

Pelekunu Preserve Moloka‘i, Hawai‘i

Long-Range Management Plan Fiscal Years 2010–2015

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

Submitted by
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EXECUTIVE SUMMARY

Established in 1980, The Nature Conservancy of Hawai‘i is a local affiliate of The Nature Conservancy, a leading international, nonprofit organization that preserves the plants, animals and natural communities representing the diversity of life on Earth by protecting the lands and waters they need to survive. The Conservancy has established a statewide system of preserves in Hawai‘i totaling almost 32,000 acres. As a member of eight watershed partnerships, the Conservancy works closely with public and private partners to help preserve nearly one million acres statewide. The Conservancy has also extended its work from the forests to the reefs and is engaged in marine conservation in the nearshore 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 funded Preserves: Pelekunu, Mo‘omomi, and Kamakou, and is the main coordinator/manager of the East Moloka‘i Watershed Partnership (EMoWP) which is directly responsible for management programs in Kamalō, Kapualei and Kawela. The Conservancy’s three preserves total 9,454 acres and the EMoWP encompasses over 30,000 acres. Management of Pelekunu Preserve has been funded by the NAPP since 1992. This long-range management plan updates the plan covering fiscal years (FY) 2004–2009 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 (FY2010 – FY2015) at Pelekunu Preserve.

The State Department of Land and Natural Resources (DLNR), which administers the NAPP program, is kept apprised of our progress in the preserve through written reports and an annual inspection. Operational plans are submitted annually (the Conservancy has adopted a July 1 – June 30 fiscal year). In addition, a six-month update is sent to DLNR each January. These documents are available upon request to others who are interested.

The first section of this plan is a brief overview of the native natural resources that are protected at 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 and a brief summary of each program’s past accomplishments. Objectives and costs for each program from FY2010–2015 are also listed. A projected budget is included for each year.

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 free-flowing stream system, one of the best remaining in Hawai‘i. Pelekunu Preserve is bordered by four other managed natural areas: state-owned Pu‘u Ali‘i and Oloku‘i Natural Area Reserves (NARs), Kalaupapa National Historical Park, the Conservancy’s Kamakou Preserve and is a part of the Kamalō/Kapualei Watershed Project. These managed areas belong to 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.

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 or “alien” plant species such as *Clidemia hirta* (see Weed Control Program section). Another potential threat to the preserve is the dewatering of the Pelekunu Stream 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 the delectable fresh water snail, hihiwai (*Neritina granosa*), by human gatherers; 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; therefore the State recognizes it as an “exemplary” Hawaiian Continuous Perennial Stream, characterized by the presence and abundance of the full array of native aquatic species. Some of these species exhibit a stream to ocean life cycle referred to as diadromous. 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.

Twenty-eight rare plant taxa have been reported from Pelekunu Preserve; eight of these are endemic to eastern Moloka‘i (Appendix 3). Ten of these taxa have also been reported from Pu‘u Ali‘i and/or Oloku‘i NARs. Of the 28 rare plant taxa reported from the preserve, 9 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 ‘amakihi (*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 include the indigenous ‘auku‘u, or black-crowned night heron (*Nycticorax nycticorax hoactli*), 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 and are currently being considered for listing under the Endangered Species Act. Englund also observed 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. 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. Boats serve only the front of the valley, and only 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 Molokaʻi 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 Molokaʻi Watershed Partnership (figure 2). Along with the Kamalō/Kapuālei project of this partnership (their boundary is the mountain divide between north and south East Molokaʻi), 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, and preventing the introduction of other invasive species.
4. Because the majority of the lower valley is dominated by non native vegetation, Conservancy management focuses on the upper valley.

Management Areas/Units

The preserve is divided into three *management areas* (Figure 4): upper Pelekunu Valley, lower Pelekunu Valley, and the Waiohoʻokalo Valley area. The upper Pelekunu Valley management area is further divided into four *management units*, as described below.

The Kīpapa and Pōhakuʻulaʻula Ridges separate Upper Pelekunu Valley from the lower valley area. The upper valley area is divided into four place name units: Pilipililau, Lanipuni, Kawainui, and Kapuhi. To date, the upper valley area (with the exception of Kapuhi unit and the upper reaches of Kawainui and Lanipuni units) is where we have focused most of our management. 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 Olokuʻi Natural Area Reserve.

Humans have substantially altered Lower Pelekunu Valley. 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 this area consists mainly of informal monitoring of the

impacts of present-day humans. Ungulate populations in this area can get very high due to limited hunting. Therefore, we will involve community hunters as needed to prevent large-scale migration into the upper valley area.

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 FY2010 – FY2015.

Program 1: Non-native Species Control

A. Ungulate Control

Program Objective

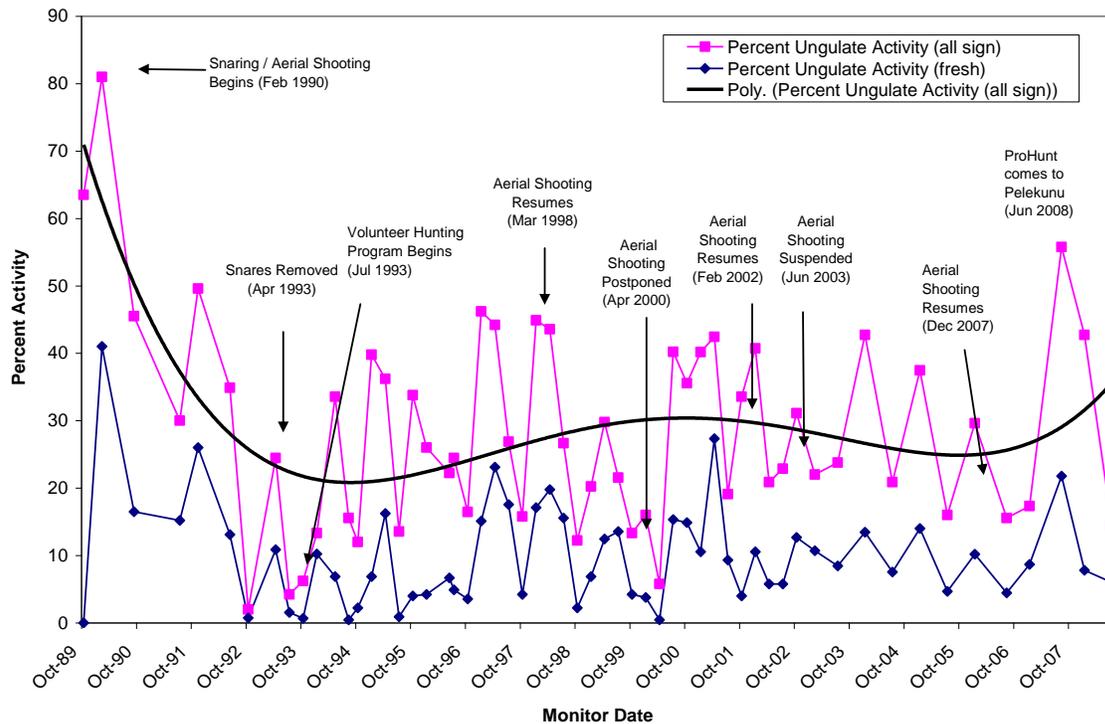
Develop and implement an ungulate control program that will ensure ungulate control coverage of all areas and identify hotspots of ungulate activity.

Discussion of Methodology

The Conservancy's ungulate control priority in Pelekunu is to prevent ungulates from moving into Oloku'i NAR from Kolo Ridge. Oloku'i is thought to be the only place in Hawai'i that has never been damaged by feral ungulates. In 1991 we began ungulate control efforts in the valley and with 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 we 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. The combined use of aerial shooting and ground hunting was reducing activity levels but the low level of 10% was not achieved and in the year 2000, aerial shooting was suspended by the State as they went through a series of policy reviews. From January 2000 – December 2007 only one aerial shoot was conducted in February of 2002. During that period we continued ground hunting and ungulate activities fluctuated but never went as low as 10% (see graph below). In December 2007 the States aerial shooting program was resumed with monthly shoots scheduled until April of 2008. The shooter reported significantly more pigs were seen higher up in the valley than in previous hunts conducted before aerial shooting was suspended. This confirmed staff reports that although the ungulate activity levels had shown some decreases there were still many animals in the valley in the high cliff areas where it was unsafe to put in transects and activity levels are not measured. Aerial shooting is considered the most effective and efficient way to remove ungulates from the steep rides in Pelekunu. We will continue to encourage and support the State's efforts to conduct aerial shoots in the valley. In 2007, the Conservancy contracted with ProHunt, a hunting firm from New Zealand, to complete a series of projects in the State of Hawaii. In Pelekunu, they were contracted to hunt in the upper valley to determine if and how the steep cliffy areas could be hunted. Additionally, they were asked to collar and monitor the movement of pigs and goats in

the valley to answer questions about how they move within the valley and if they are able to cross natural barriers into Kamakou Preserve. ProHunt uses systematic hunting and systematic recording. Based on what we've learned from them at the time of this writing, we intend to supply hunters with GPS units and outfit their tracking dogs with GPS collars to document hunting coverage in the upper valley. When possible, trails and new helicopter landing sites, established by ProHunt, will be utilized to insure systematic sweeps of the valley for ungulates. Over the next six years we will use a combination of aerial shooting, hunting, trapping and possibly strategic fencing to control feral ungulates in Pelekunu Preserve.

**Ungulate Activity in Pelekunu Preserve
(1989-2007)**



Ungulate Control Goals

Years 1-6 (FY2010-15)

1. Develop ungulate control plan in year 1 for years 2-6.
2. Maintain key trails and facilities used for ungulate control.

This program represents an estimated 70% of the overall effort and budget in this long range management plan.

B. Weed Control

Program Objective

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

Discussion of Methodology

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 in the upper valley, where native plant communities are still relatively intact and has four components: 1) developing and implementing a feasible, long-term control strategy for *Clidemia*; 2) identifying, mapping, setting management priorities and implementing control for other established habitat-modifying weeds; 3) preventing the establishment of new habitat-modifying weeds; and 4) Supporting Moloka'i/Maui Invasive Species Committee (MoMISC) activities on Moloka'i.

Clidemia hirta, a habitat-modifying weed 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. If reports become available documenting that the most recently studied biocontrol moths, *Mompha* and *Carposina* are successful and safe biocontrol 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
<i>Clidemia hirta</i>	Koster's curse
<i>Tibouchina herbaceae</i>	Glory Bush
<i>Fucraea foetida</i>	Mauritius hemp, sisal
<i>Psidium cattleianum</i>	Strawberry guava
<i>Schinus terebinthifolius</i>	Christmas berry
<i>Syzigium jambos</i>	Rose apple

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 have 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 have 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*, *Passiflora mollissima* (banana poka), and *Schefflera actinophylla* (octopus tree). 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. We also look for new weeds as part of our monitoring programs.

The Conservancy led the creation of the 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

Years 1-6 (FY2010-15)

1. Complete Pelekunu Weed Management Plan in year 1.
2. Conduct annual aerial surveys over portions of the valley to look for incipient habitat modifying weeds and monitor established priority weed species. (Cover entire preserve 2 times during the six year period)
3. Keep apprised of other agencies' *Melastome* biocontrol monitoring efforts and if success is documented, seek in-house approval to release.
4. Eliminate African tulip trees. (Currently this is the only known occurrence of an incipient weed that is feasible to eliminate)

5. Explore feasibility of eliminating the one known strawberry guava occurrence.

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

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 two years 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.

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 and now works cooperatively with the Plant Extinction Prevention Program (PEPP) Maui Nui Coordinator. The Conservancy will rely on PEPP and NTBG to survey and monitor Pelekunu preserve's rare plants and make management recommendations.

Threat monitoring focuses on invasive weeds and feral ungulates. Weeds will be monitored through aerial surveys (see weed section). Feral animals are currently monitored by eleven 500 meter ungulate activity transects throughout the valley. Other types of monitoring may be developed using the "Prohunt /Landcare" methodologies.

Monitoring and Research Goals

Years 1-6 (FY2010-2015)

1. Complete stream macrofauna monitoring in years 2, 4 and 6.
2. Subcontract stream macrofauna monitoring analysis.
3. Conduct Rare Plant monitoring on an ad hoc basis as provided by partners.
4. Monitor existing nine upper valley threat monitoring transects (bi-annually) and two lower valley transects (annually).

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

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.

Discussion of Methodology

The Conservancy's Moloka'i community outreach programs go far beyond the boundaries of any single conservation site. We have taken a multi-faceted, comprehensive approach towards community outreach on Moloka'i. The Conservancy has evolved from being a site-specific conservation manager, to an organization that does conservation on a landscape scale. The population of Moloka'i is approximately 7,000 and outreach activities help educate the community about the importance of preserving the natural resources of Moloka'i, along with 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.

Monthly, guided hikes are conducted at Kamakou and Mo'omomi Preserves (the Kamakou hike includes a scenic overlook into Pelekunu, and provides an opportunity for us to teach hike participants about Pelekunu's important stream ecosystem), and work with the public schools to provide conservation/environmental education through field trips and slideshows.

A quarterly newsletter, called "*Nature's Newsflash*" is produced by our office staff and mailed to every address on Moloka'i to inform the local community about conservation news and activities on Moloka'i.

On Moloka'i our annual "big" event is the Moloka'i Earth Day Celebration. The Earth Day Celebration is a way of bringing together conservation agencies/organization to display their mission and accomplishments to the local community. The event is interactive and is geared to provide basic environmental education to the public. The event draws at least 10% of Moloka'i's population.

For the next six years, we will continue these programs as it is important to keep the Moloka'i Community involved and informed about the island's native natural resources and the effort needed to manage them. The development of new outreach programs or, the deletion of any of the above will be determined on an annual basis. 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.

Community Outreach Goals

Years 1-6 (FY2010-FY2015)

1. Recruit annually as needed to provide field support from AmeriCorps, Moloka'i summer intern, Youth Conservation Corps (YCC), Alu Like and other intern/volunteer programs.

2. Continue to engage the Molokai community through community and school group activities.
3. Conduct monthly and special community group hikes at Kamakou and Mo‘omomi Preserves.
4. Continue production and distribution of *Nature’s Newsflash*.
5. Coordinate and organize annual Moloka‘i Earth Day Event.
6. Maintain and develop docent and volunteer participation and conduct training sessions as needed.
7. Support MoMISC (Moloka‘i Subcommittee of Maui Invasive Species Committee) activities.

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

Program 4: Fire, Emergency and Safety

Program Objective

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.

Discussion of Methodology

To provide the safest possible environment for staff; interns and volunteers, all full time staff are trained in first aid, CPR and fire suppression. As classes become available and needs warrant, training is also provided for advanced wilderness first aid, fire suppression and pre-suppression, helicopter safety, and hunters’ education. Complete first aid kits are provided to each field staff. Fully stocked first aid kits are kept in each vehicle and in preserve cabins and camps. Full personal protective gear is provided to field staff once they have completed basic fire training so that they will be equipped to assist in the event of a fire.

The Moloka‘i Fire Task Force was formed in 2004 in an effort to provide leadership to develop a response plan that will coordinate interagency cooperation during the pre-suppression and suppression stages of a wildfire. 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.

Fire, Emergency and Safety Goals

Years 1-6 (FY2010-FY2015)

1. Update Wildfire Management Plan.
2. Provide emergency training opportunities for staff including but not limited to keeping First Aid and CPR certifications current.
3. Update staff fire suppression training.
4. Purchase equipment as needed to allow immediate response to fire threats.
5. Respond to emergencies or fire threats.
6. Participate on the Moloka‘i Fire Task Force including annual assessment of fire breaks and communication exercises.

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

Program 5: Watershed Partnership

The East Moloka'i Watershed Partnership (EMoWP) was formed in 1999 when a grass roots strategic planning effort produced an application for the USDA Empowerment Zone program. Stewardship of the islands' watersheds is one of the priorities of the application's strategic plan. Pelekunu Preserve is part of The East Moloka'i Watershed Partnership. Along with the Kamalō/Kapuālei project 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, and preventing the introduction of other invasive species. Management plans and progress for the East Molokai Watershed Partnership are reported in a separate document.

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.

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:

This NAPP request will cover a portion of the costs of the Molokai Island Program staff 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 .90 FTE.

The Nature Conservancy's currently negotiated (annually with our federal cognizant agency) fringe benefit rate will accrue on all salary/wage costs.

Technical and annual planning support is also provided by the Honolulu office of the Conservancy. In particular, the Conservation Programs Director, Conservation Programs Coordinator, Conservation Planner, Senior Scientist, and other island resource staff help prepare annual plans and reports, develop and implement monitoring and research programs, and establish interpretive and intern programs at the preserve. As budget and needs allow, these support staff members may charge a small portion of their time to this project.

Supplies and Equipment:

\$9,000 has been budgeted each year to cover various project related supplies and expenses. Funds will be allocated towards vehicles, equipment and materials based on availability and need.

Travel:

A travel budget of \$3,000 has been budgeted in the first year and a 3% inflation increase added each year thereafter to cover a portion of staff inter-island travel for workshops, training, staff meetings and one mainland trip for 2 staff to attend a workshop.

Subcontracts:

3% inflation rate added each year to the base subtotal of \$55,000. An additional \$6,000 was added to helicopter travel in years FY10, FY12 and FY14 for stream monitoring and an additional \$5,000 was added in FY11, FY13 and FY15 to analyze the stream monitoring data. Funds may also be allocated for LRMP renewal and professional/contractual costs based on availability and need.

FY10

Hunting Subcontract + Helicopter Travel - \$61,000

FY11

Hunting Subcontract + Stream Monitoring Analysis + Helicopter Travel - \$61,650

FY12

Hunting Subcontract + Helicopter Travel - \$64,350

FY13

Hunting Subcontract + Stream Monitoring Analysis + Helicopter Travel - \$65,101

FY14

Hunting Subcontract + Helicopter Travel - \$67,904

FY15

Hunting Subcontract + Stream Monitoring Analysis + Helicopter Travel - \$68,761

Other:

\$4,400 has been budgeted in the first year and a 5% inflation increase each year thereafter to cover a portion of the base yard, security, insurance, communications and other miscellaneous project related expenses.

Overhead:

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

BUDGET	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	Total
Labor and Fringe	67,735	70,105	72,559	75,099	77,727	80,448	443,673
Supplies and Equipment	9,000	9,000	9,000	9,000	9,000	9,000	54,000
Travel	3,000	3,090	3,183	3,279	3,377	3,478	19,407
Subcontracts	61,000	61,650	64,350	65,101	67,904	68,761	388,766
Other	4,399	4,620	4,851	5,094	5,348	5,616	29,928
Subtotal	145,134	148,465	153,943	157,573	163,356	167,303	935,774
Overhead (10%)	14,513	14,847	15,394	15,757	16,336	16,730	93,577
TOTAL	159,647	163,312	169,337	173,330	179,692	184,033	1,029,351

	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	Total
Pelekunu Budget	159,647	163,312	169,337	173,330	179,692	184,033	1,029,351
TNC Match (1/3)	53,216	54,437	56,446	57,777	59,897	61,344	343,117
State NAPP Request (2/3)	106,431	108,875	112,891	115,553	119,795	122,689	686,234

Figure 1. Pelekunu Preserve

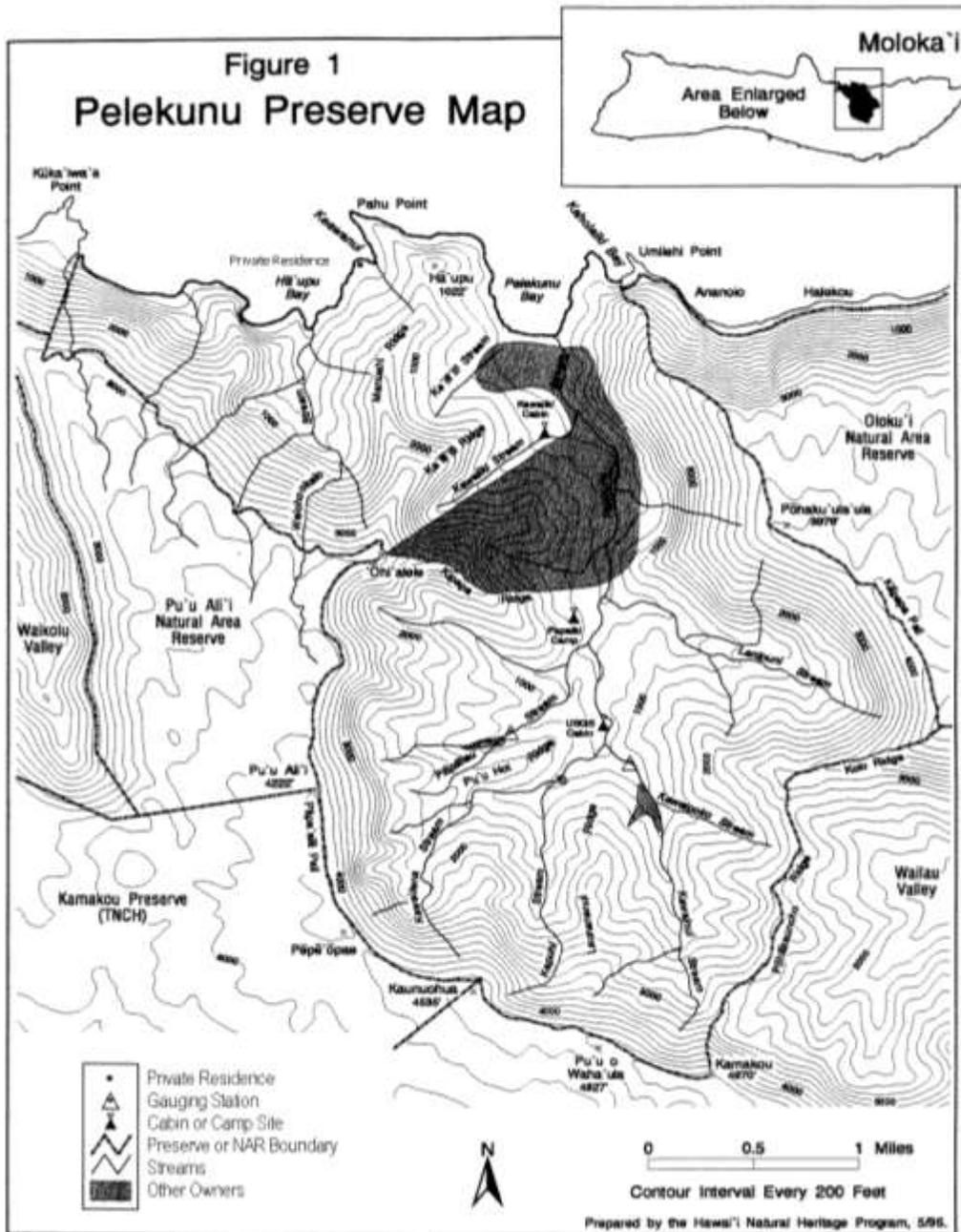


Figure 2. East Moloka'i Watershed Partnership

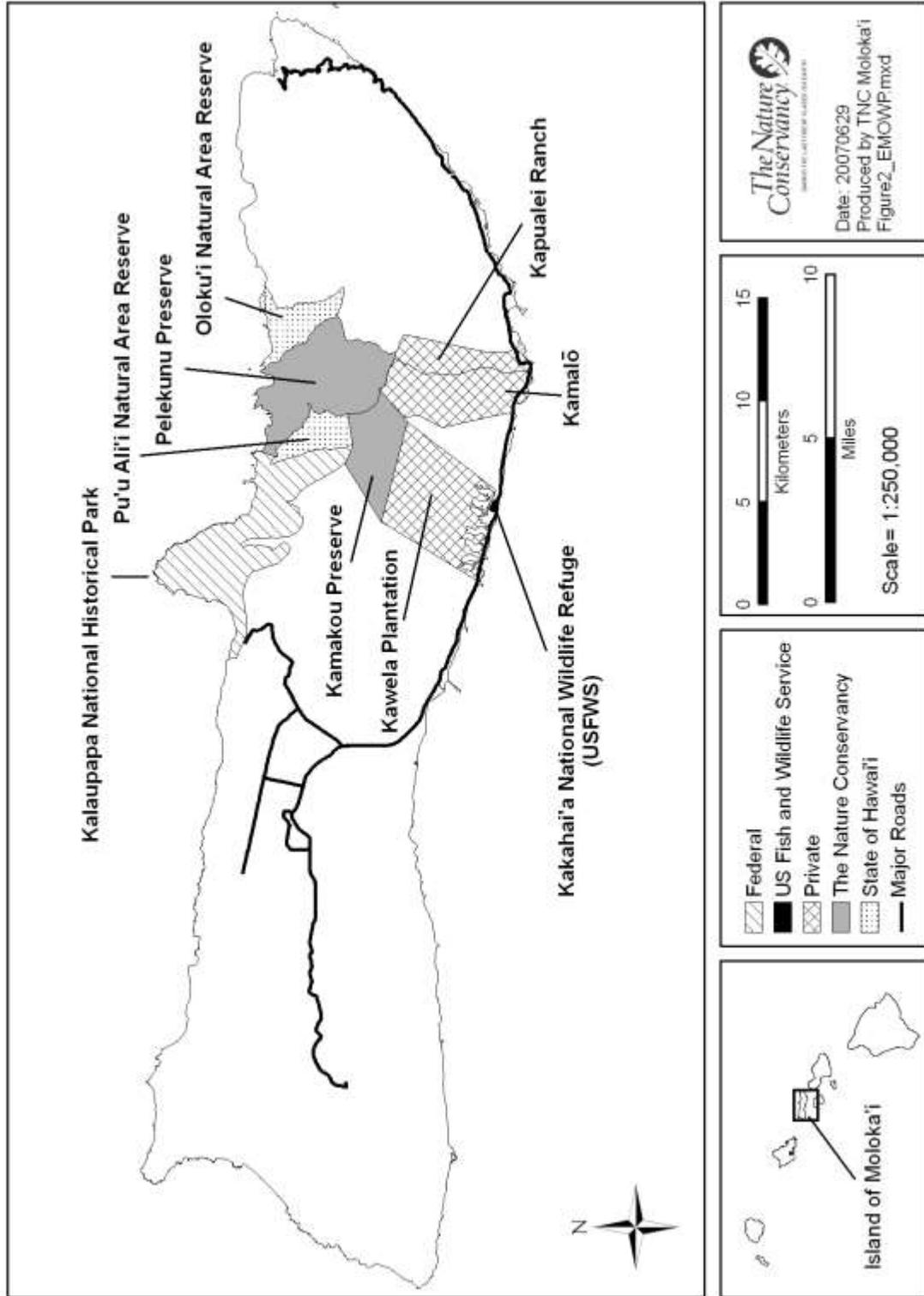
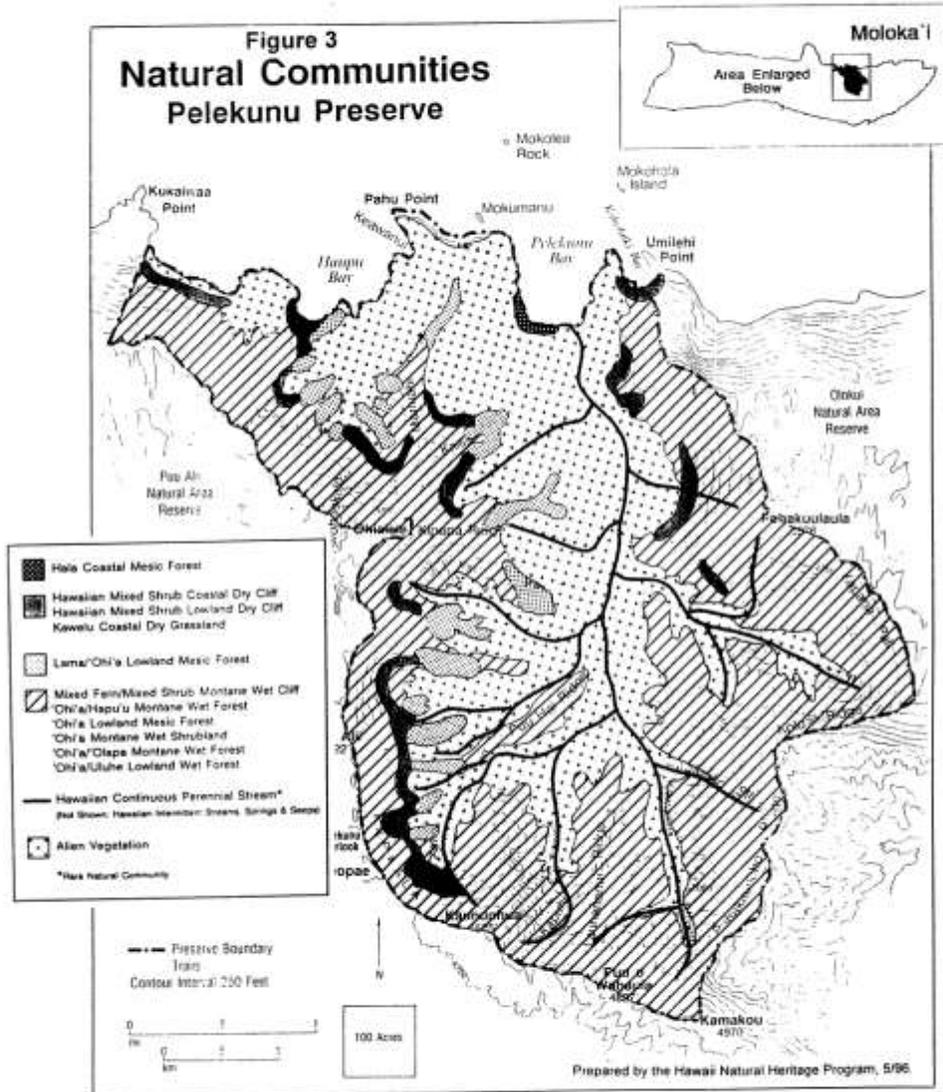


Figure 3. Native Natural Communities



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

= 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		
Gobiidae	<i>Awaous guamensis</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		
Kuhliidae	<i>Kuhlia sandwicensis</i> ¹	aholehole		
Mugilidae	<i>Mugil cephalus</i> ²	‘ama‘ama		
CRUSTACEANS				
Atyidae	<i>Atyoida bisulcata</i> ¹	‘opae kala‘ole (shrimp)	G4?	
Palaemonidae	<i>Macrobrachium grandimanus</i> ²	‘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>Melanoides tuberculata</i> ²			
Neritidae	<i>Neritina granosa</i> ¹	hihiwai, wi	G1G2	SOC
	<i>Neritina vespertina</i> ¹	hapawai		

¹ = Endemic

² = Indigenous

Source: Adapted from J. Ford and A. Yuen 1988. Natural History of Pelekunu Stream and its Tributaries. Island of Moloka‘i, Hawai‘i. Part I, Summary Report.

(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>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>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: 28 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	G2	LE
<i>Psittirostra psittacea</i>	'O'u	G1	LE
<i>Pterodroma sandwichensis</i>	'Ua'u, Hawaiian dark-rumped petrel	G2T2	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	C
<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

Ford, J. and A. Yuen. 1988. *Natural History of Pelekunu Stream and Its Tributaries, Island of Moloka‘i, Hawai‘i*. Part 1, Summary Report. Unpublished.

Kelly, M. 1988. *Cultural History of Pelekunu Valley, Moloka‘i*. Unpublished document prepared for The Nature Conservancy.

Memorandum of Understanding and Study Plan—Relationship of Biotic Attributes to the Hydrology of Waikolu and Pelekunu Stream Basins. June 17, 1994, Kalaupapa National Historical Park.

The Nature Conservancy of Hawai‘i. 1991. *Pelekunu Preserve, Moloka‘i, Hawai‘i. Long-Range Management Plan, Fiscal years 1992 – 1997*. Unpublished document prepared for the Department of Land and Natural Resources Natural Area Partnership Program.

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Resources Natural Area Partnership Program. Prepared annually; reports for 1992 – 2002 are available.

Walsh, G., G. Diaz, and B. Kondratieff. 1992. *A Research Proposal for A Hydrological and Biological Study of Waikolu Stream, Kalaupapa National Historical Site, Island of Moloka'i, Hawai'i*. Unpublished.

Englund, R. 2001. *Report on Long-Term Aquatic Insect Monitoring by Hawai'i Biological Survey, Bishop Museum in Pelekunu Valley, Moloka'i, Hawai'i*. Hawai'i Biological Survey, Contribution No. 2001-010.

Englund, R. 2000. *Report on Aquatic Insect Monitoring of May 2000 in Pelekunu Valley, Moloka'i, Hawai'i*. Hawai'i Biological Survey, Contribution No. 2000-011.

Wood, K. 2002 (draft). *The Distribution and Abundance of *Brighamia rockii* & *Brighamia insignis* (Campanulaceae) with an ecological description of *B. rockii* on the cliffs of Hä'upu Bay, Moloka'i, Hawai'i*. National Tropical Botanical Garden, Kaua'i, Hawai'i.

APPENDIX 7
Research Conducted at The Nature Conservancy's

Moloka'i Preserves
(July 1994 through June 2008)

Ongoing Projects

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

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

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

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

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

Research began June 2002 and is in progress. Kamakou Preserve. Voucher specimen will be deposited at the University of California, Berkeley and Jepson Herbaria. Evidence from comparisons of nuclear rDNA and chloroplast DNA show that introgressive hybridization and even hybrid speciation have occurred on Kauai 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.

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 September 26-29, 2005. 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*, *Argyroxiphium*), *Bidens*, and *Artemisia*.

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

Oliver Chadwick, University of California

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

A study of Aquatic insects as indicators of stream health in Pelekunu Valley.

Dr. Ron Englund, Bishop Museum.

Research initiated May 24-25, 2000 and is expected to continue annually. Pelekunu Preserve.

Collections of aquatic insects as a part of Pelekunu stream monitoring effort in conjunction with TNCH and State Dept. of Aquatic Resources (DAR). Final deposition of collected specimen at Bishop Museum.

Vespula project.

Megalagrion damselfly survey

David Foote (Hawaii Volcanoes National Park).

Vespula research began August 1998.

Megalagrion damselfly surveys were conducted in August 2005 and August 2006.

Hawaii Forest Bird Interagency Database Project.

Dr. Scott Fretz, et. al., Hawaii Department of Land and Natural Resources, Division of Fish and Wildlife.

Research conducted March 9 to April 2, 2004. Kamakou and Pelekunu Preserves. Forest Bird surveys are conducted on each of the five main islands on a five year rotation basis in key native forest bird habitat including those lands being actively managed to enhance forest bird habitat. Data is entered into a centralized database and analyzed for trends.

Web site information is available at

<http://biology.usgs.gov/pierc/HFBIDSite/HFBIDPHome.htm>

Origin and stabilization mechanisms of organic nitrogen forms in soil.

Dr. Georg Guggenberger, Martin Luther University Halle-Wittenberg, Germany

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

Mark and recapture of *Partulina redfieldi* and *Perdicella helena* (tree snails) at Kamakou Preserve.

Dr. Mike Hadfield, Department of Zoology, University of Hawaii.

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 Hawaii.

Research began January 1984 and is in progress.

Collecting Hawaiian *Omiodes* moths from TNCH Moloka'i Preserves

William Haines, Graduate student, University of Hawaii at Manoa

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

Reproductive biology, ecology, and genetics of Hawaiian violets

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

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

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

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

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

Prostostelids of Hawaii

Drs. Don Hemmes; Fred Spiegel

Research began January 3, 2007. Report pending.

***Succinea caduca* Survey and Sampling at Moomomi preserve**

Dr. Brenden Holland and Dr. Robert Cowie, Center for Conservation Research and Training University of Hawaii, Manoa 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 Hawaii. 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 Molokai 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.

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. Hawaii hosts about 350 native Carabid beetle species exclusive to the islands – 55 species are exclusive to Molokai. Species distributions on Molokai exist in two natural areas including Kawela-Puu 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.

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 Moomomi dunes (NW Molokai) and related strand areas of Maui County.

Arthur C. Mederios, Pacific Island Ecosystem Research Center.

Research initiated June 21, 2004. Moomomi 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 Mederios, UC Berkeley, Dept. of Integrative Biology PhD dissertation.

Revising two genera of Hawaiian moths, *Shrankia* (Noctuidae) and *Thyrocopa* (Oecophoridae).

Phylogeny and geographical relation in the fern genus *Elaphaglossum*.

Dr. John Mickel, New York Botanical Garden, Robbin Moran, Timothy Motley.

Project initiated Feb. 4, 2004. Kamakou Preserve. Determine the phylogenetic and geographical relationships of the genus world-wide using molecular techniques. The Hawaii 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 Kambyzellis, and Elysse Craddock, and David Baer.

University of Hawaii, 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.

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

C. Steve Perlman, Natalia Tangalin, National Tropical Botanical Garden.

Plant propagules collected for ex-situ propagation at the National Tropical Botanical Gardens on Kauai and other appropriate facilities. Collection trips began in February 1991; most recent collection held in April 1999; Collection is on-going. "Genetic Safety Net" Program began in Jan 2001. Kamakou Preserve.

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 Hawaii joint research project.

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

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.

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

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

Multi-temporal, hyperspectral mapping of landforms, surface deposits, and vegetation in the Moomomi 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. Moomomi 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 Molokai Amakihi.

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

Objectives: 1) assess the extent of genetic differentiation between the Molokai 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 Molokai amakihi population relative to other amakihi populations; and 3) compare the differentiation between populations to the average divergence within populations. If the Molokai 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 Molokai and prospects for management of this invasive species.

D. Lyman Perry, Geography Department, University of Hawaii at Manoa

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

Mycofloristic, revisionary, and monographic studies in the Xylariaceae.

E. Dr. Jack D. Rogers, 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 Hawaii.

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 Hawaii Insect Museum.

Characterization of the diversity of egg-case morphologies from Hawaii *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 Hawaii *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. Improve propagation efforts to ensure that orchids persist in the natural setting.

Completed Projects and Pending Reports

Inventory and documentation of the current distribution and systematic status of a few Molokai 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 Moomomi 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 Molokai 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, Haleakala 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.

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 Moomomi 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 Hawaii.

Ron Crombie, National Museum of Natural History.

Research began February 1998 and is complete. Kamakou and Moomomi 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 Molokai 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.

Adaptive Radiation of species in the Raillardia group of genus *Dubautia*.

Dr. Elizabeth Friar, Dr. J. Travis Columbus, Mitchell McGlaughlin, Rancho Santa Ana Botanic Garden.

Research initiated March 29-30, 2004. Kamakou Preserve. This study will quantify genetic and morphological differentiation among the species in the Raillardia group of *Dubautia*. Preliminary data indicate that populations of *Dubautia linearis* on Molokai may represent a new species. This is a continuation of an ongoing project studying the process of adaptive radiation using a small species group within *Dubautia* of the Hawaiian silversword alliance as a model system. Voucher specimen will be deposited at the Rancho Santa Ana Botanic Garden Herbarium and Bishop Herbarium.

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 Hawaii.

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 Hawaii

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

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

Collection and documentation of fungi in Kamakou Preserve.

Drs. Don Hemmes (University of Hawaii 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 Hawaii. 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 Hawaii), 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 Molokai 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 Hawaii.

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 Hawaii at Manoa leyla@hawaii.edu

Research began April 2006 in Kamakou preserve and is in progress. Species to be deposited at University of Hawaii at Manoa - 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 Hawaii, 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 Hawaii, Manoa. Voucher specimen will be deposited at the UH Botany Dept. herbarium.

Field survey and collection of the rare *Hillebrandia sandwicensis* (Begoniaceae) in Hawaii.

Maya LeGrande, Nellie Sugii, University of Hawaii / 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 Hawaii, Manoa. Voucher specimen will be deposited at the UH Botany Dept. herbarium. Excess seed will be given to the Hawaii Seed Storage Facility at Lyon Arboretum for storage trials.

Invasive arthropods in Hawaii: closing the biotic gap

Russell Messing, and Mark Wright, University of Hawaii at Manoa.

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 Molokai in July 1995; report pending.

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 Hawaii.

F. 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 Hawaii.

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, Puu Alii NAR, and Puu 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 Molokai indicates that there is a rich and diverse watermold flora. The Molokai specimen will be used to expand the universities' collection of representatives of the Protistan order Saprolegniales from worldwide sources for monographic revision of the order. Samples will be sent to the American Type Culture Collection in Maryland for cryopreservation. Project completion is scheduled to be completed in 2008. This research is funded by the US National Science Foundation (grant # DEB 0328316).

Collection of ferns in Kamakou Preserve for taxonomic classification.

Dr. Dan Palmer.

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

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

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

Survey included one field trip on Molokai 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, CSIRO 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 Pepeopae 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 Hawaii at Manoa), Don Hemmes (Department of Biology, University of Hawaii at Hilo), and Dennis Desjardin (Department of Biology, San Francisco State University)

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

FINAL REPORTS (may be PUBLISHED)

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