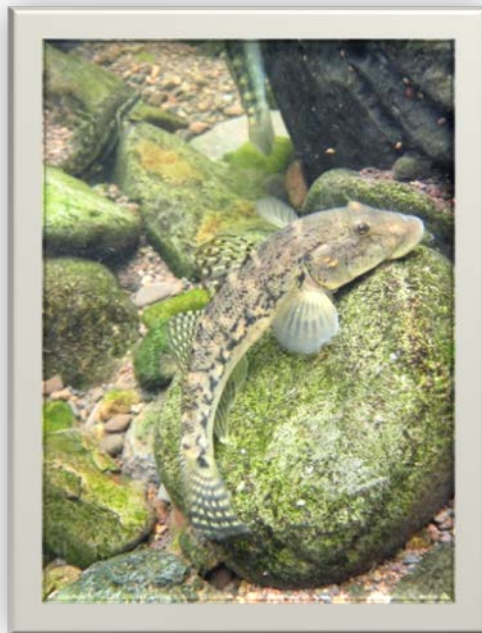


Pelekunu Preserve

Moloka'i, Hawai'i

**Long-Range Management Plan
Fiscal Years 2016–2021**



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

Submitted by
The Nature Conservancy
Molokai Program
April 2015

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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 mission of The Nature Conservancy is to conserve the lands and waters on which all life depends. Since 1980, the Conservancy has protected more than 200,000 acres of natural lands in Hawai'i and works with other public and private landowners to protect the islands' key watersheds. The Conservancy manages a statewide network of 11 preserves totaling 40,000 acres and works in 12 coastal communities to protect the coral reefs and near-shore waters of the main Hawaiian Islands.

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 the South Slope at Kamalō (3,566 acres), Kapualei (1,680 acres), and Kawela (5,500 acres). The EMoWP is also expanding further east to the "East Slope" and in FY15 began focusing on the 1,300 acre Pakui unit. Management of Pelekunu Preserve has been funded by the NAPP since 1992. This long-range management plan updates the plan covering fiscal years (FY) 2010–2015 and was prepared in compliance with the Natural Area Partnership agreement between the State and The Nature Conservancy of Hawai'i. This plan documents management programs to be undertaken in the next 6 years (FY2016 – FY2021) at Pelekunu Preserve.

The first section of this plan is a brief overview of the native natural resources that are protected at Pelekunu 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 for FY2016–FY2021 are also listed. In FY 2014, the NAPP program introduced the use of a data-driven spreadsheet to propose and report on deliverables. The spreadsheet is still being refined; a word version of the spreadsheet follows.

DELIVERABLES SUMMARY

The deliverables listed below are derived directly from the NAPP Deliverables spreadsheet (also attached), for easy reference.

UNGULATE CONTROL						
<i>Subunit</i>	<i>Proposed Action</i>	<i>Goal Quantity of Action</i>	<i>Interval of Action</i>			
Pelekunu Main Valley	# Aerial Hunts	2	Annually			
WEED CONTROL						
<i>Unit</i>	<i>Species Targets</i>	<i>Proposed Action</i>	<i>Goal</i>	<i>Methods</i>	<i>Goal Acres</i>	<i>Interval</i>
Wailau Upper	Hedgar	Ground Sweep/Control	Prevent introduction of toilet brush ginger to Pelekunu	Conduct ground sweeps to control and map outliers	10	Annually
Wailau Upper	Hedgar	Aerial Survey Only	Prevent introduction of toilet brush ginger to Pelekunu	Assist DoFAW/MoMISC with North Shore aerial surveys	10	Annually
Puu Alii	Rubarg	Ground Sweep/Control	Prevent introduction of blackberry to Pelekunu Preserve	Assist NAR with ground sweeps to eliminate blackberry	50	Annually
Pelekunu	Spacam	Ground Sweep/Control	Eliminate African tulips where feasible	Eliminate Pelekunu Populations Spacam	All	By FY2019
North Shore	Unksp	Aerial Survey Only	Prevent introduction of Priority Invasive from North Shore Areas	Assist DoFAW/MoMISC with North Shore aerial surveys	All	Annual if feasible
TRANSECT MONITORING						
<i>Transect/Station Name</i>	<i>GIS Transect Length (m)</i>	<i>Monitoring type</i>	<i>Action</i>	<i>Interval</i>		
PEL01	672.6554	Ungulate	Check	Annually		
PEL02	585.1824	Ungulate	Check	Annually		
PEL03	523.5296	Ungulate	Check	Annually		
PEL04	641.8471	Ungulate	Check	Annually		
PEL06	544.9153	Ungulate	Check	Annually		

PEL07	559.0068	Ungulate	Check	Annually
PEL08	565.6601	Ungulate	Check	Annually
PEL09	607.311	Ungulate	Check	Annually
PEL10	664.0661	Ungulate	Check	Annually
PEL11	565.0502	Ungulate	Check	Annually
PEL12	388.7804	Ungulate	Check	Annually

STREAM MONITORING

<i>Species Name</i>	<i>Species Type</i>	<i>Proposed Action</i>	<i>Proposed # Checks</i>	<i>Interval</i>
Negra	Other	Check	1	Hiihawai (<i>Neritina granosa</i>); years 1, 3 & 5
SicSti	Other	Check	1	Oopu nopili (<i>Sicyopterus stimpsoni</i>); years 1, 3 & 5
Awasta	Other	Check	1	Oopu nakea (<i>Awaous stamineus</i>); years 1, 3 & 5
Lencon	Other	Check	1	Oopu alamoo (<i>Lentipes concolor</i>); years 1, 3 & 5
Elesan	Other	Check	1	Oopu okuhekuhe (<i>Eleotris sandwicensis</i>); years 1, 3 & 5

COMMUNITY OUTREACH

MEETINGS, HIKES, EVENTS and PUBLICATIONS

<i>Event Type*</i>	<i>Proposed Action</i>	<i>Proposed Number Events/Publications</i>	<i>Proposed Num Ind. Reached</i>	<i>Interval</i>
Kamakou Hike	Hike	1	6	Annually
Partner's Meeting	Meeting	1	1	Annually
MoMISC Meeting	Meeting	1	1	Annually
Earth Day Event	Fair	1	800	Annually (April)
Nature's Newsflash	Publication	1	3100+	Annually

INFRASTRUCTURE

<i>Structure</i>	<i>Type</i>	<i>Action</i>	<i>Interval</i>
Pelekunu Trail	Trail	Maintain	Semi-Annually
Helicopter LZs	LZ	Maintain	Semi-Annually
Camps/Cabins	Facilities	Maintain	Years 2, 4, 6

* Pelekunu NAP helps to pay a portion of the community outreach activities listed here.

RESOURCES SUMMARY

General Setting

Pelekunu Preserve (Figure 1) was established in 1986 when the Conservancy purchased 5,759 acres in the northeast sector of Moloka'i (most from Moloka'i Ranch, Ltd.). The preserve was established to protect the perennial stream system, one of the best remaining in Hawai'i. Pelekunu Preserve is bordered on all sides by natural areas managed for conservation, including Kalaupapa National Historical Park, the state-owned Pu'u Ali'i and Oloku'i Natural Area Reserves (NARs), Molokai Forest Reserve (Wailau), the Conservancy's Kamakou Preserve and other private lands of the East Molokai Watershed Partnership. All of these are part of the East Moloka'i Watershed Partnership (Figure 2) and protect more than 30,000 acres of contiguous ecosystems that range from sea level to 4,970 feet in elevation. The topography of Pelekunu Preserve is spectacular, with 3,000-foot valley walls dissected by a series of convoluted streams and ridges. This isolated area contains no roads and only a few rough trails.

Pelekunu Preserve encompasses the valley watershed of Pelekunu stream, its tributaries, and other smaller streams. At the coast, the preserve extends westward beyond Pelekunu Valley to include the smaller Waioho'okalo Valley and its stream system. Annual rainfall ranges from 80 inches near the coast to more than 180 inches at the head of Pelekunu Valley. The valley's streams have never been diverted for export outside the watershed. As a result, this stream system is a prime example of an increasingly rare aquatic natural community (Hawaiian Continuous Perennial Stream) and contains a full complement of native aquatic fauna. Aquatic biologists consider Pelekunu's stream system one of the top in the State of Hawai'i.¹



Because of its isolation, Pelekunu Valley has escaped modification from modern activities such as ranching, reforestation, agriculture, and tourism, all of which have transformed other parts of Moloka'i. Historically, Hawaiians who terraced the land for crops and diverted the streams for irrigation inhabited the valley. Native-dominated vegetation occurs mainly in steep areas, especially at the coastal sea cliffs and surrounding valley walls. Many rare plants and diverse natural communities persist in these places.

The primary threats to Pelekunu's watershed and native species are the introduced ungulates: goats (*Capra hircus*), pigs (*Sus scrofa*), and axis deer (*Axis axis*). A secondary, related threat is invasion of non-native, invasive plant species such as *Clidemia hirta* (see Weed Control section). Another potential threat to the preserve is the dewatering of the Pelekunu stream

¹ Hawaii Watershed Atlas. 2008. <http://www.hawaiiwatershedatlas.com/watersheds/molokai/41009.pdf>

system. However, the Moloka'i Water Working Group, a community advisory group to the State Water Commission, has clearly stated that it does not want the undiverted north shore streams of Moloka'i harvested in the near future. Other threats include: the over-harvesting of native fresh water snail, hihiwai (*Neritina granosa*); invasion of the streams by non-native fish, insects, and prawns; and cataclysmic events such as landslides.

Flora and Fauna

Pelekunu Preserve contains at least 11 native natural communities (Figure 3, Appendix 1). Of these, the Hawaiian Continuous Perennial Stream community is considered rare, as it is found in fewer than 20 sites worldwide. The other communities are more widespread aquatic and terrestrial communities, including a variety of coastal, lowland, and montane grassland, shrubland, and forest types. About a third of the natural communities found in Pelekunu are also known from Pu'u Ali'i and Oloku'i NARs (Appendix 1).

Pelekunu Stream is one of the best remaining streams in Hawai'i; characterized by the presence and abundance of the full array of native aquatic species. It was given "Outstanding" status in the 1990 Hawaii Stream assessment Rank, and an overall Watershed Rating of 10 out of 10 in the Atlas of Hawaiian Watersheds and their Aquatic Resources. Many of these species exhibit a stream to ocean life cycle referred to as diadromy. These diadromous species include five native fishes (collectively



referred to as 'o'opu), a freshwater snail, hihiwai (*Neritina granosa*), and two native crustaceans, 'opae kala'ole (*Atyoida bisulcata*), and 'opae 'oeha'a (*Macrobrachium grandimanus*) (Appendix 2). The native 'o'opu are some of the most unique organisms in the world. The pelvic fins of four of the five 'o'opu are fused and form a "suction" cup. The 'o'opu literally scale waterfalls by using their suction cup pelvic fin and thus they are able to utilize the entire stream. The one species that does not have this feature is the 'o'opu owao (*Eleotris sandwicensis*), and thus it is confined to the lower reaches of Hawaiian rivers.

Thirty rare plant taxa have been reported from Pelekunu Preserve; eight of these are endemic to eastern Moloka'i (Appendix 3). Eleven of these taxa have also been reported from Pu'u Ali'i and/or Oloku'i NARs. Of the 30 rare plant taxa reported from the preserve, 11 are federally listed endangered species and 1 is listed as threatened.

Five endemic forest birds have been reported from Pelekunu Preserve and adjacent areas. These include two federally listed endangered birds: the kakawahie (Moloka'i creeper, *Paroreomyza flammea*), which is probably extinct, and the oloma'o (Moloka'i thrush,

Myadestes lanaiensis rutha), which may also now be extinct. The Moloka'i and O'ahu populations of 'i'iwi (*Vestiaria coccinea*) are considered endangered by the state (Appendix 4). Two common endemic forest bird species are also found in Pelekunu Preserve, 'apapane (*Himatione sanguinea*) and 'amakahi (*Hemignathus virens wilsoni*). Endangered sea birds noted from the valley include the Newell's shearwater (*Puffinus newelli*) and the 'ua'u or Hawaiian petrel (*Pterodroma sandwichensis*). Common shorebird species including the indigenous 'auku'u, or black-crowned night heron (*Nycticorax nycticorax hoactli*), the noio or black noddy (*Anous minutus*) and the migratory 'ulili, or wandering tattler (*Tringa incana*), have been reported along the main branch and tributaries of Pelekunu Stream. Koa'e kea, or the white-tailed tropicbird (*Phaethon lepturus dorotheae*), an indigenous seabird, can often be seen along the sea cliffs in the back of the valley. It is also likely that the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) may exist in the valley, though currently this is unconfirmed.

Finally, two endemic achatinellid land snail species, *Partulina mighelsiana* and *Partulina tessellata*, have been reported within or near the boundary of the preserve (Appendix 5). These rare snails are also known from Kamakou Preserve, Pu'u Ali'i and Oloku'i NARs. In May 2002, aquatic ecologist of the Bishop Museum, Ronald Englund, observed two rare damselflies, *Megalagrion xanthomelas* and *M. pacificum*, which are now extinct on O'ahu and Kaua'i; one is now federally listed as endangered and the other is a candidate for federal listing. Englund also observed there one of the most rare aquatic insects in Hawai'i, *Campsicnemus ridiculus*.

MANAGEMENT

Management Considerations

1. Pelekunu Preserve is extremely remote and the terrain is very rugged, including the highest sea cliffs in the world. There are no roads to the valley; access is only by boat, helicopter, or a long and hazardous foot trail. To accomplish management objectives, the Conservancy relies on helicopters for year-round access. Visitors may access the front of the preserve by boats during the summer months when seas are calm. Foot access is impractical due to the long (12-hour) hike over terrain too rugged to carry necessary supplies.
2. A number of landowners retain a total of more than 350 acres in the valley. These people and other members of the Moloka'i community exercise traditional access, gathering, and other rights within the valley, as recognized by law. Conservancy management does not alter these rights.
3. Pelekunu Preserve is part of The East Moloka'i Watershed Partnership's "North Slope" (figure 2) that also includes Kalaupapa National Historical Park, State's Puu Alii and Olokui Natural Area Reserve and the upper portions of Wailau (Forest Reserve). With the Kamalō through Kapualei portion (South Slope) of this partnership (their boundary is the mountain divide between north and south East Moloka'i), these two projects form the only known island profile managed for conservation of the natural resources from coast to coast. The Partnership helps to leverage effort over a larger landscape by combining resources and expertise. Our primary management activity to protect the preserve's native plants, animals, and natural communities is by protecting the watershed through the reduction of feral ungulate damage, limiting the spread of non-native, habitat-modifying plants, preventing the introduction of other invasive species, and monitoring aquatic macrofauna.
4. Pelekunu is largely dominated by non-native vegetation on the valley floor, while the steep walls are comprised of native flora that provides a high quality watershed that feeds the stream system.

Preserve Areas

The preserve is divided into *three distinct areas* (Figure 4): upper Pelekunu Valley, lower Pelekunu Valley, and the Waioho'okalo Valley area.

The lower valley is mainly comprised of the main stem stream and also the smaller Kailiili stream. The lower and upper valley is divided by the Papaiki ridge on the west and the adjacent ridge of Lanipuni to the east. The lower valley has one facility, an old house built by Clifford Soares in the early 1970's.

The upper Pelekunu Valley has four significant streams; Pilipililau, Lanipuni, Kawainui, and Kapuhi. These are the names that are used to refer the areas where management occurs. We

will continue to concentrate on this area to maintain and improve the integrity of the upper watershed and to prevent ungulates from entering the adjacent Oloku'i Natural Area Reserve. There are three facilities – the former USGS Cabin and two Papakiki remote shelters.

Finally, Waioho'okalo Valley area is west of the Manuahi ridge along the coast and is quite steep and remote. There is one resident that resides with in this area.

Humans have substantially altered lower Pelekunu Valley, with significant terracing throughout the valley floor. Historically, the lower valley had the most inhabitants and was the most heavily cultivated part of Pelekunu Preserve. This is mainly due to this area's proximity to ocean resources and the fact that the wider valley floor is well suited for taro cultivation. Management in the floor of the valley consists of maintaining the trail systems and facilities, monitoring ungulate presence, and conducting stream monitoring. From time to time animal sweeps are conducted to address the high pig populations. However, most of the funds in the past contract were spent on aerial shooting the valley walls, which keeps animal population in the native flora at low levels while helping to prevent ingress into the State's Puu Alii and Olokui Natural Area Reserves.

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 FY2016 – FY2021.

Program 1: Non-native Species Control

A. Ungulate Control

Program Objective

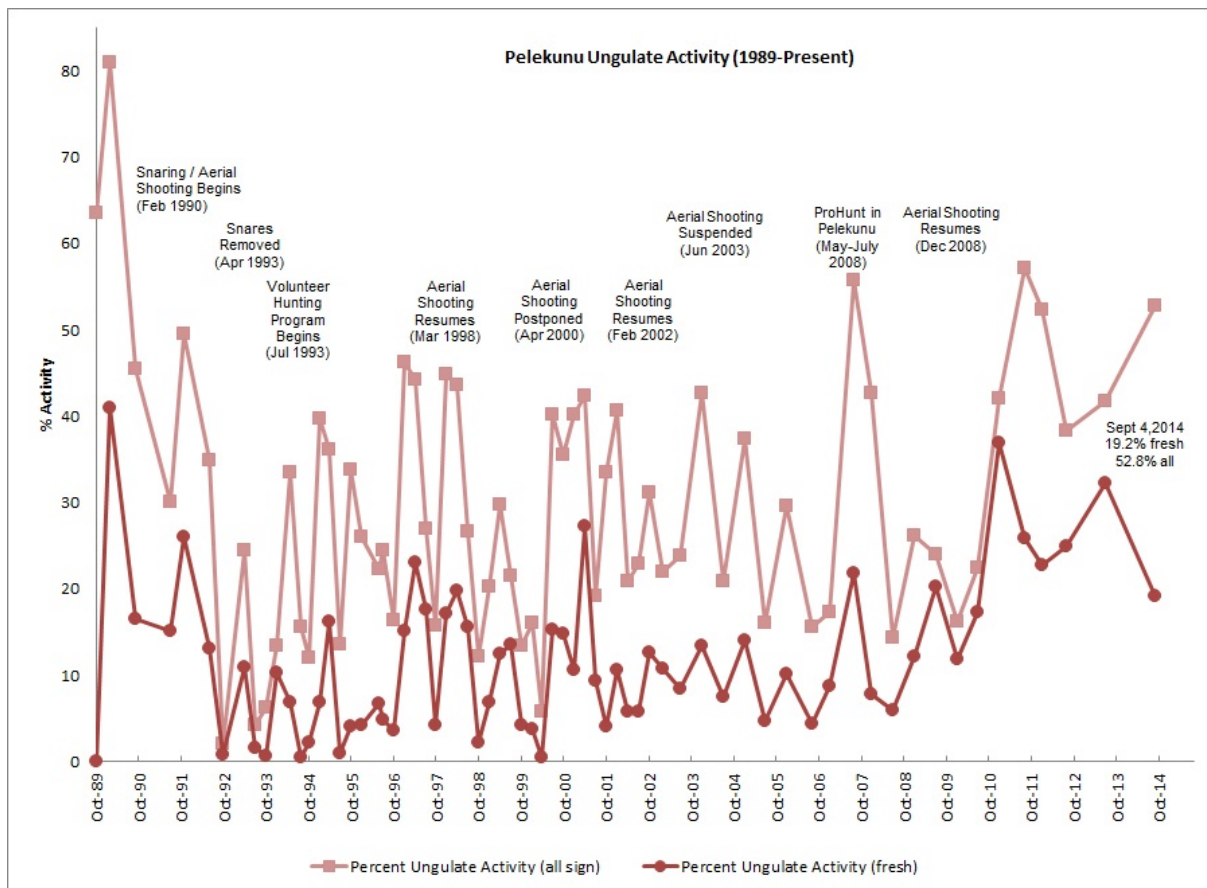
Implement ungulate control that keeps animal population low in the valley walls and to prevent ingress into the adjacent State NARS.

Program Description

Pelekunu's ungulate control priority is to support the State's NARS annual aerial shooting missions to keep animal population low on the valley walls and prevent ungulates from moving into Puu Alii and Oloku'i NARS. Oloku'i is thought to be the only place in Hawai'i that has never been damaged by feral ungulates. In the next six years, we will support the NARS staff to locate key ingress points and either construct strategic fencing or apply control methods (possibly the Pohakaunoho/Kolo ridge areas).

In 1991, we began ungulate control efforts in the valley and through a combined approach of using snaring, aerial shooting and ground hunting, we were able to reduce animal activity to less than 10% as measured by our ungulate activity surveys discussed in the monitoring and research section of this plan. While this approach was successful in achieving low ungulate activity, it also caused significant controversy about the use of snares in an area that was used

periodically by hunters with dogs. In April of 1993, TNC removed all snares from the valley in an effort to determine if hunting with volunteers using dogs could achieve the same results as the snares and aerial hunting had. This approach did not prove to be successful, so in 1998 aerial shooting was resumed in addition to ground hunting. From January 2000 – December 2007 only one aerial shoot was conducted in February of 2002. During that period we continued ground hunting and ungulate activity never reached the 10% levels. The State resumed aerial shooting in December 2007 with monthly shoots. The State’s aerial shooting is considered the most effective and efficient way to remove ungulates from the steep ridges and walls of Pelekunu as is most of the north shore areas. In 2007, the Conservancy contracted with ProHunt, a hunting firm from New Zealand, to complete a series “hunt sweeps” in the preserve. ProHunt’s systematic hunts showed some promise, as activity levels dropped. However, the 2009-2010 economic downturn (the 1st year of our current contract) resulted in funding cuts which had TNC focus the limited funds on supporting the NARS North Shore ACETA missions. Aerial shooting has been effective on the valley walls and helping to prevent ingress in the State NARS, and will be continued in the next six years. If extra funds are available, TNC will conduct hunt sweeps in the valley floor.



Ungulate Control Goals

1. Support NARS aerial shooting on Pelekunu's valley walls. Support includes funding helicopter costs and staff assistance (spotting, GIS mapping, and helicopter landing base support).
2. Support NARS staff in addressing key ingress ridges to Olokui and Puu Alii NARS, including strategic fence and trapping. Support includes staff assistance in planning, implementing and GIS mapping.
3. Conduct ground hunt sweeps if funding available.

B. Weed Control

Program Objective

Implement weed strategies to eliminate incipient habitat-modifying weeds and prevent the spread of key established weeds.

Program Description

Habitat-modifying weeds are alien plants that have demonstrated the ability to suppress regeneration of, or displace, native vegetation. Many weeds become established when an area is disturbed by ungulates, which may also carry and spread seeds. In many areas, including Pelekunu Preserve, eliminating ungulates may be the most effective means of slowing the spread of habitat-modifying weeds.

In Pelekunu Valley, much of the valley floor was altered by human habitation and agriculture prior to the 1950s. The land was terraced for agriculture, and the streams were diverted to irrigate crops. Much of the vegetation in the lower valley was introduced by Polynesians and later by European settlers.

Our weed control program focuses on preventing the spread of habitat-modifying weeds to where native plant communities are still relatively intact and has four components: 1) developing and implementing a feasible, long-term control strategy for *Melastomes*; 2) identifying, mapping, setting management priorities and implementing control for other established habitat-modifying weeds; 3) Preventing the spread of weeds from adjacent areas into Pelekunu's watershed cliff areas; 4) preventing the establishment of new habitat-modifying weeds; and 5) Supporting Moloka'i/Maui Invasive Species Committee (MoMISC) activities on Moloka'i.

Clidemia hirta, a habitat-modifying weed in the *Melastome* family that has extensively invaded other natural areas in Hawai'i, remains our primary and immediate concern. *Clidemia* occurs throughout Pelekunu Preserve. Manual and chemical control of *Clidemia* would be difficult to apply on a large scale in Pelekunu's rugged terrain; moreover, these methods have not been effective in other natural areas in Hawai'i due to the seed bank created on the ground once a plant has fruited. In May of 1990 (prior to writing the FY1992–1997 long-range plan), we began a biocontrol trial using the fungal agent *Colletotrichum gloeosporioides*. This work was done in cooperation with the state Division of Forestry and Wildlife and the University of Hawai'i Cooperative Extension Service. To date, this agent has not been effective controlling *Clidemia* in Pelekunu. After releasing the fungal agent, we learned that the Conservancy has a nationwide policy that prohibits introducing non-native species into Conservancy preserves without in-house approval. *Tibouchina herbacea*, another *Melastome* is also present in other

disturbed areas of the valley. Other species that were located in Pelekunu valley that also function as biocontrols for *Clidemia hirta* include *Mompha trithalama*, a moth which limits fruit production, and *Liothrips urichi*, a thrip which attacks the leaves of *Clidemia*.

If reports become available documenting that the most recently studied biocontrols are successful and safe agents, then we will seek approval from the Conservancy’s Worldwide Office to release them.

Table 1. Priority Weed Species in Pelekunu Preserve.

Scientific Name	Common Name	Status
<i>Clidemia hirta</i>	Koster’s curse	Established
<i>Tibouchina herbaceae</i>	Glory Bush	Established
<i>Fucraea foetida</i>	Mauritius hemp, sisal	Established
<i>Psidium cattleianum</i>	Strawberry guava	Limited
<i>Schinus terebinthifolius</i>	Christmas berry	Established
<i>Syzigium jambos</i>	Rose apple	Established
<i>Spathodea campanulata</i>	African tulip	Limited

Additional priority weeds (Table 1) may be controlled with manual (pulling or cutting), chemical methods and/or other alternative methods that may be developed. Herbicide use will be strictly limited, and in full compliance with the state Department of Agriculture’s pesticide branch. (Please note that at least one staff on Moloka’i is certified by the state Department of Agriculture’s pesticide branch as a restricted herbicide applicator.) If herbicides are needed, staff will operate in strict compliance with the label and will use pesticides that are approved for aquatic sites and in limited quantities to reduce potential negative impacts to non-target plants and animals. Staff may seek to use additional herbicides as appropriate, under the direction of the state Department of Agriculture’s pesticide branch. Heavy equipment is not used for weed control in Pelekunu valley.

Preventing the spread of established weeds such as *Clidemia* into intact areas is of a primary importance to The Nature Conservancy. Weed seeds from weed infested areas may “hitch-hike” on animal or human hosts, become deposited in more intact native forested areas, and may become established there. To reduce the risk that native and endangered species will suffer further habitat loss due to humans, weed and ungulate control staff adopted a “top-down” approach to management, working from more intact upper elevations to lower, more degraded systems. Staff are required to clean boots, backpacks, and other gear prior to entering the valley. Staff has dedicated gear for use in the valley to prevent weed seeds from moving in and out of the valley.

Examples of habitat-modifying weeds that have not yet made it to Pelekunu Preserve or to Moloka’i are *Miconia calvescens* and *Passiflora mollissima* (banana poka). As part of our community outreach program, during events like Earth Day and through our quarterly newsletter *Nature’s Newsflash*, we educate the community about the threat these habitat-modifying weeds pose to Moloka’i’s natural areas. Also, as part of our prevention program, we

enforce a protocol for alien species that includes cleaning gear and clothing prior to and after entering the preserve, and conducting annual inspections of helipads for new weeds.

While heavily impacted by *Clidemia*, Pelekunu has limited populations of a couple of notable priority species such as strawberry guava and African Tulip. Known locations of these species will be evaluated for removal based on safety and available funding. Pelekunu also lacks populations of a couple of notable priority weeds found in adjacent areas. These include an incipient 10 acre population of toilet brush ginger (*Hedychium gardenarium*) in Wailau valley and blackberry (*Rubus argutus*) established in the adjacent Puu Alii NAR. Preventing the spread of these weeds to Pelekunu and Olokui is best achieved through TNC support of NAR and DoFAW removal efforts in those areas with weed mapping and control expertise. All incipient and limited populations of African tulip, strawberry guava and toilet brush ginger on Molokai's North Slope were identified through aerial surveys, which provide a means to detect these species before they become established.

The Conservancy led the creation of the Molokai/Maui Invasive Species Committee (MoMISC) partnership of government and private organizations in FY2001. MoMISC prevents the establishment of incipient pest populations through field activities and public education.

Weed Control Goals

1. Keep apprised of other agencies' *Melastome* biocontrol monitoring efforts and if success is documented, seek in-house approval to release.
2. Eliminate African tulip trees where feasible.
3. Support NAR staff to reduce blackberry and strawberry guava populations in the adjacent Puu Alii NAR to prevent their establishment in Pelekunu Preserve. Support includes staff assistance in implementing weed sweeps, camp supplies and GIS mapping.
4. Support DoFAW and MoMISC efforts to eliminate the only known population of toilet brush ginger (*Hedychium gardenarium*) on Molokai. Support includes; staff assistance in implementing weed sweeps, and GIS mapping.
5. Conduct annual aerial surveys for incipient habitat modifying weeds when feasible or in support of partners like MoMISC Miconia survey.

Program 2: Monitoring and Research

Program Objective

To track the biological and physical resources and critical threats in the preserve and evaluate changes in these resources and threats over time to guide management programs.

A. Monitoring

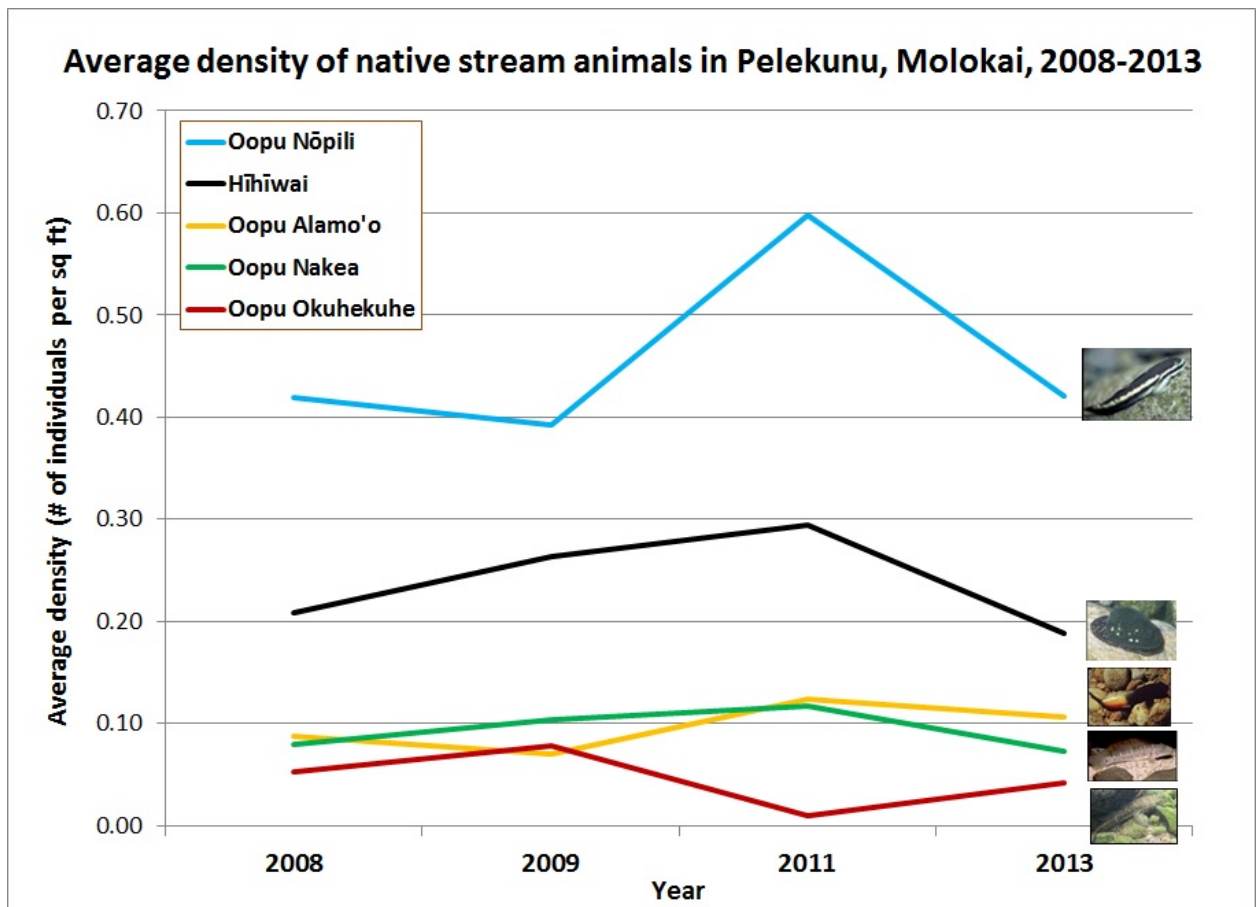
There are basically two types of monitoring, health and threat monitoring. Health monitoring tracks biological changes, while threat monitoring tracks threats to the biological resources that management is trying to protect and preserve.

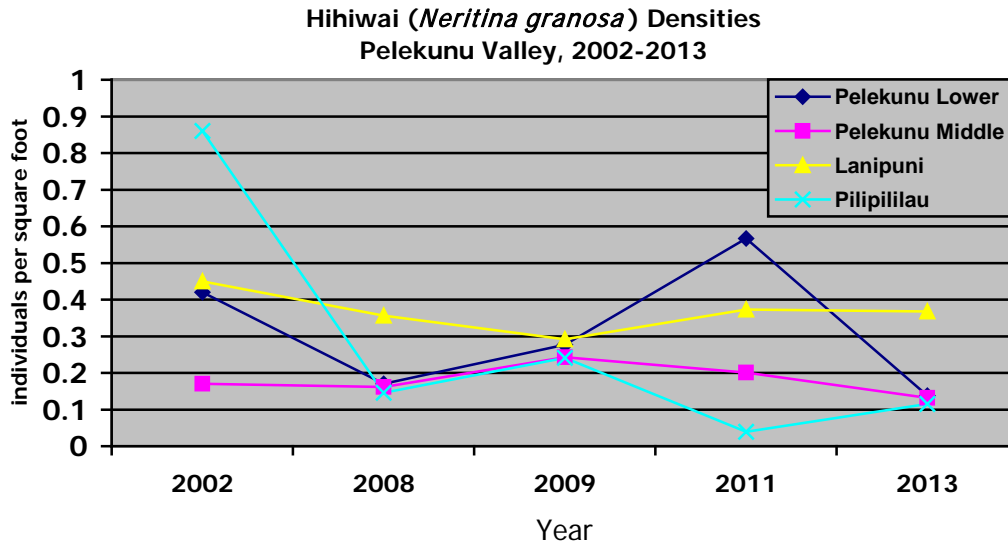
Pelekunu Preserve was acquired by the Conservancy because it contains one of the best remaining biological stream systems left in Hawaii, therefore, health monitoring focuses on detecting changes in the stream system. Stream monitoring will occur every other year and

involves surveying for diadromous macrofauna (native gobies and mollusks, and native and alien crustaceans) to determine their distribution and abundance along Pelekunu stream and its tributaries in years 1, 3 & 5.



The biennial survey also offers the opportunity to engage members of the Molokai community in monitoring stream resources. Manuel Mejia (TNC Marine program) explains monitoring methods to Momi Afelin (Molokai High student), Sept 2013.





Pelekunu’s known rare plants (Appendix 3) have been mapped and most exist in steep, treacherous areas. The National Tropical Botanical Gardens (NTBG) has been actively collecting rare plant propagules since the early 1990’s. Molokai staff of the Plant Extinction Prevention Program (MoPEPP) regularly survey, monitor, and outplant in Pelekunu Preserve, and are currently evaluating a small portion of the preserve as a test site for reintroduction of the rare dwarf naupaka (*Scaevola coriacea*) and the rare alula (*Brighamia rockii*), see photo, right. TNC will support these efforts as requested.

Figure 1- MoPEPP staff Patricia Pali outplanting rare species in Pelekunu.



Threat monitoring focuses on invasive weeds and feral ungulates. Weeds will be monitored through aerial surveys (see weed section). Feral animals are annually monitored by eleven 500 meter ungulate activity transects throughout the valley.

Monitoring Goals

Years 1-6 (FY2016-2021)

1. Complete stream macrofauna monitoring in years 1, 3 and 5.
2. Monitor all ungulate activity transects annually.
3. Assist MoPEPP with staff as requested to implement rare plants species projects in Pelekunu.

Program 3: Community Outreach

Program Objective

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 Moloka'i 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 Moloka'i'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.

A. Community Outreach/Public Awareness Activities:

- Monthly Preserve hikes are offered to Kamakou and Moomomi from March to October. The Kamakou hike, which ends at the Pelekunu overlook, affords the opportunity to share about that preserve as well. No hikes are conducted from November to February as the seasonal winter rains make the roads impassable and unsafe. School field trips are done as requested.
- 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 on Moloka'i. The event engages local conservation and cultural agencies, organizations, and groups who bring awareness and engagement to their projects on Moloka'i through interactive exhibits. The event attracts about 1,000–1,200 community members annually.
- Volunteer/Internships – Hike docents and turtle monitors directly help with learning programs at Kamakou and Mo'omomi. 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 and the Youth Conservation Corp.
- Nature's Newsflash is a semiannual publication that updates the community of the Conservancy's activities on Moloka'i. The newsflash also recognizes community members who volunteer and or contribute to the Moloka'i program. It is bulk mailed to every address on Moloka'i.

B. Partners include:

- Moloka'i 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.

- 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 decides on how to eliminate key pests.
- 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 Lānaʻi Soil and Water Conservation District as part of the national Coral Reef Task Force Program.
- East Molokaʻi Watershed Partnership (EMoWP) – The EMoWP has three main areas; North Slope; South Slope and East Slope. TNC coordinates the activities in the South and East slope areas. The East Molokaʻi Watershed Partnership (EMoWP) was formed in 1999 when a grass roots strategic planning effort produced an application for the USDA Empowerment Zone program. The Conservancy will continue to work with partners to promote stewardship activities in forest and watershed regions of Molokaʻi.
- Papahana Kuaola Lelekamanu (Penny Martin) – Since the early 1990’s, Papahana Kuaola Lelekamanu has been TNC’s main environmental and cultural educator partner. Penny helps lead school field trips to Mo’omomi and Kamakou.
- Aha Kiole O Molokai (Molokai Aha Moku)- TNC consults and seek support of the Aha Kiole O Molokai on major project initiatives. This relationship brings transparency and support from Molokai’s indigenous/local community. Projects that were consulted on and gained support in FY13 (and continue to be supported in FY15) include: Kapualei Fence, Kamakou Fence, South Slope ACETA, and the EMoWP East Slope Startup Watershed Management Plan.
- Stream Monitoring community engagement - Key community members are invited to be part of the monitoring team. In the past, those that have been engaged become “ambassadors” for the stream and the native aquatic life that thrive in Pelekunu stream.

We do not promote the public use of Pelekunu Valley due to its remoteness and our inability to provide any emergency facilities, communication, or logistical assistance to the public users. We request that any public camping remain restricted to the beach.

Years 1-6 (FY2016-FY2021) Community Outreach Goals

1. Produce and distribute the semiannual *Nature’s Newsflash*.
2. Conduct monthly and special community group hikes at Kamakou Preserve which features the Pelekunu Preserve at the end of the hike.
3. Coordinate and organize annual Molokaʻi Earth Day Celebration Event.
4. Maintain and develop intern, docent, and volunteer engagement, and conduct training

sessions as needed.

5. Support partner groups including EMoWP, MoMISC, and Moloka'i Fire Task Force.

Program 4: Fire, Emergency and Safety

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

Program Description

All staff are trained in basic first aid and CPR. Other training may include advanced wilderness first aid, fire suppression and pre-suppression, helicopter safety, and hunter's education. Field staff are provided with first aid kits and required to use proper personal protective equipment (PPE) when conducting field work.

TNC is part of and helps to facilitate the Moloka'i 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. The Conservancy is a key supporting and coordinating member of the task force. Maui County Fire Department, the State Division of Forestry and Wildlife (Maui District) and the Molokai/Lāna'i Soil and Water Conservation District are the co-leaders of the task force. Pelekunu Preserve's fire plans are embedded within The Nature Conservancy's *Moloka'i Wildland Fire Management Plan* and is updated annually.

The Nature Conservancy maintains two cabins and one remote shelter facility in Pelekunu Valley: the USGS Cabin ("Upper Camp"), the Papaiki remote shelters ("Middle Camp"), and the Kawaiiki Cabin ("Lower Camp."). A trail system connects these facilities to ungulate survey transects and remote helicopter landing zones. This infrastructure provides critical access both to and within the highly remote valley for management. When possible, TNC combines facilities and trail maintenance to reduce costs. One trip annually will be dedicated just to trail clearing, while trail clearing is also combined with the annual ungulate survey trip. Because of Pelekunu's wet

Fire, Emergency and Safety Goals

Years 1-6 (FY2016-FY2021)

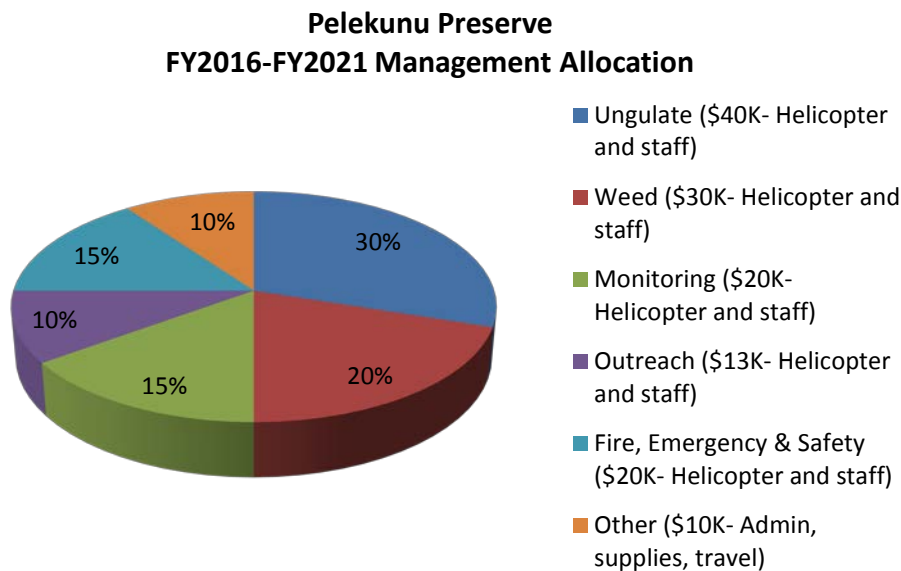
1. Annually update the TNC *Moloka'i Wildland Fire Management Plan*.
2. Provide emergency training opportunities for staff including but not limited to maintaining current First Aid and CPR certifications.
3. Conduct annual first aid kit inventory and resupply.
4. Update staff fire suppression training.
5. Respond to emergencies or fire threats.
6. Maintain helicopter landing zones and trails twice per year.
7. Maintain facilities in years 2, 4 & 6.

Areas Needing Technical Assistance

We will seek advanced fire pre-suppression and suppression training from DOFAW. In addition we may occasionally contract the services of the Hawai'i Natural Heritage Program/CCRT/UH for assistance with rare species monitoring, vegetation monitoring, GPS mapping and other stewardship projects requiring their expertise.

Management Allocation

The following chart summarizes annual costs by program associated with management of Pelekunu Preserve for the period FY2016-FY2021:



Budget Summary

The following table summarizes the six-year budget for the Pelekunu 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 1/3.

Personnel (labor & benefits): This NAPP request will cover a portion of the costs of the Molokai Island Program staff currently has 4 that will have responsibilities in implementing the management plan. Other part-time, short-term, or year-to-year personnel may be hired periodically as the budget allows and project needs warrant. The Personnel line item includes: a combined effort of Molokai's base staff equal to about .90 FTE. The Nature Conservancy's currently negotiated (annually with our federal cognizant agency) fringe benefit rate will accrue on all salary/wage costs. The Molokai 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.

Contractual: This contractual cost is mainly the cost of helicopter needed to travel to and from the valley.

Other: Covers a portion of the Office and Baseyard, security, insurance, communications (satellite phone and radio system) and other miscellaneous project related expenses such as supplies and equipment needed for management. Also includes some travel for staff to attend training or workshops related to management.

Overhead:

The allowable overhead rate of 10% on NAPP projects has been included on all direct costs.

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 Pelekunu NAPP budget represents a significant reduction in funding since the last LRMP (2010–2015). As such, TNC has modified deliverables in some areas to accommodate the lower funding amount. We have identified objectives above that will not be covered by NAPP funds. However, should TNC receive significant private funds in addition to the NAPP funds, we hope to complete these specific management activities. 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 Pelekunu Preserve and on adjacent lands regardless of funding source.

FY2016- FY2021 Pelekunu NAPP Budget Table

(d)

Pelekunu NAPP	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	TOTAL
Labor & Benefits	45,000	45,000	45,000	45,000	45,000	45,000	270,000
Contractual	50,000	50,000	50,000	50,000	50,000	50,000	300,000
Other	12,000	12,000	12,000	12,000	12,000	12,000	72,000
<i>Subtotal</i>	<i>107,000</i>	<i>107,000</i>	<i>107,000</i>	<i>107,000</i>	<i>107,000</i>	<i>107,000</i>	<i>642,000</i>
Overhead	10,700	10,700	10,700	10,700	10,700	10,700	64,200
TOTAL	117,700	117,700	117,700	117,700	117,700	117,700	706,200
Private Match (1/3 of total)	39,233	39,233	39,233	39,233	39,233	39,233	235,398
TOTAL NAPP REQUEST (2/3)	78,467	78,467	78,467	78,467	78,467	78,467	470,802

Figure 1. Pelekunu Preserve: Management Areas and Units

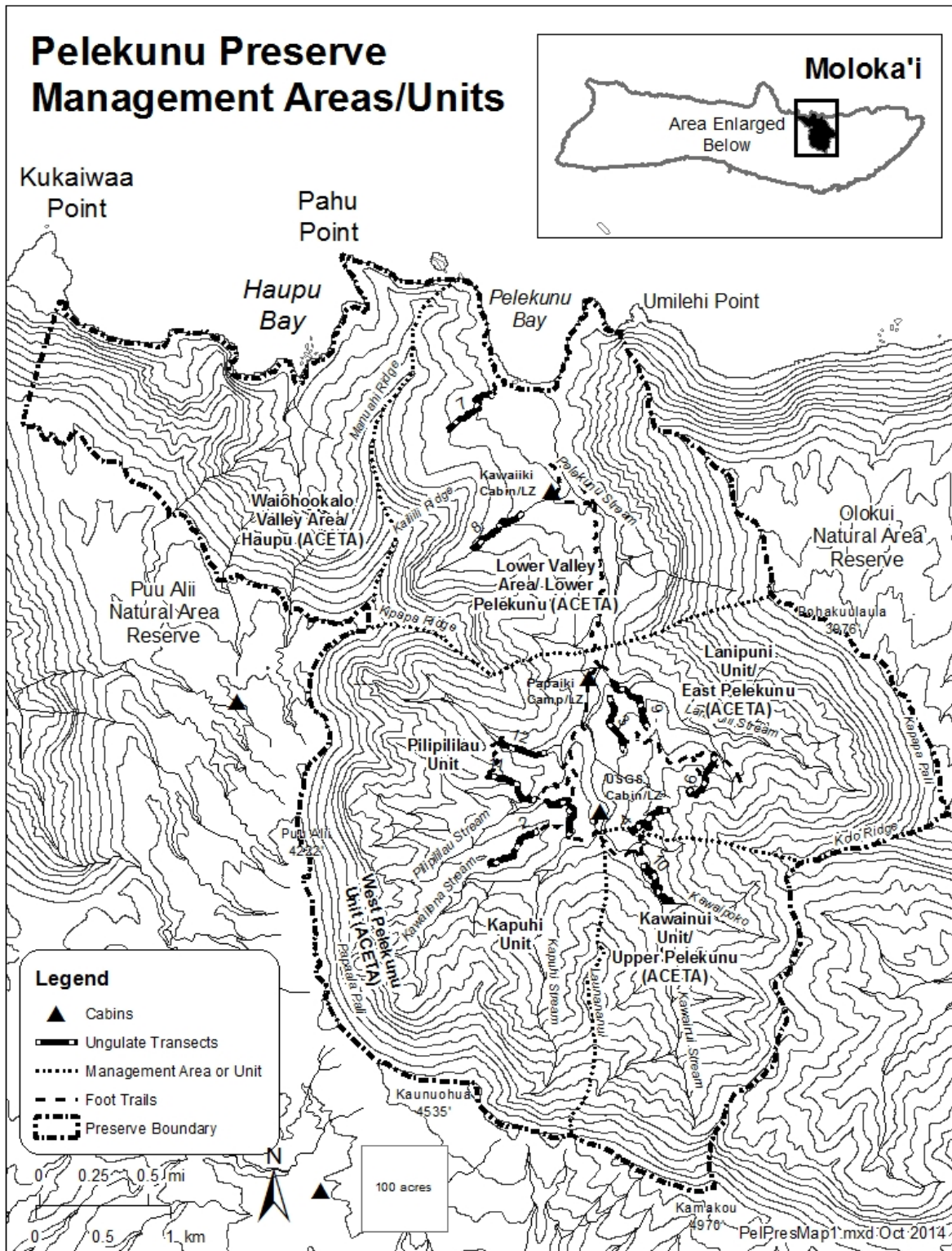


Figure 2. East Moloka'i Watershed Partnership

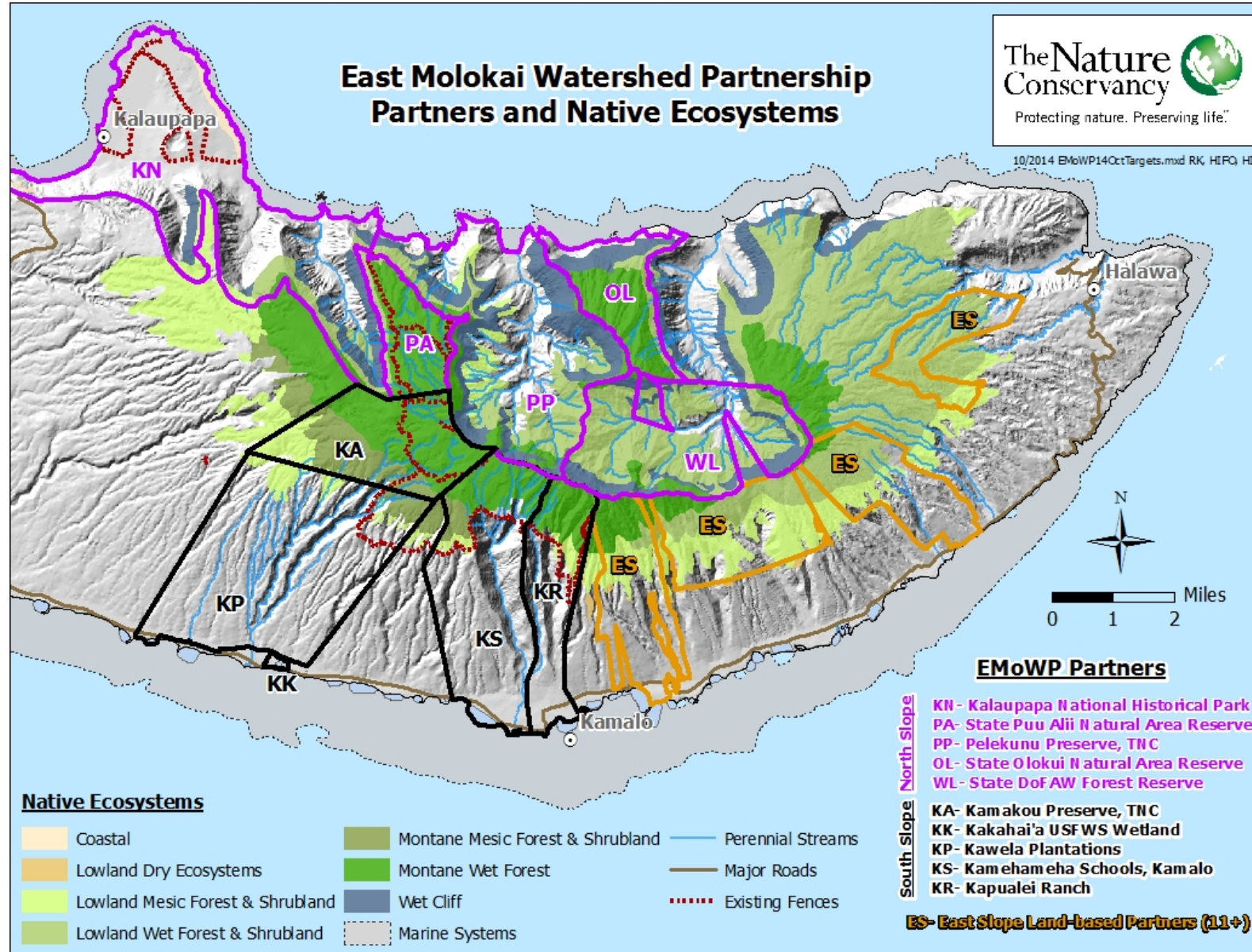
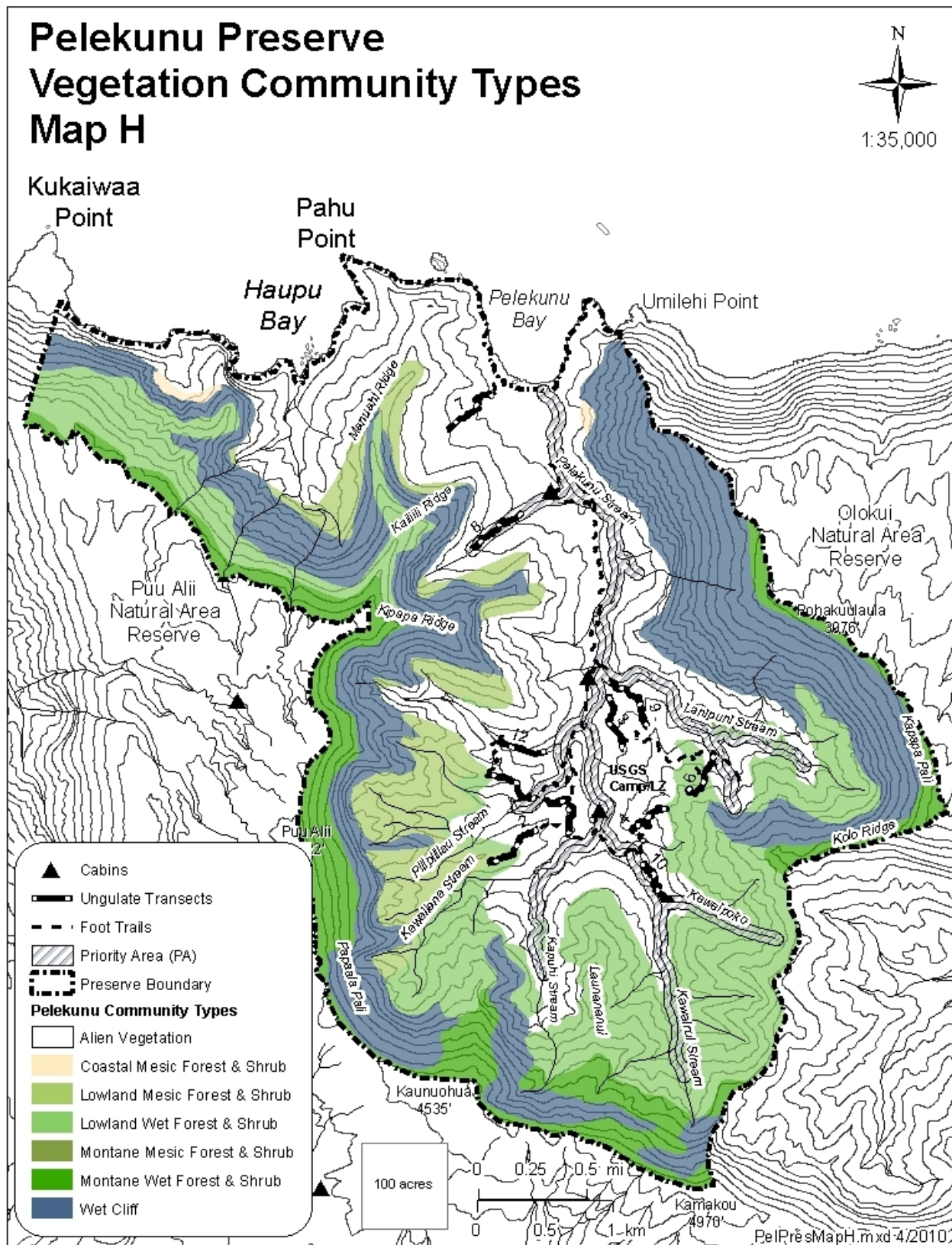


Figure 3. Native Natural Communities



APPENDIX 1
NATIVE NATURAL COMMUNITIES OF PELEKUNU PRESERVE

NATURAL COMMUNITY	GLOBAL RANK (a)*
Coastal	
Hala (<i>Pandanus</i>) Coastal Mesic Forest	G3
Hawaiian Mixed Shrub Coastal Dry Cliff#	G3
Kawelu (<i>Eragrostis</i>) Coastal Dry Grassland	G3
Lowland	
Lama/'Ohi'a Lowland (<i>Diospyros/Metrosideros</i>) Mesic Forest	G3
'Ohi'a (<i>Metrosideros</i>) Lowland Mesic Forest	G3
'Ohi'a/Uluhe (<i>Metrosideros/Dicranopteris</i>) Lowland Wet Shrubland	G3
Montane	
Mixed Fern/ Shrub Montane Wet Cliffs#	G3
'Ohi'a/Hapu'u (<i>Metrosideros/Cibotium</i>) Montane Wet Forest#	G3
'Ohi'a (<i>Metrosideros</i>) Montane Wet Shrubland	G3
'Ohi'a/'Olapa (<i>Metrosideros/Cheirodendron</i>) Montane Wet Forest#	G3
Aquatic Communities	
Hawaiian Continuous Perennial Stream	G1

* These community types are no longer tracked by NatureServe.

= Known also from adjacent NARs

(a) Key to Global Ranks as defined by the Hawai'i Natural Heritage Program, Mar 2008:

- G1 = Critically imperiled. At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
- G2 = Imperiled. At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
- G3 = Vulnerable. At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), 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.
- G5 = Secure. Common; widespread and abundant.

APPENDIX 2
CONSPICUOUS NATIVE AQUATIC ANIMALS (EXCLUDING INSECTS)
OBSERVED IN PELEKUNU STREAM AND ITS TRIBUTARIES

TAXON	SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK (a)	FEDERAL STATUS (b)
FISHES				
Eleotridae	<i>Eleotris sandwicensis</i> ¹	'o'opu akupa, 'o'opu okuhe	G3	
Gobiidae	<i>Awaous quamensis</i> ^{1*}	'o'opu nakea	G4	
	<i>Lentipes concolor</i> ¹	'o'opu alamo'o	G3	
	<i>Sicyopterus stimpsoni</i> ¹	'o'opu nopili	G2?	
	<i>Stenogobius hawaiiensis</i> ²	'o'opu naniha	G3	
Kuhliidae	<i>Kuhlia sandwicensis</i> ¹	aholehole		
Mugilidae	<i>Muqil cephalus</i> ²	'ama'ama	G5	
CRUSTACEANS				
Atyidae	<i>Atyoida bisulcata</i> ¹	'opae kala'ole (shrimp)	G4?	
Palaemonidae	<i>Macrobrachium</i>	'opae 'ohea'a (prawn)	G3?	
MOLLUSKS				
Ancylidae	<i>Ferrissia sharpi</i> ¹	limpet		
Lymnaeidae	<i>Erinna aulacospira</i> ¹	pond snail	GH	SOC
	<i>Pseudisidora rubella</i> ¹	pond snail		
Melanidae	<i>Melanooides tuberculata</i> ²			
Neritidae	<i>Neritina aranosa</i> ¹	hihiwai, wi	G1	SOC
	<i>Neritina vespertina</i> ¹	hapawai	G1G2	

¹ = Endemic

² = Indigenous

Source: NatureServe.org, Sept 2014

* This species is being re-evaluated as a Hawaiian endemic, *Awaous stamineus*.

(a) Key to Global Ranks as defined by the Hawai'i Natural Heritage Program, Mar 2008:

- GH = Possibly Extinct (species)— Missing; known from only historical occurrences but still some hope of rediscovery.
- G1 = Critically imperiled. At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
- G2 = Imperiled. At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
- G3 = Vulnerable. At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), 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.
- G5 = Secure. Common; widespread and abundant.

(b) Key to Federal Status:

- SOC = Taxa that available information does meet the criteria for concern and the possibility to recommend as candidate.

APPENDIX 3
RARE NATIVE PLANTS OF PELEKUNU PRESERVE

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK (a)	FEDERAL STATUS (b)
<i>Bidens molokaiensis</i>	ko'oko'olau, koko'olau	G1	SOC
<i>Bidens wiebkei</i> [^]	ko'oko'olau, koko'olau	G1	LE
<i>Brighamia rockii</i> [*]	alula, puaupaka, 'olulu	G1	LE
<i>Canavalia molokaiensis</i> [^]	'awikiwiki, puakauhi	G1	LE
<i>Clermontia oblongifolia</i> ssp. <i>brevipes</i>	'oha, 'oha wai	G3T1	LE
<i>Cyanea solanacea</i> [*]	'oha, haha, 'oha wai, popolo	G1	SOC
<i>Cyanea solenocalyx</i> ^{#^}	'oha, haha, 'oha wai	G2	SOC
<i>Cyrtandra halawensis</i> ^{*^}	ha'iwale, kanawao ke'oke'o	G1	SOC
<i>Cyrtandra hematos</i> ^{*^}	ha'iwale, kanawao ke'oke'o	G1	SOC
<i>Diellia erecta</i>		G1	LE
<i>Eurya sandwicensis</i> ^{#*}	anini, wanini	G2	SOC
<i>Gardenia remyi</i>	nanu, na'u	G1	C
<i>Hedyotis elatior</i>		G1	SOC
<i>Hedyotis littoralis</i>		G1	SOC
<i>Ischaemum byrone</i>	Hilo Ischaemum	G2	LE
<i>Joinvillea ascendens</i> ssp. <i>ascendens</i> [*]	'ohe	G5T1	C
<i>Lobelia hypoleuca</i>	'opelu, liua, mo'owahie	G3	
<i>Lysimachia maxima</i> ^{#^}		G1	LE
<i>Melicope hawaiiensis</i>	alani	G2	SOC
<i>Peucedanum sandwicense</i>	makou	G2	LT
<i>Phyllostegia hispida</i> [^]		G1	C*
<i>Plantago princeps</i> var. <i>laxiflora</i> [*]	ale	G2T1	LE
<i>Pritchardia lowreyana</i> [^]	loulu	G1	
<i>Scaevola coriacea</i>	dwarf naupaka	G1	LE
<i>Schidea diffusa</i>		G1	SOC
<i>Schiedea globosa</i> [*]		G2	
<i>Schidea pubescens</i> var. <i>pubescens</i>		G2T1	C*
<i>Stenogyne bifida</i> ^{#^}		G1	LE
<i>Tetramolopium sylvae</i>		G1	SOC
<i>Zanthoxylum hawaiiense</i>	hea'e, a'e	G1	LE

Number of rare plants in Pelekunu Preserve: 30 taxa

Appendix 3 continued.

* = Known from Oloku'i NAR

= Known from Pu'u Ali'i NAR

^ = Endemic to East Moloka'i

(a) Key to Global Ranks as defined by the Hawai'i Natural Heritage Program, Mar 2008:

GH = Possibly Extinct (species)— Missing; known from only historical occurrences but still some hope of rediscovery.

G1 = Critically imperiled. At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

G2 = Imperiled. At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

G3 = Vulnerable. At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), 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.

G5 = Secure. Common; widespread and abundant.

T1 = Subspecific taxa critically imperiled globally.

(b) Federal Status:

LE = Taxa formally listed as endangered.

LT = Taxa formally listed as threatened.

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

SOC = Species of Concern that available information does meet the criteria for concern and the possibility to recommend as candidate.

APPENDIX 4
RARE NATIVE BIRDS REPORTED FROM PELEKUNU PRESERVE

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK (a)	FEDERAL STATUS (b)
<i>Moho bishopi</i>	Bishop's 'O'o	GH	SOC
<i>Myadestes lanaiensis rutha</i> #	Oloma'o, Moloka'i thrush	GHTH	LE
<i>Palmeria dolei</i>	'Akohekohe, Crested honeycreeper	G1	LE
<i>Psittirostra psittacea</i>	'O'u	G1	LE
<i>Pterodroma sandwichensis</i>	'Ua'u, Hawaiian dark-rumped petrel	G2	LE
<i>Puffinus newelli</i>	'A'o, Newell shearwater	G2T2	LT
<i>Paroreomyza flammea</i> #	Kakawahie, Moloka'i creeper	GH	LE
<i>Vestiaria coccinea</i> #	'I'iwi	G4T1	E, -

#=Known also from adjacent NARs.

(a) Key to Global Ranks as defined by the Hawai'i Natural Heritage Program, Mar 2008:

- GH = Possibly Extinct (species)— Missing; known from only historical occurrences but still some hope of rediscovery.
- G1 = Critically imperiled. At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
- G2 = Imperiled. At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
- G3 = Vulnerable. At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), 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.
- G5 = Secure. Common; widespread and abundant.

- T1 = Subspecific taxa critically imperiled globally.
- T2 = Subspecific taxa imperiled globally.
- TH = Subspecific taxa historical. No recent observations, but there remains a chance of rediscovery.

(b) Federal Status:

- LE = Taxa formally listed as endangered.
- LT = Taxa formally listed as threatened.
- SOC = Species of Concern that available information does meet the criteria for concern and the possibility to recommend as candidate.
- E = Moloka'i population considered endangered by the state only.
- = No federal status.

APPENDIX 5
RARE NATIVE INVERTEBRATES OF PELEKUNU PRESERVE

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK (a)	FEDERAL STATUS (b)
<i>Campsicnemus ridiculus*</i>	Aquatic fly		
<i>Megalagrion pacificum</i>	Pacific Megalagrion damselfly	G2	LE
<i>Megalagrion xanthomelas</i>	Orange-Black Megalagrion damselfly	G2G3	C
<i>Partulina mighelsiana#</i>	Achatinellid Land Snail	G1	SOC
<i>Partulina tessellata#</i>	Achatinellid Land Snail	G1	SOC

#=Known also from adjacent NARs.

*=Source: Hawai'i Biological Survey, July 2001.

(a) Key to Global Ranks as defined by the Hawai'i Natural Heritage Program, March 2008:

G1 = Critically imperiled. At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

G2 = Imperiled. At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

G3 = Vulnerable. At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

UNK = Rank unavailable

(b) Federal Status:

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

SOC = Species of Concern that available information does meet the criteria for concern and the possibility to recommend as candidate.

APPENDIX 6
DOCUMENTS RELATED TO PELEKUNU PRESERVE

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APPENDIX 7

Research Conducted at The Nature Conservancy's Moloka'i Preserves (July 1994 through June 2014)

Ongoing Projects

Long term climate change and carbon sequestration in Hawaiian mountain bogs: Pepe'opae, Molokai.
Dr. David W. Beilman, UH Manoa, Geography Dept. with collaboration from Niklas Schneider, Axel Timmerman (Oceanography) and assistance from Karl Hsu and Derek Ford.

Pepe'opae Bog represents a very rare community type, the Hawaiian montane bog. Aside from harboring a specific set of plants, bog systems are critical sites of long term carbon storage and provide a window to understanding past climate changes. Dave Beilman began research there on May 28th, 2013 to look at past changes to that bog and others statewide. Radiocarbon dating in FY2014 suggests the bog's age is roughly about 9,500 years before present.

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

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

Research began June 22, 2007. Study 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 Moloka'i 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 Hawai'i at Mānoa

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

Genetic lineage of the Hawaiian dragonfly (*Anax strenuous*)

Seth Bybee, Brigham Young University, Dept. of Biology.

Research began at Kamakou Preserve in August 2012, comparing genetic sequences between samples on Molokai to others statewide to learn about potential colonization patterns.

Genetic differences in the Hawaiian Coprosma.

Jason Cantley, UH Manoa, Dept of Botany.

Molokai is home to four species of *Coprosma*, or in Hawaiian, pilo, a common native forest shrubs. These shrubs also commonly hybridize, making their identification challenging.

Collections were made in Kamakou Preserve on March 2013 by Jason Cantley, UH Manoa for DNA analysis.

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.

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.

Community Assembly in Hawaiian Spiders, Adaptive Radiation in *Tetragnatha* & *Ariamnes* and Molecular Genetics & Evolution of the Hawaiian Happy Face Spider.

Cotoras, Darko, William Roderick, Andrew Rominger and Rosemary Gillespie

Investigation into adaptive radiation of many native spider species. Field research began in Kamakou preserve in June 2012. Several new species of spiders likely to be described.

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 last conducted 2009. 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.

Surveying for the Kamehameha butterfly *Vanessa tameamea* at Kamakou Preserve

William Haines, Graduate student, University of Hawai'i at Mānoa

Collections began in May 2014. The objective of this project is to identify the current extent of the Hawaiian endemic Kamehameha butterfly across Hawaii. The Hawaiian nettles (family Urticaceae) on which they exclusively feed and nest were examined for signs including eggs, caterpillars and feeding damage.

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. Four species have been identified on Molokai. See publication section. A more comprehensive dissertation is underway.

Functional Trait evolution in the Hawaiian endemic *Planchonella sandwicensis*

Chris Havran, Graduate Student, Campbell University

Research began in June 2012 into the morphology of 'ala'a (*Planchonella sandwicensis*), a Hawaiian endemic hardwood. Examines relationship between leaf traits and local rainfall.

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 flies, with potentially 5 new species discovered in the genus *Campsicnemus*.

Taxonomic studies of Hawaiian predatory ground beetles (Carabidae).

James Lieherr, 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. Four species of *Hylaeus* are being considered for ESA listing at Mo'omomi as of 2011. Magnacca has aided with TNC staff identification of *Hylaeus* to the genus level at locations in upper Kawela and at Kawaaloo Bay, Molokai in FY13-14.

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. Medeiros, 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, Moloka'i

Dr. Klaus Mehlreter.

Project executed May 24-30, 2010. Fern diversity surveyed on 10 transects in Kamakou Preserve around the Pēpē'ōpae Boardwalk. No introduced fern species were found on transects. The fern species richness index of 33 species/1000 m² 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 *Elaphoglossum*.

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 Hawai'i 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 Kambyssellis, and Elysse Craddock, and David Baer. University of Hawai'i, NY University, University of NY. (808) 676-4974

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

Evaluation of native invertebrates at Mo'omomi 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 (less than fifty plants in the wild, in the world).

Floral trait evolution and pollination ecology in the Hawaiian lobelia genus, *Clermontia* (Campanulaceae)

Richard Pender, Dept of Botany, UH Manoa

Kamakou Preserve; research began in July 2011 and completed in 2013. Doctoral dissertation completed in July 2013, examined genetic variation among *Clermontia* species, their floral characteristics identified their morphologically effective bird pollinators. Molokai has 5 species of *Clermontia*- *C. arborescens*, *C. kakeana*, *C. grandiflora*, *C. pallida* and *C. oblongifolia* subspecies *brevipes*. DNA analysis suggests that the critically rare *Clermontia oblongifolia*

subspecies *brevipes* only present in east Molokai should be removed from its current subgenus status and reclassified as its own, separate species. Its closest relative is another Molokai endemic lobelioid, *Clermontia pallida*. Results to the pollinator study suggest that the only effective bird pollinator of the all Molokai *Clermontia*, the 'i'iwi (*Vestiaria coccinea*), is now functionally extinct there.

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 Botanical Gardens on Kaua'i and other appropriate facilities. Collection trips began in February 1991. Collections are ongoing. "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.

Nutrient limitations in Hawaiian forests.

Stephen Porder, Brown University, Field Assistant Heraldo Farrington.

Research began at Kamakou Preserve in May 2011 and concluded March 2013. Soils found in Hawaiian forests are often low in nitrogen and/or phosphorus which may affect plant growth. Experiment examined the effect of fertilization on Hawaiian forests through minimally-invasive mini-root ingrowth samples. Despite published literature suggesting the contrary, Porder found the control group's media was high in available phosphorus. New bags with nitrogen, phosphorus or no added nutrients were placed in the field in March 2013. In July 2013, all sample root bags were removed and root growth was measured. No additional root growth was noted over control bags, suggesting that the soils at the site are limited by neither of these nutrients or co-limited by both sets of nutrients at the same time.

¹⁵N 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.

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 Moloka'i include Hālawā Valley, Pelekunu and Kamakou Preserves. First study to inventory freshwater algae in Hawai'i in over 50 years. Kamakou Preserve

collections began in May 2010. Specimens being analyzed to determine species.

***Partulina redfieldii* around Puu Kolekole, Molokai.**

David Sischo, UH Manoa

Began in March 2012. Survey outside the area known as “Snail Meadow” in Kamakou Preserve comparing meadow and connected-forest habitat to determine if habitat fragmentation has an effect on genetic diversity, inbreeding, and population structure of this Hawaiian tree snail.

Moore DNA Barcoding Project for *Clermontia*, *Cyrtandra*, and *Metrosideros*

Elizabeth Stacy and Donald Price, Project Technician: Jennifer Johansen, UH Hilo.

Examination of DNA sequences from *Clermontia*, *Cyrtandra*, and *Metrosideros* species to establish DNA barcoding as a means to facilitate plant species identification. Three species of *Cyrtandra* (*C. procera*, *C. macrocalyx*, and a taxonomically unclear *Cyrtandra*) and three species of *Clermontia* (*C. pallida*, *C. kakeana*, and *C. arborescens waikoluensis*) were sampled, and approximately ten taxa of *Metrosideros*.

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.

On-going Projects (unsure of status)

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

Ruth Agurauja, 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.

Hawaiian Bristletails.

Alan De Quieroz, University of Nevada, Reno (Dept. of Biology)

Very little is known about the Hawaiian bristletails, cousins to the insects known collectively as silverfish (order Archaeognatha). Bristletails were collected from Kamakou preserve by lead researcher Alan de Quieroz in early September 2012. Preliminary results suggest that the genus is highly variable, and a Molokai endemic species may exist.

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 Pu'u 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 enclosure 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 Moloka'i 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 Mo'omomi Preserve. Collections to be deposited in NYBG, BPBM. Collected *Clermontia grandiflora*, *Alnus nepalensis*, *Lycopodium venustulum* at Kamakou; *Chamaesyce degeneri*, *Heliotropium anomalum* var. *argenteum*, and *Fimbristylis cymosa* at Mo'omomi. 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 Moloka'i 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. 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 led 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.

Evolutionary Relationships, Interisland Biogeography, and Molecular Evolution in the Hawaiian Violets (Viola: Violaceae). American Journal of Botany 96(11):2087-2099. 2009

J. Christopher Havran, Kenneth J. Sytsma, and Harvey E. Ballard, Jr.

Reviews relationships in evolution among the Hawaiian violets, proposing four taxa of violets found on Molokai.

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. (Urticaceae), 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 oviposition behavior, and determining phylogenetic relationships from DNA and morphology. (collaborative effort with Dr. Kaneshiro.)

Drs. Patrick O'Grady, Michael Kambyzellis, 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. spelunca* 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 Pēpē'ōpae 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 Pu'u Kolekole cabin.

Collection of assorted fleshy fungi from Kamakou Preserve.

Drs. George Wong (Department of Botany, University of Hawai'i at Mānoa), Don Hemmes (Department of Biology, University of Hawai'i 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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