and relocation of the rare Maui Nui species, *D. sodomae*.

Inter-island population genetics of *Dubautia laxa* within the Hawaiian Archipelago.
***Mitchell McGlaughlin, Rancho Santa Ana Botanic Garden / Claremont Graduate University, Ph.D. program*.**

Research initiated Sept. 27-30, 2002. Kamakou Preserve. Document the extent of genetic variability and sub-division among populations and islands to formulate hypotheses about D. laxa diversification and adaptation over time. Also gathering data on the number and location of extant populations and major threats.

Community dynamics and long-term conservation potential of Mo'omomi dunes (NW Moloka'i) and related strand areas of Maui County.
Arthur C. Mederios, Pacific Island Ecosystem Research Center.

Research initiated June 21, 2004. Mo'omomi Preserve. Document long-term changes in

vegetation communities and document the current stand structure of the plant communities to be used as a proposed template for restoration of coastal sites in various substrate types elsewhere in Maui County. Collected propagules will be grown in collaboration with Maui Nui Botanical Gardens, and used as a gene bank for restoration of other Maui County sites.

Biogeography and Repeated Evolution of Flightlessness in Cave and Alpine Hawaiian Moths.
Matt Medeiros, UC Berkeley, Dept. of Integrative Biology PhD dissertation.

Revising two genera of Hawaiian moths, *Shrankia* (Noctuidae) and *Thyrocopa* (Oecophoridae). Mites (Parasitengona: Trombellidae) appear to be infecting larger moth species (esp., *Scotorythra*). Researcher to contact TNC if control method is identified.

Comparative fern diversity at Kamakou preserve, Molokaʻi
Dr. Klaus Mehltreter.

Project executed May 24-30, 2010. Fern diversity surveyed on 10 transects in Kamakou Preserve around the Pēpēʻōpae Boardwalk. No introduced fern species were found on transects. The fern species richness index of 33 species/1000 m^2 in the study is among the highest in the Hawaiian Islands, only comparable with some sites on Maui with 35-42 species on sampled areas twice as large as in Kamakou. Nineteen fern species were vouchered and deposited at UH Mānoa.

Phylogeny and geographical relation in the fern genus Elaphaglossum.
Dr. John Mickel, New York Botanical Garden, Robbin Moran, Timothy Motley.

Project initiated Feb. 4, 2004. Kamakou Preserve. Determine the phylogenetic and geographical relationships of the genus world-wide using molecular techniques. The Hawaiʻi origins are likely from the South Pacific but one species may originate from Mexico. Project support from the National Science Foundation. Voucher specimen deposited at the New York Botanical Garden herbarium.

Breeding ecology and oviposition preferences of the Hawaiian Drosophilidae.
Drs. Steven L. Montgomery, Michael Kambysellis, and Elysse Craddock, and David Baer. University of Hawaiʻi, NY University, University of NY. (808) 676-4974

Research began July 1998 and is in progress. Kamakou Preserve.

Evaluation of native invertebrates at Moʻomomi for listing under the Endangered Species Act.
Dr. Steven L. Montgomery, Anita Manning. (808) 676-4974

Research began December 1997 and is in progress. Collections of specimens will be deposited in Bishop Museum (Honolulu).

Catalog of Hawaiian Drosophilidae and their host plants and study of the phylogenetic relationships among the major groups of the family Drosophilidae.
Dr. Patrick O'Grady

Research began in April 2002 and is in progress. Kamakou Preserve. The research goals are: (1) to catalog of the endemic Hawaiian Drosophilidae and their host plants, making specific notes on abundance, distribution, and ecological associations; (2) to infer the phylogenetic relationships among the major groups of the family Drosophilidae, especially the endemic Hawaiian species, using molecular character data and phylogenetic methodology.

Plant Extinction Prevention Program
Hank Oppenheimer

This project began in May 2006. The Maui Nui Genetic Safety Net focuses on stabilizing, seed

collection and storage and propagation of endangered plants on the brink of extinction.

Collection of propagules and/or status updates of the following plant species from Moloka'i: ***Adenophorus periens, Cyanea dunbarii, Cyanea procera, Gouania hillebrandii, Phyllostegia manii (or P. hispida), Platanthera holochila, Stenogyne bifida, Pritchardia munroi.***

Steve Perlman, Natalia Tangalin, Ken Wood of National Tropical Botanical Garden.

Plant propagules collected for ex-situ propagation at the National Tropical Botatical Gardens on Kaua'i and other appropriate facilities. Collection trips began in February 1991. Collections are on-going. "Genetic Safety Net" Program began in Jan 2001 and later became the Plant Extinction Prevention Program.

Survey of *Metrosideros polymorpha* arthropod fauna across the long substrate age gradient in the Hawaiian Islands.

***Dr. Dan A. Polhemus, Daniel S. Gruner, Curtis P. Ewing, Smithsonian Institution, Bishop Museum and University of Hawai'i joint research project*.**

Research began in October 1997 and is in progress. Kamakou Preserve.

^{15}N Natural abundance of soil microbial biomass as a tool for assessing controls on N-cycling processes in ecosystems.

Egbert Schwartz, Paul Dijkstra, Steve Hart & Bruce Hungate, Northern Arizona University.

Research initiated Oct 10, 2004 and will be in progress for the next 3 years. Kamakou Preserve. This study will research the effect of substrate age on the natural abundance stable N isotope composition of the soil microbial biomass and will relate this to ecosystem level N-cycling processes. Results from this project will open a window in soil microbial activity and provide a better understanding of how ecosystem processes of disturbance, alien invasion and succession (ecosystem and soil health) affect soil microbial life, and *vice versa*. Support provided by the National Science Foundation (DEB-0416223) and in collaboration with Peter Vitousek.

Biological survey of endangered species throughout the Hawaiian archipelago.

Ken Wood, National Tropical Botanical Garden [Conservation Dept.] kenwood@ntbg.org

Research began in Dec. 1997. The main goal is to establish conservation collections of all endangered taxa in order to conserve their unique line of evolutionary divergence. Biological survey focus on the collection of endangered species throughout the Hawaiian archipelago including the collection of seed, tissue, and genetic collections. This project is being funded by the Weathertop Foundation.

<u>On-going Projects (unsure of status)</u>

The critically endangered endemic fern genus Diellia (Aspleniaceae): its population structure and ecology.

Ruth Aguraiuja, Institute of Botany and Ecology, University of Tartu.

Research began in July 8-11, 2003. Kamakou Preserve. Population stage structure will describe the condition of all local population for the endemic fern taxa of Diellia on the Hawaiian Islands and will be used to understand the regional dynamics of the species. Since these species are endangered, this information is needed for conservation purposes. No final report on file.

Multi-temporal, hyperspectral mapping of landforms, surface deposits, and vegetation in the Mo'omomi Dunes Preserve.

Dr. Ray E. Arvidson, Thomas Stein, Maggie Grabow, Julie Mintzer, Eric Frye, Meredith Berwick, Rachel

Torrey, Washington University.

Research began on August 18-27, 2004. Mo‘omomi Preserve. This project is supported by the Pathfinder Program in Environmental Sustainability in which 5 undergraduate senior year thesis projects will be completed at the end of this year. Their analyses of digital images and maps acquired from spectrometry (MASTER, AVIRIS, and ASTER) will result in a better understanding of nature and distribution of landforms, deposits and vegetative covers on the dunes. Analyses of maps from 20 years ago will show how the dunes changed over time.

Defining units of conservation: Genetic distinctiveness of the Moloka‘i Amakihi.

Dr. Robert Fleischer and Cheryl Tarr, National Zoological Park, Smithsonian Institution.

Objectives: 1) assess the extent of genetic differentiation between the Moloka‘i amakihi and other amakihi populations (primarily Maui) through analysis of nucleotide sequence variation in a hypervariable region of mitochondrial DNA; 2) determine the level of variability within the Moloka‘i amakihi population relative to other amakihi populations; and 3) compare the differentiation between populations to the average divergence within populations. If the Moloka‘i amakihi is distinct, then the average divergence between it and its sister population (presumably Maui) will exceed the average divergence within each population. Research began March 1995 and is in progress.

The impact of Tropical ash (*Fraxinus uhdei*) on understory vegetation composition in a native forest on Moloka‘i and prospects for management of this invasive species.

Lyman Perry, Geography Department, University of Hawai‘i at Mānoa

Research began in 1992 and is in progress (draft summary to be sent, Dec. 2000). Kamakou Preserve.

Mycofloristic, revisionary, and monographic studies in the Xylariaceae.

Dr. Jack D. Rodgers, Washington State University

This mycofloristic study of this family of fungus (Xylariaceae) was proposed in order to assess this mycobiota while it is still available. Research began in January 1996 and is in progress.

Ecological Diversity, Systematics and Conservation of Hyposmocoma (Cosmopterigidae).

Daniel Rubinoff, University of Hawai‘i.

Research initiated May 18-20, 2004. Kamakou Preserve. Develop a systematic framework for examining ecological and phylogenetic patterns of ecological diversification, and enable a conservation assessment to be made for the group. Vouchers will be deposited at the University of Hawai‘i Insect Museum.

Characterization of the diversity of egg-case morphologies from Hawai‘i *Tetragnatha* species.

Joseph Spagna, University of California, Berkeley, Ph.D. program.

Research began March 24-26, 2001. Kamakou Preserve. Voucher specimen will be deposited at the Essig Museum of Entomology, UC Berkeley. This study will characterize the diversity of egg-case morphologies from Hawai‘i Tetragnatha species and placement of this data in phylogenetic and biogeographical contexts.

Population genetic study of the Hawaiian endemic *Hillebrandia sandwicensis* (Begoniaceae).

Dr. Mark Tebbitt, Brooklyn Botanic Garden; Dr. Susan Swenson, Ithaca College;
Dr. James Yeadon, Brooklyn Botanic Garden; Zeke Nims, Ithaca College student;
Wendy Clement, Ithaca College student.

Research initiated May 19, 2000 and is in progress. Kamakou Preserve. Collected leaf samples of

Hillebrandia sandwicensis. One herbarium specimen deposited at Bishop Museum; Silica dried material will be deposited at Brooklyn Botanical Garden.

Evaluation of below-ground patterns of primary succession and community development in the Hawaiian archipelago.

Dr. David Wardle, Landcare Research Surface; Dr. Richard Bardgett, Landcasle University; Gustavo Hormiga.

Research initiated on June 22, 2000. Kamakou Preserve. Collections of soil and plant litter from site near Puʻu Kolekole cabin.

Terrestrial Orchid Conservation by Symbiotic Seed Germination.

Dr. Larry W. Zettler, Illinois College. lwzettle@hilltop.ic.edu

Research initiated Aug. 8, 2003. Kamakou Preserve. Set up field trials for *Platanthera holochila* seed germination with naturally occurring symbiotic mycorrhizal fungi, with goal of improving propagation efforts to ensure that orchids persist in the natural setting. Zettler reports that growing Platanthera with non-native fungi was successful, as was growing the orchid in a sterile medium. Growing with the associated Hawaiian fungi was not successful. Nine seedlings of the rare orchid were reintroduced from Dr. Zettler's lab to an unoccupied exclosure in the Kamakou Preserve in March 2011.

Completed Projects and Pending Reports

Inventory and documentation of the current distribution and systematic status of a few Molokaʻi plants with screening for novel therapeutic activity.

Carol Annable, New York Botanical Garden. (808) 261-7397

Research began February 1998 and is complete. Kamakou and Moʻomomi Preserve. Collections to be deposited in NYBG, BPBM. Collected *Clermontia grandiflora, Alnus nepalensis, Lycopodium venustulun* at Kamakou*; Chamaesyce degeneri, Heliotropium anomalum var. argenteum*, and *Fimbristylis cymosa* at Moʻomomi. No published report will be made.

Systematics and Evolution of Hawaiian Planthoppers (Insecta: Hemiptera: Fulgoromorpha: Delphacidae and Cixiidae).

Drs. Manfred Asche, Hannelore Hoch, Museum fur Naturkunde Berlin manfred.asche@rz.hu-berlin.de

Research began March 1998. Evaluation of song patterns is in progress. Kamakou Preserve. Collected *Oliarus* sp.aff *hevahva, O. morai, O. similis molokaiana, Iolania* sp.*, Leialoha* sp. aff *mauiensis, Nesosydne* sp., *Siphanta acuta*. Collections to be deposited in Bishop Museum (Honolulu), Museum fur Naturkunde Berlin. Created "Love songs from Paradise" compact disk (Hawaiian planthopper mating calls from 5 islands; copy at Molokaʻi and HFO).

Risk Assessment for selected avian diseases in Hawaiian and Pacific Parks.

Dr. Carter Atkinson, Dr. Denis A. LaPointe, Sam Aruch, USGS-BRD, Pacific Island Ecosystem Research Center.

Research was conducted January 2003- November 2003 and is completed. Kamakou and Pelekunu Preserves, Kalaupapa National Historical Park, Haleakalā National Park (NP), and the NP of American Samoa. Assess severity and urgency of avian disease risks at the three national parks and feasibility of controlling mosquito vectors. Report pending.

Origin and evolutionary diversification of the Hawaiian silversword alliance (Argyroxiphium, Dubautia, Wilkesia).

Dr. Bruce Baldwin, University of California, Berkeley. Bbaldwin@uclink4.berkeley.edu

Research began June 2002 and is in progress. Kamakou Preserve. Voucher specimen will be deposited at the University of California, Berkeley and Jepson Herbaria. Evidence from comparisons of nuclear rDNA and chloroplast DNA show that introgressive hybridization and even hybrid speciation have occurred on Kaua'i but the degree to which these phenomena have influenced evolution of the group on the younger islands remains uncertain. Comparing unlinked molecular markers between populations on different islands is a powerful method for detecting whether hybridization has had a lasting impact on the genetic composition of populations. Research has lead to identification of two new species: a Moloka'i endemic, *Dubautia carrii*, and a Maui endemic, *Dubautia hanaulaensis*.

Status and Biogeography of *Rhyncogonus* weevils in the Pacific.
Elin Claridge, Dr. George Roderick, U.C. Berkeley, Ph.D. program.

Research initiated June 28-July 1, 2003. Kamakou and Mo'omomi Preserves. Conducting phylogenetic analysis of the group to understand the processes of ecological diversification and colonization processes on islands. Final deposition of collected specimen at Bishop Museum.

Genetic diversity and population structure of *Sesbania tomentosa*
David Cole, Pacific Island Ecosystem Research Center, USGS-BRD

Research Conducted February 7, 2006. Mo'omomi Preserve.
Use randomly amplified polymorphic DNA (RAPD) marker analysis to address the following questions: How much genetic variability exists (remains) in HAVO populations of *S. tomentosa*, as compared against a wider geographical sampling? Are all relic populations and taxonomic varieties equally diverse (how is genetic variability structured)? How genetically similar or dissimilar are the six existing population nodes and the varieties they contain? How does this population structure relate to the occurrence of the species on the islands of Maui and Oahu? The results and conclusions are expected by December 2007 and will be used to design an augmentation and recovery plan for *S. tomentosa*.

Documentation of distribution and taxonomic resolution of reptile and amphibian fauna in Hawai'i.
Ron Crombie, National Museum of Natural History.

Research began February 1998 and is complete. Kamakou and Mo'omomi Preserve. Collections to be deposited in the SI herp collection at USNM. Collected one gecko from near TNC office. No published report will be made.

Japanese Bush-Warbler: Population growth spread and impacts.
Jeffrey Foster, University of Illinois.

Research initiated July 17, 2004 and field collection has been completed. Kamakou Preserve and Moloka'i Forest Reserve. This study will assess the degree of morphological and genetic adaptation that occurs following founder events, and will provide insight into the population ecology of the invading bird species, Japanese bush-warbler (*Cettia diphone)*. Analysis of the bird's diet will be done to assess the potential for resource competition with native bird species.

Taxonomic study and phylogenetic relationships among species of Hawaiian *Dryopteris* (Dryopteridaceae) ferns.
Jennifer Geiger, University of Colorado at Boulder, Ph.D. program.

Research began June 14, 2001. Kamakou Preserve. Collections will be deposited at NTBG and the University of Colorado herbarium (COLO). Morphological and molecular data will be used to delimit species of *Dryopteris*. This study will determine the actual number and distributions of *Dryopteris* species in Hawai'i.

Phylogenetic relationships and breeding system evolution of insular Pacific *Pittosporum* (Pittosporaceae).

Dr. Chrissen Gemmil, Postdoctoral visiting scientist at Smithsonian Institution, working with Drs. Warren L. Wagner and Elizabeth Zimmer.

Research began June 1997. Kamakou Preserve. Collections *of P. argentifolium* specimens will be deposited at US and/or BISH.

Remote Sensing in Tropical Dry Forests in Hawai‘i

Dr. Thomas W. Gillespie University of California, Los Angeles

Research was conducted from June 26- July 27 2005. Kamakou preserve. There is currently no comparative data on species richness, floristic composition, or the conservation status of woody plant species or remaining fragments of tropical dry forest. Therefore, this endangered forest type is ideal for testing a number of remote sensing, biogeographic, and conservation theories related to such parameters in severely endangered and fragmented systems. At the stand level, data on species richness, floristic composition, and forest structure at each study site was collected will following Gentry (1982, 1988). Woody plant biodiversity will be quantified at the stand and patch level in tropical dry forests of the Pacific.

Collection and documentation of fungi in Kamakou Preserve.

Drs. Don Hemmes (University of Hawai‘i at Hilo), Robert Gilbertson (University of Arizona), Jack Rogers (Washington State University), and Fred Spiegel (University of Arkansas).

Studies are a part of surveys and inventories to document the types of fungi that are found in Hawai‘i. Collected wood rotting species polypores and Xylariaceae. Collected January 2000; final report pending.

Biological pattern of diversification of Hawaiian linyphiid spiders of the genus *Labulla.*

Drs. Gustavo Hormiga, Jonathan A. Coddington, Rosemary Gillespie (collaborator in Hawai‘i), Department of Entomology, National Museum of Natural History, Smithsonian Institution

This research required the collection of a small number of adults of *Labulla* spp. for detailed studies of their morphological features and if possible, their DNA sequence character information. Research included one field trip on Moloka‘i in August 1995; report pending.

Taxonomic and phylogenetic studies of Cryptograms (bryophytes).

Hiroyuki Kashiwadani, Masanobu Higuchi, Tatsuwo Furuki, Yoshihito Ohumura, Dr. Clifford Smith, University of Tokyo, National Science Museum, University of Hawai‘i. hkashiwa@kahaku.go.jp

Research began July 1997 and is in progress. Kamakou Preserve. Collections of bryophytes will be deposited in National Science Museum, Bishop Museum (Honolulu).

Identifying key environmental factors that might influence the parasitoid community and parasitism levels of the endemic non target moth, *Udea stellata*

Leyla V. Kaufman Graduate Research Assistant Plant & Environmental Protection Sciences University of Hawai‘i at Mānoa leyla@hawaii.edu

Research began April 2006 in Kamakou preserve and is in progress. Species to be deposited at University of Hawai‘i at Mānoa - Insect Museum. This study aims to identify key environmental factors that might influence the parasitoid community and parasitism levels of the endemic non target moth, *Udea stellata* (Butler) (Lepidoptera: Crambidae), by purposely introduced biological control agents and adventive parasitoids in remote native habitats in Hawai‘i. *Pipturus* spp. (Urticacea), are the host plants of *U. stellata*. These endemic plant species are distributed across

a wide range of habitats in Hawai‘i, creating the opportunity to investigate various environmental gradients that might influence the infiltration of exotic parasitoids into natural ecosystems, and their parasitism levels and potential impact on non-target species. By doing this they aim to elucidate the factors that might be playing a role in the infiltration of exotic biocontrol agents on native areas.

Genetic diversity within and among populations of *Sophora chrysophylla* across the Hawaiian Islands.
Shelley Lammers, Dr. Clifford Morden, University of Hawai‘i, M.S. Program.

Research initiated Oct. 21-22, 2002. Kamakou Preserve. Characterization of genetic diversity within and among populations of *mamane* (*Sophora chrysophylla)* across the Hawaiian Islands to elucidate patterns of evolution. DNA will be accessioned in the Hawaiian Plant DNA Library at the University of Hawai‘i, Mānoa. Voucher specimen will be deposited at the UH Botany Dept. herbarium.

Field survey and collection of the rare *Hillebrandia sandwicensis* (Begoniaceae) in Hawai‘i.
Maya LeGrande, Nellie Sugii, University of Hawai‘i / Harold L. Lyon Arboretum.

Research initiated Oct. 21-22, 2002. Kamakou Preserve. Survey existing populations and document the number of individuals, locality, general health and threats. The plant material will be propagated and established as *ex situ* accessions within Lyon Arboretum greenhouse, garden plantings at the Arboretum, or as *in vitro* cultures as a part of the Micropropagation Laboratory-Hawaiian Rare Plant Project. DNA samples will be accessioned in the Hawaiian Plant DNA Library at the University of Hawai‘i, Mānoa. Voucher specimen will be deposited at the UH Botany Dept. herbarium. Excess seed will be given to the Hawai‘i Seed Storage Facility at Lyon Arboretum for storage trials.

Invasive arthropods in Hawai‘i: closing the biotic gap
Russell Messing, and Mark Wright, University of Hawai‘i at Mānoa.

Collection conducted on March 18, 2005 Kamakou Preserve. Collected samples for use in a semi-quantitative ranking method to analyze and prioritize target pest species for biological control. This will be based on four main criteria: biological feasibility; economic assessment; institutional assessment; and risk assessment. Results will provide a roadmap for focusing biocontrol resources, and a system for rapid evaluation of new invasive species.

Evolution of breeding systems in Hawaiian *Psychotria*: A phylogenetic approach.
Drs. Molly Nepokroeff and Kenneth J. Sytsma (PI), Department of Botany, University of Wisconsin-Madison

National Science foundation Doctoral Systematic Biology Dissertation Improvement Program. This research required the collection of *Psychotria* spp. leaves for genetic work. Research included one field trip on Moloka‘i in July 1995. Suggests a pattern for radiation of the various species of *Psychotria*.

Phylogenetic studies on Cydia (Lepidoptera: Tortricidae) moths.
Peter Oboyski, University of California, Berkeley, CA. poboyski@nature.berkeley.edu

Research initiated July 24-28, 2003. Kamakou Preserve. Moths will be analyzed for morphological and molecular characters that provide evidence for relationships among species. Phylogeny will be constructed and biological characters assessed to determine the likely processes that lead to the diversification of this genus. Collections will be deposited in the Entomology collection at Bishop Museum.

Collecting samples of *Drosophila* species at Kamakou to examine patterns of ovarian development and ovipostition behavior, and determining phyllogenetic relationships from DNA and morphology. (collaborative effort with Dr. Kaneshiro.)

Drs. Patrick O'Grady, Michael Kambysellis, and Elysse Craddock.

Began in September 1997. Collected in July.

Predicting invasiveness of non-native plants in Hawai'i.

Drs. Gordon Orians and Sarah Reichert, Washington State University

Ecosystem Research Program-funded project. Research included one field trip in July 1995; report pending.

Relationship between the relative abundance of introduced ungulates and their adverse impacts on indigenous forest ecosystems in Hawai'i.

Mr. Graham O'Reilly-Nugent, Landcare Research, New Zealand; Dr. Peter Sweetapple, Landcare Research, New Zealand; Dr. Peter Bellingham, Landcare Research, New Zealand.

Research is developed and funded in part by TNC Ecosystem Research Program. Research initiated May 1998 and is in progress. Kamakou Preserve, Pu'u Ali'i NAR, and Pu'u O Hoku Ranch. Final report received in 2001 through Secretariat for Conservation Biology; "A Simple Method for Assessing Ungulate Impacts and the Relationship Between Ungulate Densities and Impacts in Hawaiian Forests."

Monographic revision of representatives of the Protistan order Saprolegniales (watermolds).

Dr. David Padgett, The University of North Carolina at Wilmington. Padgett@uncw.edu

Research began in July 2004 and is in progress. Kamakou Preserve. Samples taken in 1970's from Moloka'i indicates that there is a rich and diverse watermold flora. The Moloka'i specimen will be used to expand the universities' collection of representatives of the Protistan order Saprolegniales from worldwide sources for monographic revision of the order. Samples will be sent to the American Type Culture Collection in Maryland for cryopreservation. Project completion is scheduled to be completed in 2008. This research is funded by the US National Science Foundation (grant # DEB 0328316).

Collection of ferns in Kamakou Preserve for taxonomic classification.

Dr. Dan Palmer.

Looking at *Dryopteris podosorus, D. unidentata, Polypodium pellucidum, Microlepia strigosa, M. speluncae* and their hybrids to determine status of these ferns. Collected in October 1999; report pending.

Study of Hawaiian Orangeblack Damselfly (*Megalagrion xanthomelas*) in Pelekunu Valley and Leeward Coastal Systems of Moloka'i.

Dr. Dan A. Polhemus and David Preston, Bernice Pauahi Bishop Museum

Survey included one field trip on Moloka'i in August 1995; report pending.

Diversity and radiation in Australasian and Pacific Triozidae (Psylloidea, Hemiptera): evidence from morphological, molecular, behavioral and acoustic data.

Dr. Diana Percy, SCIRO Entomology, Australia, and University of California, Berkeley. Diana.percy@csiro.au

Research initiated Aug. 17-18, 2003. Kamakou Preserve. Endemic psyllids are closely associated with the endemic Hawaiian flora. This project will investigate the extent to which the psyllid insects and plants may have co-diversified or co-evolved. Collections will be deposited at

Bernice

Speciation in genus Cyrtandra.
James Smith (Biology Department, Boise State University).

Studying the process of speciation in genus Cyrtandra. Kamakou Preserve. Collected *Cyrtandra procera* specimen in October 1999 along Pēpēʻōpae boardwalk; final report pending.

Evaluation of below-ground patterns of primary succession and community development in the Hawaiian archipelago.
Dr. David Wardle, Landcare Research Surface; Dr. Richard Bardgett, Landcasle University; Gustavo Hormiga.

Research initiated on June 22, 2000. Kamakou Preserve. Collections of soil and plant litter from site near Puʻu Kolekole cabin.

Collection of assorted fleshy fungi from Kamakou Preserve.
Drs. George Wong (Department of Botany, University of Hawaiʻi at Mānoa), Don Hemmes (Department of Biology, University of Hawaiʻi at Hilo), and Dennis Desjardin (Department of Biology, San Francisco State University)

Research began in March 1991 and completed January 1996; final report pending.

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