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# 2013 Annual Report

## Hawai'i Experimental Tropical Forest



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## List of Acronyms

DHHL - Department of Hawaiian Homelands

DLNR - Hawai'i Department of Land and Natural Resources

DOFAW - Hawai'i Division of Forestry and Wildlife

FR - Forest Reserve

FBS - Forest Bird Sanctuary

HETF - Hawai'i Experimental Tropical Forest

HIPPNET - Hawaii Permanent Plot Network

IPIF - Institute of Pacific Islands Forestry

LAC - Laupāhoehoe Advisory Council

LAU - Laupāhoehoe Unit of the Hawai'i Experimental Tropical Forest

LCPCS - Laupāhoehoe Community Public Charter School

NARS - Natural Area Reserve System

PAC - Pu'u Wa'awa'a Advisory Council

PSW - Pacific Southwest Research Station

PWW - Pu'u Wa'awa'a Unit of the Hawai'i Experimental Tropical Forest

RTC - Research Technical Committee for the Hawai'i Experimental Tropical Forest

SP- State Parks

USDA - United States Department of Agriculture

USFS - United States Forest Service

## Acknowledgements

The establishment and administration of the Hawai'i Experimental Tropical Forest (HETF) has been successful due to the support and hard work of many individuals. First, we would like to recognize Alex Friend, Ric Lopez, Paul Scowcroft, Pat Manley, Roger Imoto, and Lisa Hadway for their leadership and support in 2013. The U.S. Department of Agriculture, Forest Service (USFS) would like to thank the State of Hawai'i including the Board of Land and Natural Resources, the Division of Forestry and Wildlife and State Parks for their cooperation in the administration of the HETF. In particular we would like to thank the following State staff in 2013 for their efforts to reach agreements, provide valuable feedback, and help move forward the processes needed to effectively administer the HETF's mission: Steve Bergfeld, Ian Cole, Gordon Heit, Sheri Mann, Joey Mello, Kevin Moore, Elliott Parsons, Lyman Perry, Tanya Rubenstein, Hans Sin and Dean Takebayashi. Mahalo to Colleen Cole and Cheyenne Perry for their work with the HETF Planning Group and as HETF partners via the Three Mountain Alliance and Mauna Kea Watershed Alliance, respectively. Special thanks to the additional USFS employees who have tirelessly worked to support the HETF's success in their respective capacities in 2013 including: Jerry Carlson, Tom Cole, Susan Cordell, Sherri Eng, Kainana Francisco, Christian Giardina, Susan Litteral, Dean Oshiro, David Oldenburg, Wendy Powell, William Nielson, Randy Shrank, Jean Stoner, Michael Sullivan, and Chris Wong. Special thanks to James Akau, Cheyenne Perry and Christian Giardina for their time and energy towards education and outreach activities and guidance. Mahalo also to Bob Masuda who continues to support HETF operations and growth. Additionally, we acknowledge the Laupāhoehoe and Pu'u Wa'awa'a Advisory Council members for their important role in the guidance of HETF activities.

## Introduction

The Hawai'i Experimental Tropical Forest (HETF) was established in 2007 and includes two Units: the Laupāhoehoe Wet Forest, totaling 12,343 acres (4,990 ha), and the Pu'u Wa'awa'a Dry Forest, totaling 38,885 acres (15,736 ha) (Figure 1). The HETF overlays existing State of Hawai'i, Department of Land and Natural Resources (DLNR) managed lands. The USDA Forest Service (USFS), Pacific Southwest Research Station in Hilo, Institute of Pacific Islands Forestry (IPIF), works with the DLNR – Division of Forestry and Wildlife (DOFAW) and State Parks to cooperatively manage research and education activities within the HETF. The HETF is part of a network of USFS Experimental Forest and Range units across the United States (<http://www.fs.fed.us/research/efr/>).

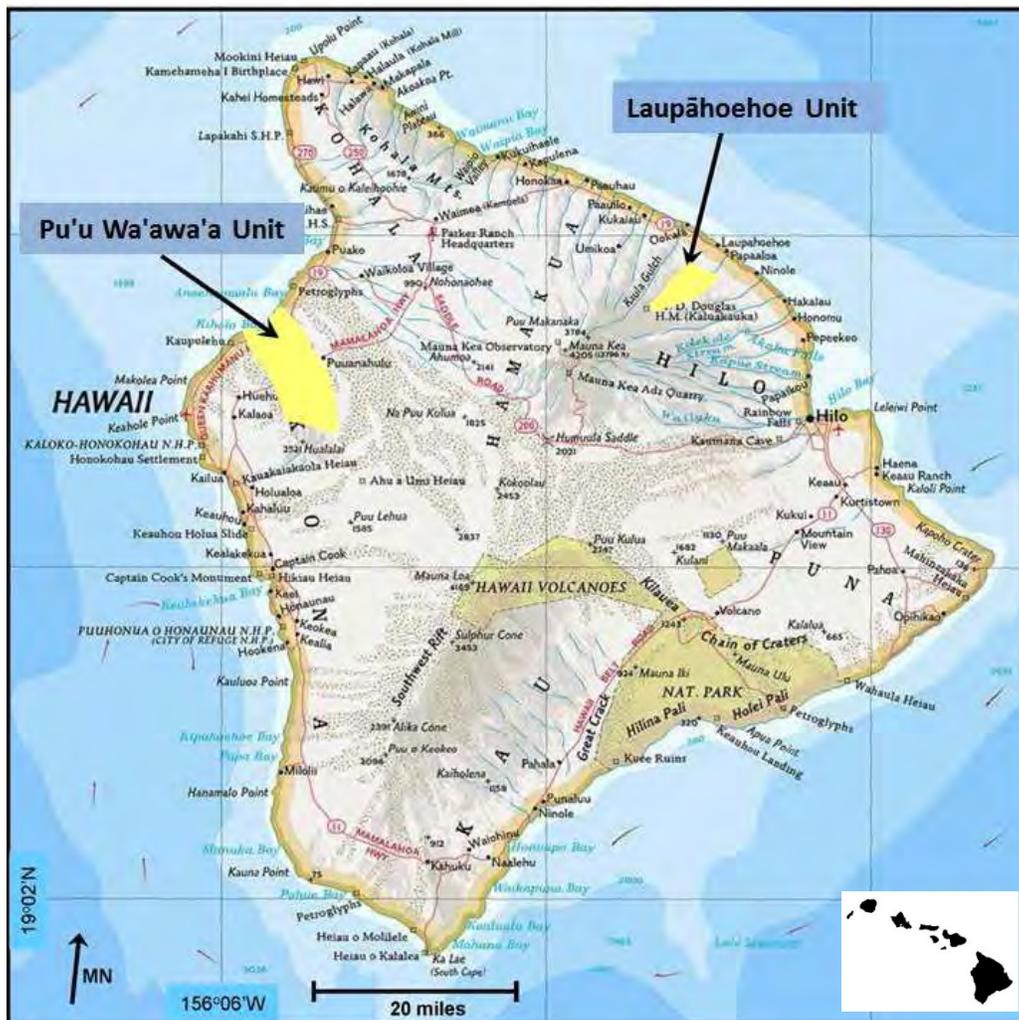


Figure 1: Map of Hawai'i Island highlighting the Pu'u Wa'awa'a and Laupāhoehoe Units of the HETF.

The Laupāhoehoe Experimental Forest Unit is located on the east side of Hawai'i Island (Figure 2) and incorporates 4,449 acres (1,800 ha) of DOWA managed land designated as Forest Reserve and 7,894 acres (3,195 ha) of land designated as Natural Area Reserve (NAR). This Unit contains native-dominated forested landscapes from lowland forest at 2,300 feet (700 m) above sea level extending through four life zones to almost 6,200 feet (1,890 m) in elevation. Laupāhoehoe contains magnificent examples of tropical rain forest and is the habitat of numerous endangered plant and animal species.

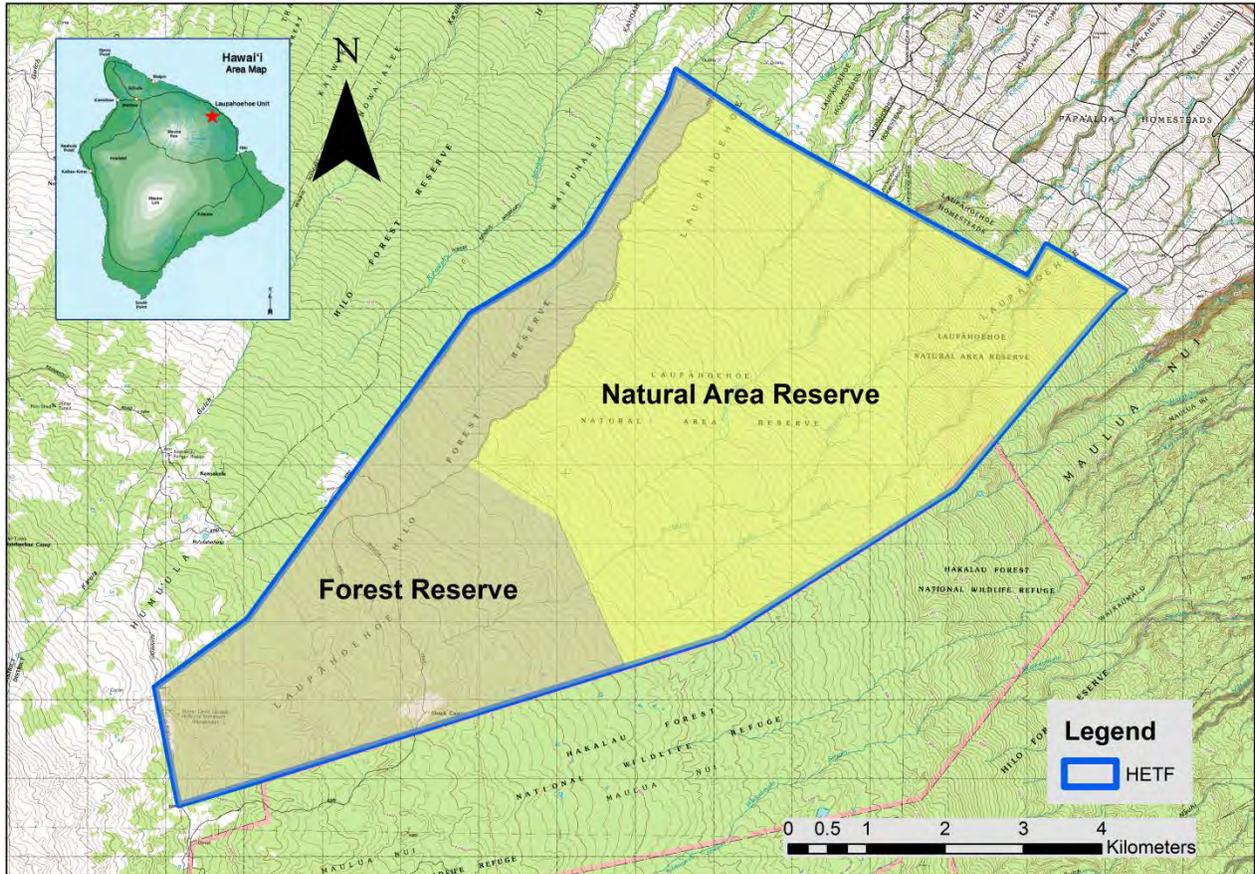
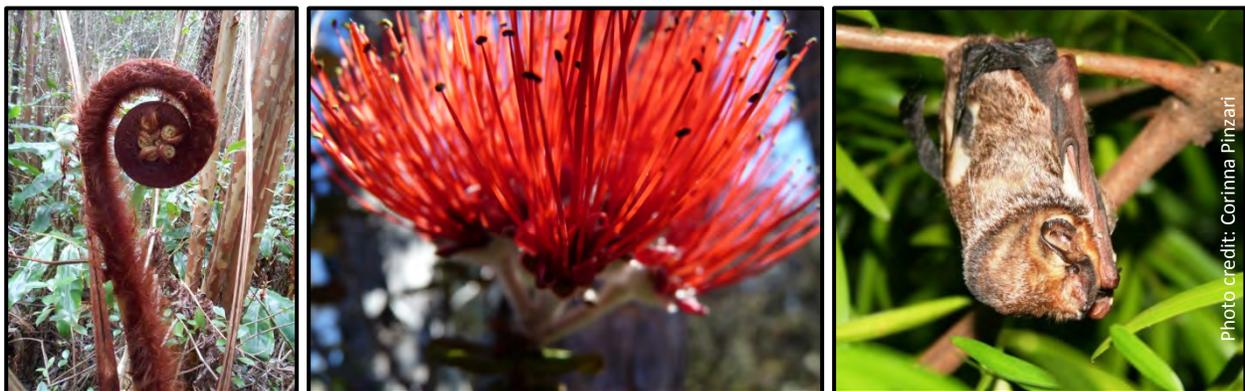


Figure 2: Map of the Laupāhoehoe Unit of the HETF, indicating the Forest Reserve and Natural Area Reserve land designations.



Photos (L-R): 1) Hapu'u fern shoot uncurling, 2) 'ōhi'a lehua, 3) ōpe'ape'a, Hawaiian hoary bat.

The Pu'u Wa'awa'a Experimental Forest Unit is located on the North Kona coast (Figure 3) of Hawai'i Island and incorporates three DLNR land designations. Approximately 31,475 acres (12,743 ha) are designated as Forest Reserve and together with the 3,806 acre (1,542 ha) Forest Bird Sanctuary (Wildlife Sanctuary), are managed through DOFAW. The remaining 3,530 acres (1,430 ha) are managed by the DLNR Division of State Parks. In addition there are approximately 74 acres (30 ha) of private in holdings within the HETF boundary. Tropical dry forests are considered among the most endangered forest types in the world, and in Hawai'i the few remaining remnants are severely threatened by wildfire, invasive plant species, and non-native ungulates.

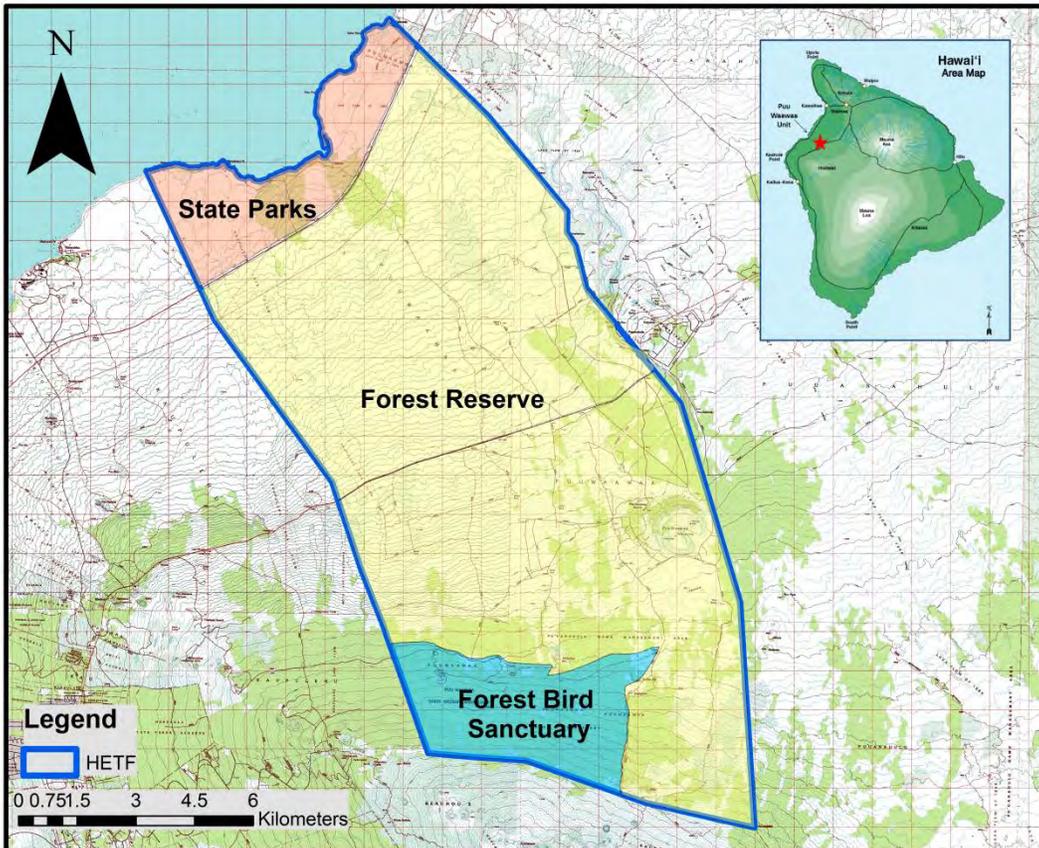


Figure 3: Map of the Pu'u Wa'awa'a Unit of the HETF, indicating the State Parks, Forest Reserve and Forest Bird Sanctuary land designations.



Photos (L-R): 1) A view of Pu'u Wa'awa'a taken from the Pu'u Anahulu bluff, 2) kokio flower, 3) aerial view of Kiholo bay.

The HETF's mission is to provide landscapes, facilities, and data/information to support research and education activities contributing to a better understanding of how to conserve and manage the biological diversity and functioning of tropical forest and stream ecosystems as well as to understand the human dimensions of natural resources conservation and management. The HETF represents a significant contribution in the global effort to understand and protect some of the most threatened and endangered ecosystems in the world. This can be accomplished in the following ways: facilitating research by providing research areas, facilities and information; fostering an environment for interaction and the exchange of information among scientists and to those outside the scientific community, and providing education and demonstration opportunities for those interested in tropical forest studies and management.

The report information herein is focused on the research and education activities that took place within the HETF in 2013 including annual reports received from researchers. Activity data from the previous four years is included in graphical data where relevant. Also included is information related to HETF facilities, research infrastructure and administration including concerns, comments, and challenges that took place relating to operations. Additional information regarding the HETF's history, future plans and annual reports as well as other resource documents can be found online at [www.hetf.us](http://www.hetf.us).

## Administration

Per the HETF Cooperative Agreement, "owing to the many values and benefits that arise from research, education and demonstration on the HETF and elsewhere, the Parties (*the USFS and the State of Hawai'i*) further agree they will consult and reach agreements with each other to coordinate research, management, and education activities". The HETF Planning Group was established to fulfill this objective and includes the USFS-HETF Line Officer, the USFS-HETF Science Lead, the USFS-HETF Facilities Manager, the Hawai'i Island DOFAW Branch Manager, the Hawai'i Island Natural Area Reserves Program Manager, the Hawai'i Island Forestry Program Manager, East and West Hawai'i Island Wildlife Biologists, the Pu'u Wa'awa'a coordinator, and two to three external partners. The HETF Planning Group is facilitated by the HETF Coordinator (USFS employee) and meets bi-monthly. See [Appendix C](#) for a list of HETF related personnel.

## Permitting

Permit applications for research and education activities are reviewed by a subset of the HETF Planning Group, the Research Technical Committee (RTC), which includes the USFS-HETF Line Officer, the Hawai'i Island DOFAW Branch Manager, the USFS-HETF Science Lead, the Natural Area Reserve Hawai'i Island Manager, the Forest Reserve Hawai'i Island Manager, East and West Hawai'i Island Wildlife Biologists, and the Pu'u Wa'awa'a coordinator. Permit processing and tracking is coordinated and administered by HETF staff. Signing authority for all permits within DOFAW managed lands lies with the Hawai'i Island DOFAW Branch Manager. All research permits are valid for one year and require an annual report. In Pu'u Wa'awa'a research permitting for the HETF is limited to land activities. Research activities that take place in water including the tide line are under the jurisdiction of the DLNR-Division of Aquatic Resources. Permits within State Parks are issued by, State Parks Hawai'i Island District Superintendent.

## Community Advisory Councils

Per the HETF Cooperative Agreement, "the Parties will consult with scientists, managers, general citizens, and local community members concerning ongoing research activities. Existing State sanctioned advisory councils may be utilized for this purpose". The Pu'u Wa'awa'a Advisory Council (PAC) has been in existence since 2002. The Laupāhoehoe Advisory Council (LAC) was formed in December 2010. Both

Councils participate in research permit application review and their comments and/or recommendations are provided to the RTC during the review process.

## Planning

In November 2013, the LAC reviewed an internal draft of the Laupāhoehoe Forest Management Plan. Plan content was solicited during public LAC meetings in 2012 and 2013. A public draft is expected for release by July 2014. As part of the information gathering activities for the management plan a forest bird survey was conducted in the spring of 2013.

## Funding

In addition to USFS staff time focused on HETF administration and development of the draft Laupāhoehoe Forest Management Plan, funds were expended on the HETF related activities and programs described below.

Laupāhoehoe Forest Management Plan - \$47,265 was expended on personnel devoted to data collection, gathering, and summarization for the draft plan as well as the production and distribution of outreach materials related to species found in Laupāhoehoe Forest.

AmeriCorps/Youth Conservation Corps – Specific to the HETF, \$26,000 in USFS Region 5 funds and \$3K in PSW/IPIF funding was expended to support several AmeriCorps programs.

## State Management and Research Activities

As mentioned previously, HETF lands are managed cooperatively by DOFAW and State Parks. State management activities and research and monitoring activities performed by State staff do not require HETF permits and are not tracked within this annual report. Management activity reports for each State land designation (Forest Reserves, NARS, Wildlife Sanctuary and State Parks) are available via annual reports to the Legislature. For information on the aforementioned reports, visit <http://hawaii.gov/dlnr/reports-to-the-legislature>.

## Facilities

### Laupāhoehoe Unit

HETF support facilities for the Laupāhoehoe Unit are present in two locations within the town of Laupāhoehoe but outside the forest boundary. The Laupāhoehoe Science and Education Center (Center) is located on 55 acres of old sugar cane lands within the Laupāhoehoe community, approximately four miles from the HETF boundary. Facilities include a bunkhouse, kitchen, restrooms, and classroom/meeting space. The facility site offers opportunities for research, education, and demonstration. A weather station, installed in 2009, is located onsite.

Additionally, there are plans to build a covered pavilion with restrooms and parking on a three acre fenced parcel directly below the Laupāhoehoe forest boundary. This site would serve as a stepping stone for education and outreach into the forest with the potential for restoration and other forest activities within the three acre fenced area. The potential date of construction for the facilities is unknown.

### Pu'u Wa'awa'a Unit

There are plans to build dedicated HETF facilities including a bunkhouse with kitchen, restrooms and classroom/meetings space for Pu'u Wa'awa'a. Facility locations have changed through time as

information is gathered and USFS fiscal policies change. Two sites are currently being considered for HETF facilities, either the old landing strip located within the DLNR Forest Reserve or a DLNR Land Division site located just outside the Forest Reserve within the community of Pu'u Anahulu. Non-exclusive use of specific DOFAW owned buildings are available for HETF related meetings and activities.

## Research Infrastructure/Databases

Long term climate monitoring equipment has been installed in both Units and the Laupāhoehoe Unit also includes hydrology monitoring equipment. HETF specific infrastructure was installed under Categorical Exclusions and Decision Memos are on file with the USFS. The HETF climate stations are part of the EPSCoR-ENDER (Experimental Program to Stimulate Competitive Research - Environmental Dynamics and Ecosystem Responses) Climate Network, an island-wide network of climate stations at locations across the island of Hawai'i.

Laupāhoehoe Unit equipment includes a stream gauge in Manowai'ōpae Stream (outside the forest boundary and managed by the USFS) and a free standing aluminum weather station located within the Forest Reserve. The purpose of the stream gauge is to measure natural stream flows, water quality and sediment in a non-destructive manner. The weather station, installed in 2009, extends 10 feet (3 m) above the forest canopy and collects daily rainfall, temperature, relative humidity, wind-speed, solar radiation (sunlight), soil moisture, soil temperature, and wind direction.

The Pu'u Wa'awa'a Unit hosts multiple weather stations including two in the Forest Reserve, installed in 2003 (RAWS station) and 2011, and one in the Forest Bird Sanctuary, installed in 2012. In addition to the Decision Memo on file for station installation, an Office of Conservation and Coastal Lands, District Use permit is also on file at the USFS.

Long term vegetation plots are available in both Units including:

- The Hawai'i Permanent Plot Network (HIPNET), <http://www.hippnet.hawaii.edu/>
- Forest Inventory and Analysis (FIA), <http://www.fia.fs.fed.us/>

Additionally, State management infrastructure (fencing) to protect plants is found within both Units. Detailed information regarding this infrastructure is found within the management plans for each unit.

- Pu'u Wa'awa'a - <http://www.puuwaawaa.org/index.html>
- Laupāhoehoe - a draft management plan is currently in progress. Release of a public draft is expected in July 2014.

## Awards and Accomplishments

### Human Diversity Award

The USFS received the Organization of Biological Field Station's (OBFS) Human Diversity Award in 2013. The OBFS Human Diversity Award provides recognition for unique activities, programs, or approaches (funded or unfunded) that increases the involvement, engagement, and sustainability of underrepresented groups in field science. Founded in 1963, the OBFS is a non-profit multinational organization representing field stations and research centers around the globe ([www.obfs.org](http://www.obfs.org)).

### Kupu Site of the Year Award

The IPIF received a Site of the Year Award in 2013 for its conservation education work with Hawaiian youth from Kupu, a nonprofit community organization that administers AmeriCorps programs in Hawai'i ([kupu.hawaii.org](http://kupu.hawaii.org)). The IPIF has hosted AmeriCorps members through three of Kupu's Hawai'i Youth

Conservation Corps sub-programs (the Gateway, Frontiers, and Extended Internship programs) since 2010. The AmeriCorps team members participated in ongoing restoration and invasive species control projects within the HETF and surrounding lands encompassed within the Mauna Kea Watershed Alliance. AmeriCorps team members worked with multiple site managers including staff members from DOFAW, Mauna Kea Watershed Alliance, and the USFS providing a broad range of interactions with multiple agencies.

### American Forests’ National Big Tree Program

American Forests’ National Big Tree Program is a conservation movement to locate, appreciate and protect the biggest tree species in the United States. Selected trees are called National Champions. In 2013 four trees from the Pu’u Wa’awa’a Unit of the HETF, kōlea lau nui, māmane, olopua and pāpala kēpau, were nominated by DOFAW staff and selected as National Champions (Figure 4). The mission of American Forests’ is to protect and restore forests, helping to preserve the health of our planet for the benefit of its inhabitants.

Common Name	Scientific Name	Tree Circumference (in.)	Height (ft.)	Crown Spread (ft.)
kōlea lau nui	<i>Myrsine lessertiana</i>	85.14	32	25.5
māmane	<i>Sophora chrysophylla</i>	165	24	25.5
olopua	<i>Nestegis sandwicensis</i>	204.52	32	42.58
pāpala kēpau	<i>Pisonia brunoniana</i>	520.46	28	15.25

Figure 4: 2013 American Forests' National Big Tree Program, national champion trees from Pu’u Wa’awa’a.

## 2013 Research Summary

Twenty-nine research applications were submitted and approved in 2013. Twenty-six projects were initiated (13 renewals and 13 new). Three projects went uninitiated, but the applicants are expected to reapply in 2014. See [Appendix A](#) for detailed information regarding research projects. HETF-related journal articles were published in *Evolution*, *Pacific Science*, *Ecosphere*, *Forest Ecology and Management* and more. See the “HETF Related Citations” section of this report for a complete list. Maps indicating the 2013 active research sites grouped by primary investigator within each Unit are provided in Figures 5 and 6.

2013 marks the highest number of active research projects within the HETF to date. Looking at the applicant categories since 2012, permit applications from the ‘University of Hawai‘i’ have nearly tripled (increasing 166%), while submissions from ‘Other Universities’ doubled, ‘Other Government Organizations’ quadrupled and ‘Others’ increased by 33%. Permits from the USFS have decreased by 25% with two USFS projects currently in hibernation. Projects listed in hibernation refer to inactive research plots (closed permits) but with plot markers remaining in the field in anticipation of future measurements. A few of the 2013 research projects are highlighted here.

- ***Impacts of strawberry guava management across a density gradient*** – Dr. Tracy Johnson of the IPIF began a project to measure impacts of strawberry guava invasion on native forest species and evaluate the effectiveness of biological and chemical control as tools for suppressing invasion and maintaining native forest health. This invasive fruiting tree forms dense, nearly impenetrable thickets that crowd native species, break up natural areas, and disrupt native animal communities. Without an effective and sustainable means of control, the invasive tree may eventually invade and degrade nearly half of the state's total land area. The biological control agent *Tectococcus ovatus*, a natural enemy from the native range of strawberry guava, will be transferred onto mature trees in half Dr. Johnson's study plots. The insect generates galls on new leaves, over time suppressing growth and reproduction. After the biological control has established, chemical treatments will be applied to half of the plots with and without biocontrol. The effectiveness of these different treatments will then be evaluated as a function of strawberry guava density will help to develop management options for broader application. *Dr. Johnson received a prestigious USDA Secretary's Honor Award in the category of protecting natural resources. Dr. Johnson led the USFS's international search to identify insect species for use as host-specific biological control agents against invasive plants in Hawai‘i. His 13 year effort culminated in the release of leaf gall-forming scale insects to help regulate the strawberry guava invasive plant species.*
- ***Assessing the Scotorythra paludicola (Lepidoptera: Geometridae) outbreak on koa: population abundances, rates of parasitism and patterns of spread*** – An outbreak of the native koa moth (*Scotorythra paludicola*) was first detected on Hawai‘i Island in January 2013. At that time, a large section of koa along the Hamakua Coast had already been defoliated by the koa caterpillar. Beginning in February 2013, Robert Peck (University of Hawai‘i at Hilo), Paul Banko (U.S. Geological Survey) and Will Haines (University of Hawai‘i at Mānoa) began studying the outbreak along Blair Road within Laupāhoehoe forest. Caterpillars of the koa moth feed almost exclusively on koa, and at population levels found during outbreaks, often consume all foliage on koa trees. The main goals of the project were to monitor abundances of koa moths and caterpillars over time, track the progression of the outbreak, and examine factors that bring the outbreak under control. Since the onset of the outbreak, extensive sections of koa forest were defoliated along Blair Road on three occasions: early-mid March 2013, early-mid August and mid-late January 2014. The first two defoliations occurred between approximately 800 and 1200

m elevation while the third defoliation was limited to about 845 and 915 m elevation. Measurements of moth populations identified peaks in abundance beginning in mid-April 2013, early September 2013 and late February 2014. The interval between the defoliation and the peaks in moth abundance represents the time that the caterpillars were in the pupal stage. The team was unable to monitor caterpillar abundance and rates at which caterpillars were parasitized because koa foliage was generally too high above the forest floor to sample. Parasitoids known to attack koa caterpillars were collected in malaise traps throughout the study, but results have not yet been analyzed.

- ***Sandalwood sampling*** – Hawai'i's once abundant stands of sandalwood are mostly gone today with only remnants surviving on public and private land. Commercial logging of Hawaiian sandalwood is legal and does occur on private land. A study conducted by Paul Chang and the Clark R. Bavin Forensics Laboratory of the US Fish and Wildlife Service, Office of Law Enforcement, obtained sandalwood samples needed to create a baseline standard upon which samples from commercial shipments can be compared. Although legal sandalwood logging on public land no longer occurs, the significant value of the wood continually provides incentive for obtaining wood illegally. Modern forensics can test for unique characteristics in heartwood to determine the species of wood down to the sawdust level. For example, a sample of wood chips (taken from a shipment headed for China) can be compared to an established standard to determine the species in the shipment. Currently there is no standard available for the three species of Hawaiian sandalwood focused on during this study. This effort will hopefully provide those standards. Two of the three species, *S. paniculatum* and *S. ellipticum*, occur on Hawai'i Island. Establishing a standard to test sandalwood samples from commercial shipments will allow for improved monitoring of the volume and types of sandalwood being exported.
- ***Documenting acoustic variability and loss of song complexity in Hawaiian Honeycreepers*** - With recent declines in native forest bird populations across Hawai'i Island, research has begun to document the consequences of decreasing bird numbers. Joshua Pang-Ching a University of Hawai'i at Hilo, Tropical Conservation Biology and Environmental Science (TCBES) Master's Program student, conducted a study seeking to document the possible loss of acoustic complexity and song variability, a well-documented consequence of bird population decline, in the Hawai'i 'akepa (*Loxops coccineus coccineus*) and the Hawai'i creeper (*Oreomystis mana*). The main effects of small population size include the loss of genetic variation, gene flow, and various other allele effects such as density dependence and individual fitness. Similar consequences can also occur in the acoustic structures of songbird species. Complexity of song components and variability within a population's song pool can dramatically decrease with population declines, with much faster rates than genetic variation. Based on historic evidence the Pu'u Wa'awa'a Forest Bird Sanctuary is one of the few remaining areas on the island where both species are believed to be surviving. By recording the vocalizations of both bird species within the Sanctuary and comparing their complexity to other remnant populations, researchers may be able to demonstrate the uniqueness of each species within the Sanctuary and reiterate the need for their continued management.
- ***Examining the effect of invasive thrips infestation on natural and planted Hawaiian Myoporum seedlings*** - Corie Yanger a University of Hawai'i at Hilo, TCBES Master's Program student, began examining the invasive insect *Myoporum* thrips and its impacts on the native naio tree on Hawai'i Island. These insects feed on naio and can cause widespread leaf damage and tree loss across the dry forest where naio makes up roughly half of the forest canopy, including within the Pu'u Wa'awa'a Forest Reserve. DOFAW staff and University of Hawai'i at Mānoa researchers have been monitoring thrips damage to mature naio trees since 2010 but,

there is little information about how the thrips affect seedling growth and survival. Understanding how thrips affect naio seedling establishment is important because the seedlings will be the future mature trees. To understand how invasive *Myoporum* thrips impact naio seedlings, natural native seedlings between 3600 and 5000 ft in elevation be will counted and measured. Seedlings will be labeled and revisited every month for one year and measurements including height, total number of leaves, number of healthy leaves, number of infested leaves and infestation level, will be documented. Data is still currently being gathered for analysis.

- ***Sources and fates of nutrients on a substrate age gradient across the Hawaiian archipelago and their consequences for forest dynamics*** - Initiated in 1990 by Dr. Peter Vitousek of Stanford University, this project is designed to determine what controls the development of soils and ecosystems in the long term. It is focused on the sources of biologically important elements, and on determining which elements control the growth of native forests and why. Much of the research in the Laupāhoehoe area is carried out as part of a soil age sequence across the Hawaiian Islands that include six sites ranging from 300 year-old soils on Kilauea to about 4.1 million year-olds soils on Kauaʻi. The project is built around three fertilizer experiments on ancient soils at Nā Pali-Kona Forest Reserve on Kauaʻi, highly productive soils at Laupāhoehoe, and infertile young soils near Hawaiʻi Volcanoes National Park. The main focus is to understand what controls soil fertility, plant productivity, and biological diversity along the range from fairly new rock to ancient soils. The Laupāhoehoe site is the largest-stature and highest-nutrient forest along the gradient, and so it gives a clear idea of what is possible given those conditions of elevation and rainfall. Many aspects of ʻōhiʻa forest ecosystems occur more quickly at Laupāhoehoe than on younger or older soils, from the turnover of canopy leaves to the decomposition of ʻōhiʻa leaf litter. For additional findings on this research see: *Vitousek, Peter M. Nutrient Cycling and Limitation: Hawaii as a model system Princeton University Press 2004.*

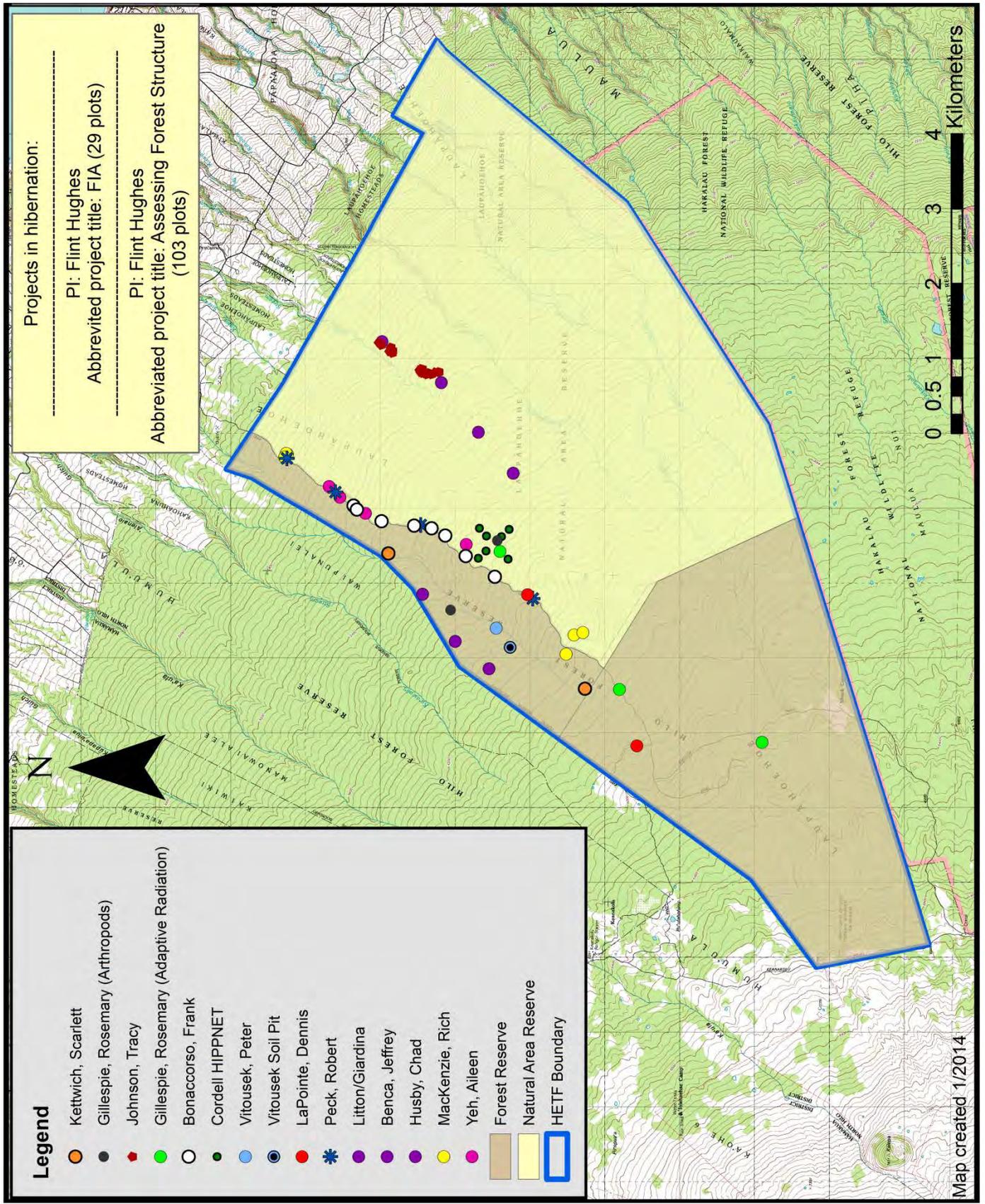


Figure 5: Map indicating all 2013 active research projects within the Laupāhoehoe Unit.

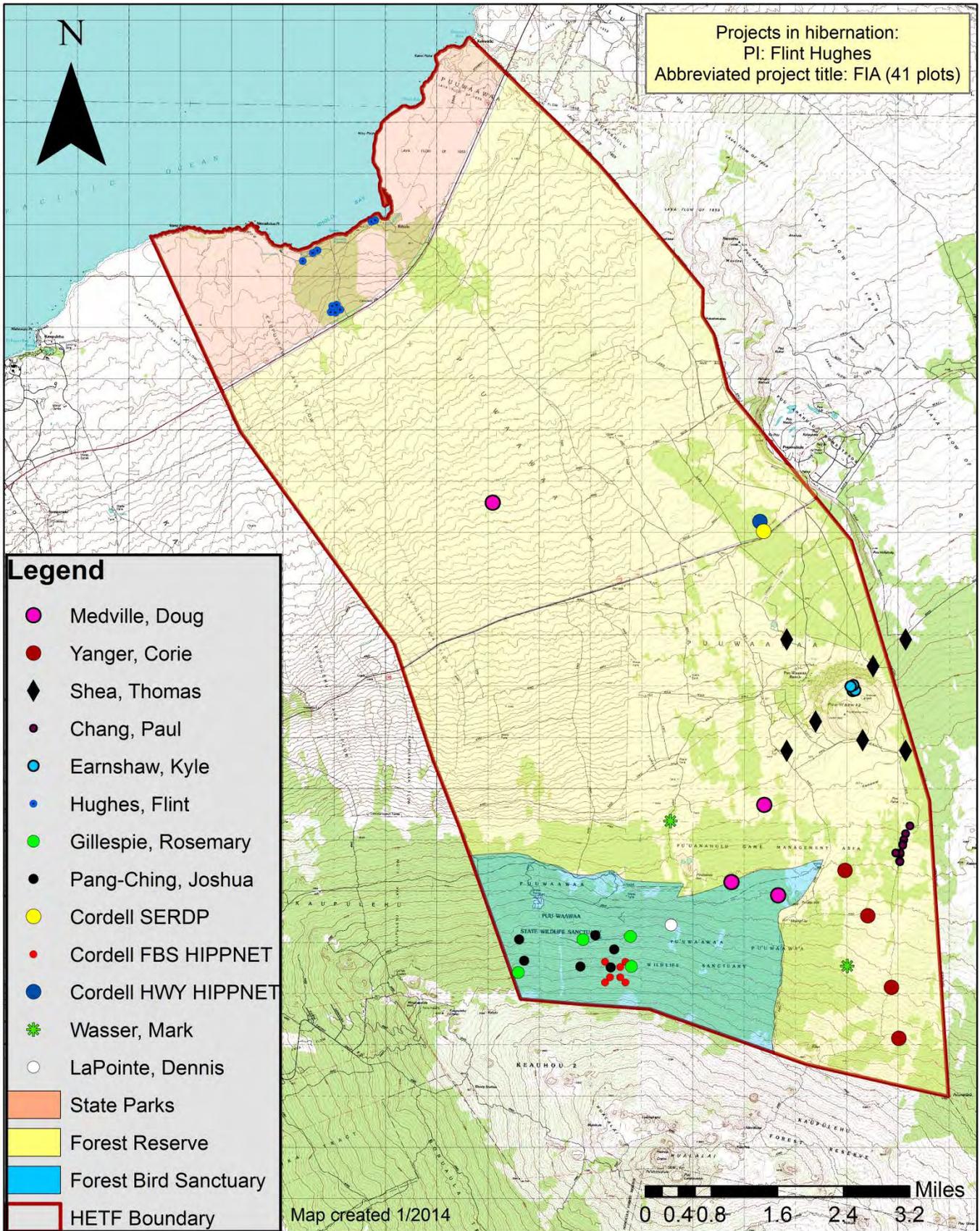


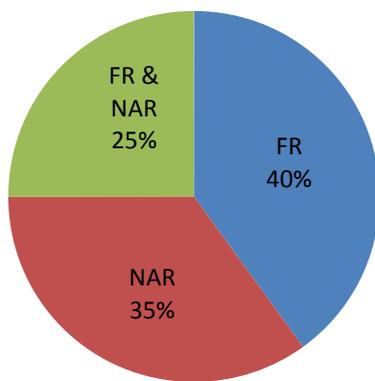
Figure 6: Map indicating all 2013 active research projects within the Pu'u Wa'awa'a Unit.

Research project locations may be specific to an HETF Unit or take place within both Units. Likewise, research projects can be restricted to specific State land designations or occur within multiple State land designations. Fourteen of the 26 projects initiated in 2013 were located in the Laupāhoehoe Unit, ten occurred within the Pu‘u Wa‘awa‘a Unit, and two research projects were conducted in both Units (Table 1). Figure 7 shows the percentage of 2013 HETF research projects grouped by State land designation. Figure 8 shows research affiliation for projects within the HETF over a five-year period 2009-2013. In Pu‘u Wa‘awa‘a research permitting for the HETF is limited to land activities. Research activities that take place in water including the tide line are under the jurisdiction of the DLNR-Division of Aquatic Resources.

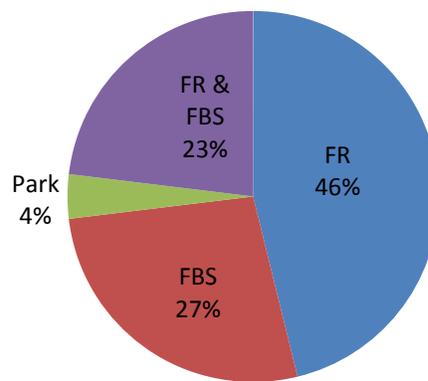
**Table 1: Total number of research projects initiated in the HETF per year and grouped by Unit from 2009-2013.**

Year	Laupāhoehoe Unit Only	Pu‘u Wa‘awa‘a Unit Only	Both HETF Units	Total # of Projects Initiated
2013	14 (54%)	10 (38%)	2 (8%)	26
2012	8 (44%)	8 (44%)	2 (12%)	18
2011	5 (42%)	5 (42%)	2 (16%)	12
2010	8 (44%)	9 (50%)	1 (6%)	18
2009	10 (59%)	6 (35%)	1 (6%)	17
<b>Total</b>	<b>45</b>	<b>38</b>	<b>8</b>	<b>91</b>

### Laupāhoehoe



### Pu‘u Wa‘awa‘a



**Figure 7: Percentage of HETF research projects grouped by state land designation in 2013. (NAR=Natural Area Reserve, FR=Forest Reserve, FBS=Forest Bird Sanctuary, and Park=State Parks)**

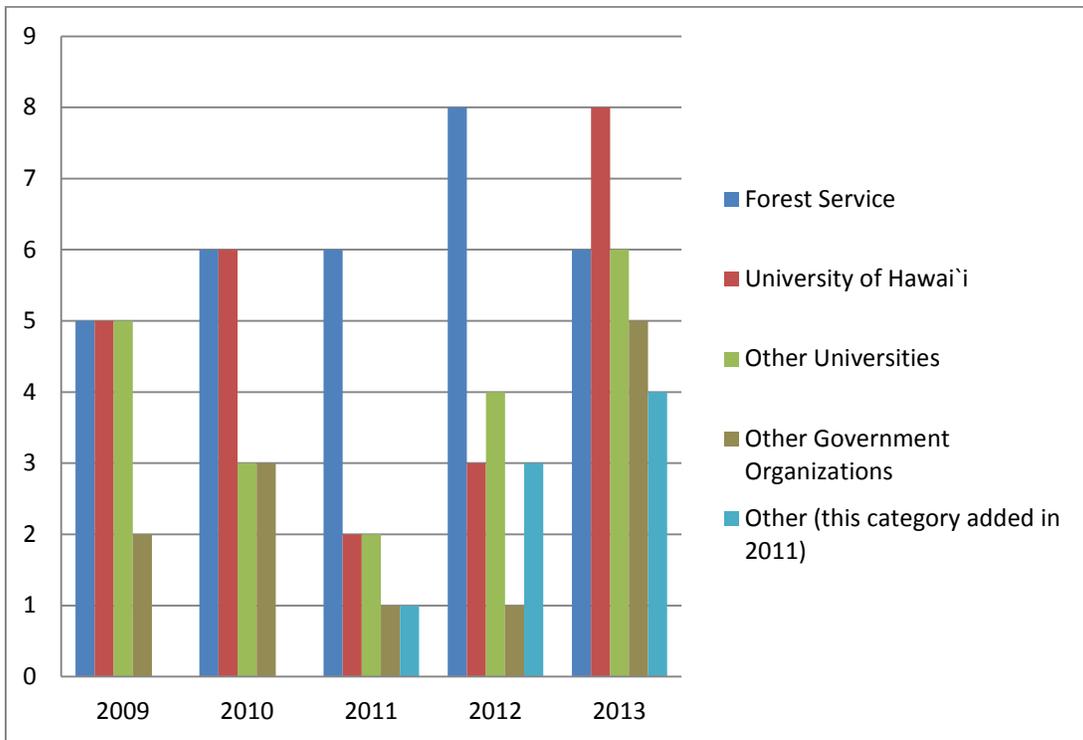


Figure 8: Affiliation for research projects initiated and ongoing within the HETF from 2009-2013.

## 2013 Education, Outreach and Access Activity Summary

This section highlights various non-research program activities, as well as specific Unit education, outreach, and access details that occurred within the HETF in 2013.

### Hawai'i Youth Conservation Corps

2013 marked the second year Hawai'i received National Forest System funding in support of Youth Conservation Corps (YCC) programs through Region 5. The Region 5 funding (\$26K) supported a five-member Gateway team. Additionally, IPIF supported two weeks of Gateway team time as well as 4 Frontiers interns, and one Extended Internship position. Gateway program members gained introductory experience in all aspects of natural resource management, working in both HETF Units, as well as other conservation areas managed by agency partners, such as the DOFAW, Mauna Kea Watershed Alliance, Hakalau National Wildlife Refuge and the Office of Mauna Kea Management. Furthermore, the four Frontier interns received more intensive, one-on-one mentoring from USFS or State of Hawai'i staff, concentrating on a single worksite/project through-out the summer. For additional information about the 2013 IPIF/HETF YCC activities and accomplishments, see [Appendix D](#).



Photos (L-R): YCC Gateway crew members planted 544 trees and understory species at Hakalau National Wildlife Refuge; crew controlling weeds in Laupāhoehoe Forest.

## Manaulu Manowai'ōpae

The USFS is a partner with Laupāhoehoe Community Public Charter School (LCPCS) and works with the school's teachers and administration on ways to integrate curriculum with hands on experience both in and out of the classroom. Graduate student James Akau has been working with the LCPCS to increase student exposure to local natural and cultural resources, and teach conservation and restoration through the Manaulu Manowai'ōpae program. The program currently focuses on three components. The first component involves working with students in dry land food gardens or *mala'ai*. LCPCS is the first school in Hawai'i to receive a USDA Farm to School grant. Seeds and plants were donated to the school and roughly 20 pounds of food are produced daily. The produce is then prepared by the cafeteria for student consumption. The second component of the project focuses on beekeeping. Students gain hands on experience working with bees, learning about pollination and understanding the bee's connection to the garden as pollinators. Finally, the third component is *haloa*. *Haloa* emphasizes long-term *kokua* (help; aid), *kako'o* (support) and *laulima* (many hands), cultural values practiced when growing food and working the land. The children experience growing, harvesting, pounding, and eating *kalo* (taro) which is a culturally important food source in Hawai'i.



Photos (L-R): James Akau instructs LCPCS students on how to sow seed and LCPCS students wearing their bee suits.

## Laupāhoehoe Unit

Thirteen participants on two trips visited the Laupāhoehoe Unit in 2013 (Table 2). Cheyenne Perry, the Mauna Kea Watershed Alliance Coordinator lead a group of watershed partners to discuss general forest attributes as well as current Laupāhoehoe forest management and access issues. The USFS Director of Engineering made a site visit to Laupāhoehoe Science and Education Center as well as the 3 acre field education site. A breakdown of trip totals, affiliation and type from 2009-2013 is detailed in Figure 9.

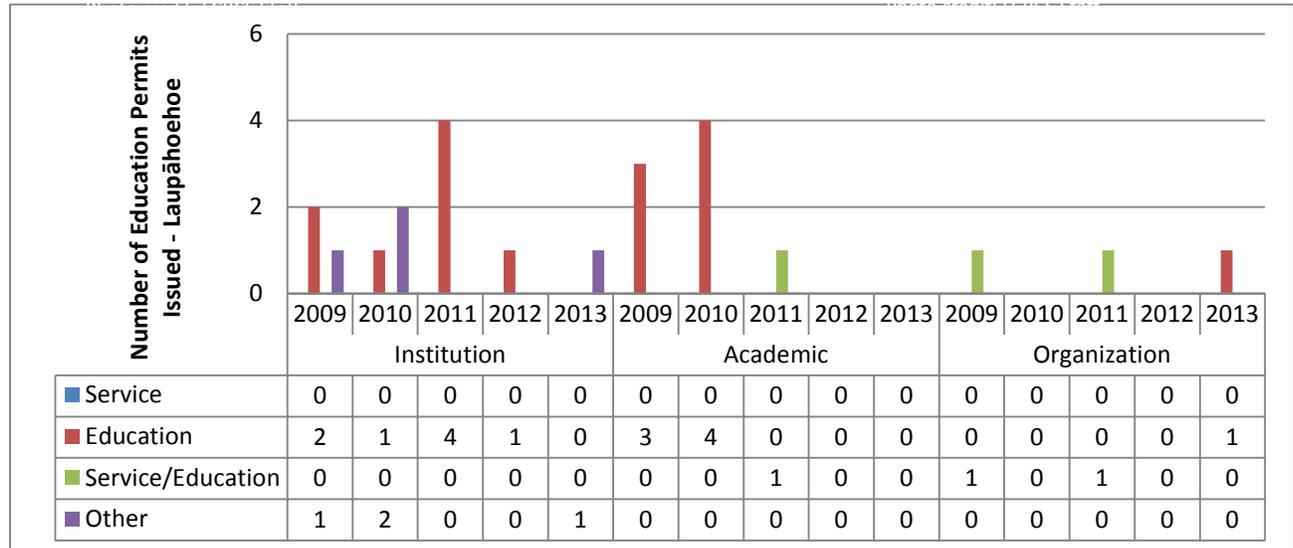


Figure 9: Trip totals, affiliation and type of education/service/other trips taken in the HETF Laupāhoehoe Unit from 2009-2013.

Table 2: Information relating to 2013 education/service/other trips taken in the HETF Laupāhoehoe Unit.

Organization		Participant Age	Activity	Service Provided	Contact	Date	Group Size
USFS	Government Agency	Adult	Other		Jerry Carlson	1/15/2013	3
Mauna Kea Watershed Alliance	Non-profit	Adult	Education		Cheyenne Perry	9/6/2013	10

## Pu'u Wa'awa'a Unit

Five hundred participants on 22 trips visited the Pu'u Wa'awa'a Unit in 2013 (Table 3). The high number of participants, compared to the Laupāhoehoe Unit, who are able to visit, work, and learn in Pu'u Wa'awa'a is in a large part due to the presence and availability of onsite DOFAW staff that lead, participate in, and facilitate these activities. The existing road and facility infrastructure in Pu'u Wa'awa'a Forest Reserve also play an important role in making these trips possible. The continued presence and availability of onsite staff is necessary for Pu'u Wa'awa'a to be able to continue to support this level of public interaction. A further breakdown of trip totals, and affiliation and type from 2009-2013 is detailed in Figure 10, with additional details in Figure 11. A few of the 2013 HETF education trips are detailed here.

- *Cindy Navarro-Bowman of Honoka'a High & Intermediate School* and students installed student designed watering systems in the rare plant outplanting area inside the reservoir enclosure at Pu'u Wa'awa'a. Students returned regularly throughout 2013 to collect data on plantings and document reforestation progress. Other topics discussed during their visits include species identification, dry forest ecology, conservation, and the natural history of the area.
- *Jon Hayashi of the Boy Scouts of America, Aloha Council Troop 1078* spent 3 days and 2 nights at Pu'u Wa'awa'a with a group of 25 participants. Participants took part in a reconnaissance hike of the Forest Reserve area with a discussion emphasis of the impact of non-native mammals on the ecosystem. Participants also learned orienteering/map reading skills used in conjunction with visible landmarks, and the troop participated in an outplanting led by Pu'u Wa'awa'a coordinator Elliott Parsons.
- *Orlando Oxiles of the DLNR, Division of Conservation and Resource Enforcement* conducted the 2013 Hawai'i Conservation Wilderness Education Project (HCWEP) at Pu'u Wa'awa'a. This is a camp for youths between the ages of 10 to 13 years old. The camp expands upon the basic hunter education course by involving the students in hands-on activities in each of the HCWEP course segments which include: nature walks orienteering with compass/GPS, archery, 22 rifle, shotgun, muzzle loader, firearms cleaning, practice/mock hunting, and motivational speaking.

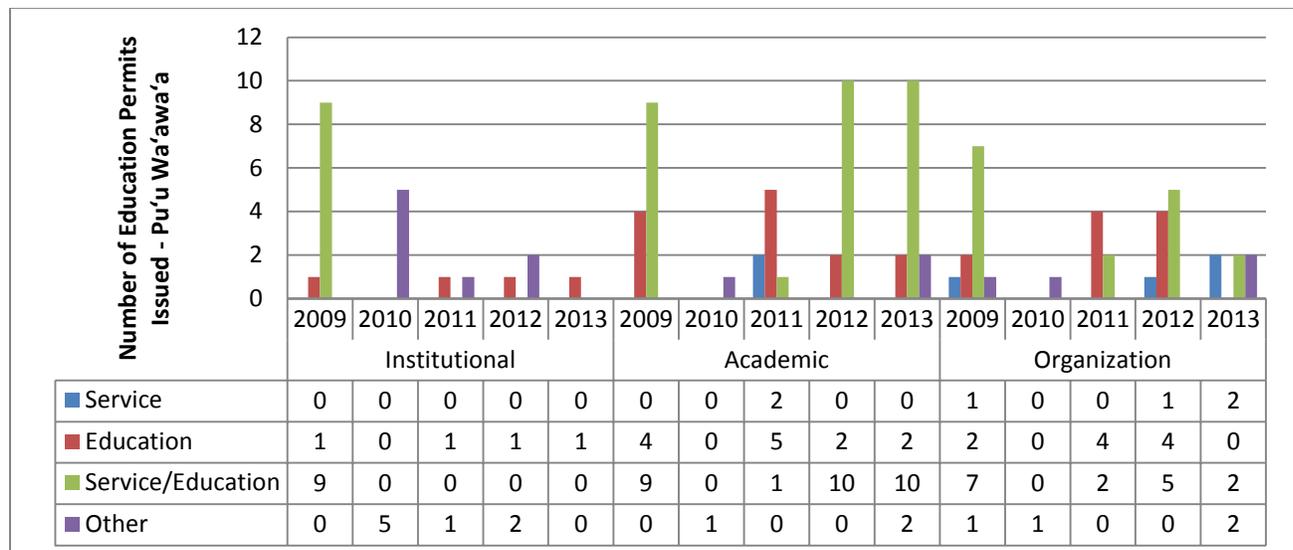


Figure 10: Trip totals, affiliation and type of education/service/other trips taken in the HETF Pu'u Wa'awa'a Unit from 2009-2013.

**Table 3: Information relating to 2013 education/service/other trips taken in the HETF Pu'u Wa'awa'a Unit.**

Organization		Participant Age	Activity	Service Provided	Contact	Date	Group Size
American Association of University Women	Non-profit	Adult	Other		Susan Hicks	1/19/2013	21
Hartwick College	School	College	Education		David Griffing	1/22/2013	22
The Kohala Center	Non-profit	Intermediate grades 6-8	Education/Service	Outplanting	Erica Perez	2/1-2/2013	38
UH Hilo	School	College	Education/Service	Outplanting	Jenna Waipa	2/10/2013	10
Honoka'a High & Intermediate School	School (DOE)	Intermediate grades 6-8	Education/Service	Outplanting, clearing around plants, weeding	Cindy Navarro-Bowman	2/11/2013	32
Cornell University	School	College	Education/Service	Outplanting	Alexandra Moore	2/20-21/2013	22
E Mau Na Ala Hele	Non-profit	Adult	Other	Outplanting	Barbara Schaeffer	2/23/2013	20
Honoka'a High & Intermediate School	School (DOE)	Intermediate grades 6-8	Education/Service	Outplanting, clearing around plants, weeding	Cindy Navarro-Bowman	3/8-9/2013	35
UH center at West Hawaii	School	College	Education/Service	Outplanting	Richard Stevens	3/22/2013	15
Honoka'a High & Intermediate School	School (DOE)	Intermediate grades 6-8	Education/Service	Clear around plantings	Cindy Navarro-Bowman	3/28/2013	25
Honoka'a High & Intermediate School	School (DOE)	Intermediate grades 6-8	Education/Service	Clear around plantings	Cindy Navarro-Bowman	5/4/2013	10
Kona Hiking Club	Non-profit	Adult	Other		Kathleen Johnson	5/18/2013	25
Boy Scouts of America, Aloha Council Troop 1078	Non-profit	Ages 11-17	Education/Service	Outplanting	Jon Hayashi	5/25-27/2013	25
Waimea Boy Scouts	Non-profit	Ages 11-17	Service	Invasive plant removal	Glenn Bertelmann	6/1/2013	18
Honoka'a High & Intermediate School	School (DOE)	Intermediate grades 6-8	Education/Service	Outplanting & weeding	Cindy Navarro-Bowman	6/10/2013	13
DLNR/Division of Conservation & Resources Enforcement	State Agency	Intermediate grades 6-8	Education		Orlando B. Oxiles	7/10-14/2013	31
Boy Scouts of America	Non-profit	Ages 11-17	Service	Outplanting	Elrey Tupe	9/28/2013	30
Honoka'a High & Intermediate School	School (DOE)	Intermediate grades 6-8	Education/Service	Watering & clearing around plantings	Cindy Navarro-Bowman	10/21/2013	32
Honoka'a High & Intermediate School	School (DOE)	Intermediate grades 6-8	Education/Service	Clear around plantings	Cindy Navarro-Bowman	11/16-17/2013	35
DLNR/Division of Forestry and Wildlife	State Agency	Adult	Education		Elliott Parsons	11/20/2013	16
UH - Windward Community College (WCC)	School	College	Education/Service		Floyd McCoy	12/2/2013	21
Spatial Data Analysis and Visualization Lab - UH Hilo	School	College	Other		Nicolas Turner	12/16-19/2013	4

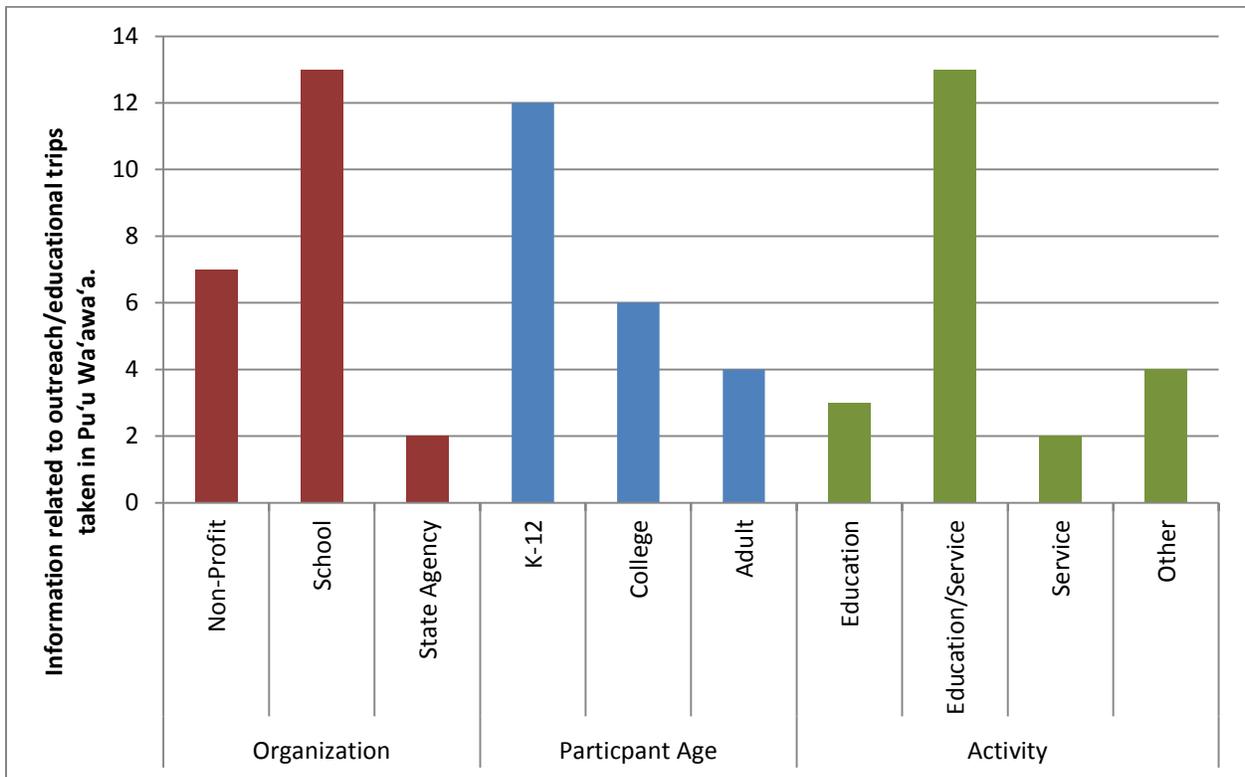


Figure 11: Information relating to the types of groups, age of participants, and types of activities performed during outreach/education trips taken within the HETF Pu'u Wa'awa'a Unit in 2013.

## 2013 HETF Concerns, Comments, and Challenges

### Laupāhoehoe Unit

*Submitted by researchers via annual reports:*

- A 4WD is necessary to access many points of the forest reserve, in both Units of the HETF.
- Challenges stem from safely accessing the remote regions in the HETF.
- Researchers in the Laupāhoehoe Unit had field sites vandalized, gear had been moved and/or removed, and guylines had been cut off poles at one site. Also there was one attempted theft of gear from the back of researcher's vehicle.
- Getting through all four gates by oneself can be cumbersome.
- HIPNET researchers have made significant progress on communication with the Laupāhoehoe community by actively engaging in dialogue about the relevance of their work at LAC meetings as well as making compromises through removal of rebar in the plot. All known rebar associated with the HIPNET plot has been removed as of October 2010.
- Terrain is hard to navigate within the Laupāhoehoe Unit.

*Submitted by USFS staff:*

- Feedback received from the Laupāhoehoe Advisory Council (LAC) and other community members highlight the need to increase community outreach activities for Laupāhoehoe Forest and in communicating the value and findings of scientific research to the community.
  - In 2013 two research projects in Laupāhoehoe Forest were discussed during LAC meetings with concerns relating to using nails as markers in trees and bird mist netting and banding. LAC review is part of the research permitting process. To address those concerns speakers involved with the research presented an overview of their work and were available to answer questions and address concerns. For the HIPNET research project which uses nails as identifying points for long term re-measurement, Dr. Becky Ostertag (UH-Hilo) and Dr. Christian Giardina (USFS) attended the November 13, 2013 meeting. For bird mist netting and banding, Dr. Eben Paxton with the US Geological Survey attended the September 11, 2013 meeting. In addition, Dr. Tracy Johnson (USFS) presented at the July 10, 2013 LAC meeting to introduce his project to monitor the release of a bio-control agent to combat strawberry guava infestation as his permit was being reviewed.
  - Efforts to further address the feedback received above are being planned for 2014.
- Feedback received from the LAC and other community members also included concerns that research related trash is being left in the forest. There is a long history of research activity in Laupāhoehoe Forest that pre-dates the establishment of the HETF. There are both historic and what appears to be more recent research related items that have been abandoned in the forest.
  - The USFS and DOFAW are working to address these concerns in three ways that will apply to both Pu'u Wa'awa'a and Laupāhoehoe:
    - 1) Clean Up: Agency personnel are cleaning up remnants from completed or abandoned research projects when such sites are located. Site locations are reported from forest users as well as historic study site locations being surveyed by agency staff. An example includes several long pieces of window screening used to collect leaf litter reported by both a research user and members of the hunting community. USFS staff located and removed the screening on July 19, 2013. In December 2013 USFS staff did site reconnaissance to locate and GPS several study sites installed in the 1970's and survey the need for cleanup.

While various research related activities have since occurred in those plots they were no longer part of any active research permits. USFS staff plan to remove the located infrastructure in 2014 after discussing the State's interest in maintaining any of the fenced units. Infrastructure primarily includes old fenced units, some of which are still intact.

- 2) Updating the HETF research application including the adoption of a responsible research statement: Suggestions to further highlight expectations for research permittees in regards to good stewardship have been offered by community members as well as HETF Planning Group members. These suggestions including a responsible research statement will be included in the next revision of the HETF permit application scheduled for 2014.
- 3) Creating a forest protocol video: A desire to produce a video that outlines appropriate forest protocol has been discussed since HETF establishment. The completion of such a video would offer an additional avenue to promote forest stewardship and address the concern of any trash being left in the forest. The viewing of such a video could be part of the research permit application guidelines though this would be hard to ensure. USFS staff will pursue completion such a video for a completion date of late 2015.
  - It is possible that in spite of the efforts to correct this issue moving forward that abandonment of research infrastructure may still occur from time to time. The USFS and DOFAW are committed to following through on any outlined repercussions for such behavior, continuing to promote good stewardship protocols for all research activities and cleaning up study sites as needed.

### **Pu'u Wa'awa'a Unit**

*Submitted by researchers via annual reports:*

- A 4WD is necessary to access many points of the forest reserve, in both Units of the HETF.
- Challenges stem from safely accessing the remote regions in the HETF.
- Prolonged drought conditions were a challenge to some researchers.
- Routine natural challenges encountered include accessing cave entrances, avoiding native vegetation when traversing the flows, not disturbing bird bones and other features in the caves while surveying, and working within constraints imposed by poor weather, property closures due to fire danger and drought, and other HETF constraints on access.
- It takes an extensive time to analyze each bird recording. It involves prolonged visual and listening surveys.

*Submitted by USFS/DOFAW staff:*

- Remnants from completed or abandoned research projects and trash from uncontrolled public use of Kīholo have been found in the Pu'u Wa'awa'a Unit. In 2013, USFS and DOFAW staff cleaned up and removed a couple of large garbage bags of trash at Kīholo while working on a USFS research project.

### **Prior HETF Concerns, Comments, and Challenges still ongoing:**

- How do the new Wildlife Administration rules apply to the existing USFS permit to use State lands?

## 2013 Annual Reports Received

Annual reports received from researchers are listed alphabetically in this section. Annual reports are due within one year of project initiation. The included annual reports were submitted either with renewal applications or at the termination of a research project and pertain to the previous year's work. All information submitted in these annual reports, are included as is. We do not add any diacritical marks, correct punctuation, capitalization or grammatical errors.

**Amsili, Joseph - Soil development on the trachyte flow (100,000-105,000 years old) vs. on the Hawi flow (140,000-260,000 years old) on Kohala Mtn. at a site with similar precipitation.**

Submitted: March 30, 2012

**Project Location(s):** Puu Waawaa Forest Reserve  
**HETF Annual Report for Project Period:** 04/2012-05/2012

**Status Update** (including any significant findings):

Initially the proposal was to compare soil development on similar age flows, namely the trachyte flow (100,000-105,000 years old) vs. on the Hawi flow (140,000-260,000 years old) on Kohala Mtn, and at sites with similar precipitation through the lens of mineral control of organic matter storage. The three soil pit descriptions on top of Pu'u Wa'a Wa'a confirmed that the web soil survey description of Pu'u Wa'a Wa'a as Pu'u Pa was wrong and was based off of the 1973 Soil Survey for the Big Island and the currently the Soil Survey is being updated. The description of the three soil pits on top of the Pu'u ended up being an exercise in seeing how accurate my descriptions were compared to the staff at NRCS-big island because they had actually recently described a Pu'u Wa'a Wa'a soil series (which I didn't find until later). So there are no real significant findings.

**Timeline** (including overall expected completion date):  
04/2012-05/2012

**Changes to Methodology** (or other aspects of the project):

Methodology remained the same except that I didn't send the soil samples to Oliver Chadwicks lab and that I didn't pursue this research question further after my conversation with Robert Gavenda (see below).

**Noteworthy Observations** (including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):

**Challenges** (encountered while working in the HETF):

An email from Robert Gavenda, NRCS USDA-NRCS Pacific Islands Area - West Soil Scientist, pointed out to me that my research question and hypothesis wasn't well thought out enough. Therefore I ended up not sending the soil samples from 35cm depth to Oliver Chadwicks lab because these soil samples don't represent higher silicic material associated with the trachyte flow. Here's Robert Gavenda's email that he sent me: "The Waawaa soil on PW is not associated with the trachyte flow that forms PW. The Waawaa soils developed on ash that accumulated long after PW trachyte erupted. The ash is comes from the slow accumulation from numerous eruptions of widely scattered cinder cones and possibly some of the calderas. Especially if you're sampling at 35cm depth you will not be sampling soils with higher silica associated with the PW rock. Any soil developed on PW bedrock has been buried by meters of volcanic ash that originated many miles from PW. Unless your sampling site actually has trachyte rock outcrops close to the surface, it is highly unlikely that the soil you sample will have anything to do with the underlying bedrock, other than it just happened to accumulate there. The soils you sample will be much younger than soil on the Hawi flows on Kohala and you may indeed find differences in mineralogy and OM accumulation. The surface area of minerals in the young soil at 35 cm may be different than the older weathered ash on Hawi lavas".

**Bibliography of Publications** (Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):

None to date

## Cordell, Susan and Colleagues – Hawaii Permanent Plot Network

Submitted: December 2013

**Project Location(s):** Laupāhoehoe NAR and Pu‘u Wa‘awa‘a Forest Reserve and Wildlife Sanctuary  
**HETF Annual Report for Project Period:** 05/2011 - 12/2013

### **Status Update** *(including any significant findings):*

Our long-term goal in the Hawai‘i Permanent Plot Network (HIPNET) is to establish several large-scale, permanent plots in native-dominated forest across elevation and precipitation gradients throughout the Hawaiian Islands. Long-term forest dynamics plots have been established worldwide; these plots establish Hawaii as part of the Center for Tropical Forest Science (CTFS) network ([www.ctfs.si.edu](http://www.ctfs.si.edu)). The Laupāhoehoe plot represents montane wet forest, the Pu'u Wa'awa'a Wildlife Sanctuary plot represents montane mesic forest, and the Mamalahoa plot represents ohia dry forest. In 2013 we began doing our 5-year resurvey of the 4-ha Laupāhoehoe plot. In previous years we only resurveyed 10% of that plot (after initial survey in 2008/2009). We continue to resurvey the Mamalahoa and Pu'u Wa'awa'a plots annually.

Based on previous analyses, diameter growth in Laupāhoehoe ranged from -0.06-0.71 cm yr<sup>-1</sup> and in Pu'u Wa'awa'a ranged from -0.07-0.40 cm yr<sup>-1</sup>. Species-specific mortality rates were 0.6-5.1% yr<sup>-1</sup>.

Only seven species recruited. Olapa, Ohia, Hapuu, Koa, Kolea, and Pilo at Laupāhoehoe and Ohia, Koa, and Mamaki at PWW.

Despite very low species diversity and slow growth rates, Hawaiian forests are structurally similar to other tropical forests, and consistent with global trends for relationship of forest structure to climate. These results are now being reworked with the more updated data available. We are currently working on correlating tree growth and mortality to climate. The long-term nature of these data will serve as an important baseline to understand how Hawaiian forests function and to understand the effects of climate change and invasive species.

Currently the climate stations adjacent to the plots are recording a variety of climate related information including: air temperature, relative humidity, solar radiation, soil moisture and temperature, and others. Data are now being downloaded remotely via modem on a daily basis. Efforts are underway to create an automated QA/QC procedure to screen and organize data so it can be made available publicly. One potential outlet for these data could be the EPSCOR Hawaii website.

### **Timeline** *(including overall expected completion date):*

Because of the slow growth of Hawaiian trees and the considerable climate variations year-to-year, we hope to keep collecting data until this type of data collection is no longer feasible.

### **Changes to Methodology** *(or other aspects of the project):*

No changes occurred within the last year. However, in response to safety concerns related to protruding nails and rebar, nails were bent, and rebar was removed as of October 2011.

### **Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

No new observances of T & E species – however the non-native banana poka and German ivy seem to be expanding at Pu'u Wa'awa'a Sanctuary plot. We plan to coordinate with Elliott Parsons to manage the

invasive species the Pu'u Wa'awa'a plot, and will also try to reduce weeds as needed in the Laupahoehoe and Mamalahoa plots.

**Challenges** (*encountered while working in the HETF*):

We are working with the Laupahoehoe Advisory Council to address the issue of nails in the trees.

**Bibliography of Publications** (*Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.*):

*Conference presentations:*

Ecological Society of America, August 2012, Portland, OR: Inman-Narahari, Faith, Ostertag, Rebecca, Cordell, Susan Cordell, Giardina, Christian P., Hubbell, Stephen P., Sack, Lawren. Density-dependent seedling mortality varies with light availability and species' abundance in wet and dry tropical forests.

Ecological Society of America, August 2012, Portland, OR: Ostertag, Rebecca, Cordell, Susan, Giambelluca, Thomas, Giardina, Christian, Inman-Narahari, Faith, Litton, Creighton, Sack, Lawren, VanDeMark, Joshua. Decoupling of tropical forest structure and diversity: stand characteristics, growth, and mortality in wet and dry Hawaiian forests and global comparisons.

Hawai'i Conservation Conference, August 2011, Honolulu: Ostertag, Rebecca, Inman-Narahari, Faith, Cordell, Susan, Giardina, Christian, Sack, Lawren. Structure of wet and dry Hawaiian forests of low diversity: global comparisons across tropical forests.

Hawai'i Conservation Conference, August 2011, Honolulu: VanDeMark, Joshua, Cordell, Susan, Giambelluca, Thomas, Giardina, Christian, Litton, Creighton, Inman-Narahari, Faith, Ostertag, Rebecca, Sack, Lawren. Long term dynamics in Hawaiian forests: The first glimpse of forest demography from the Hawai'i Permanent Plot Network (HIPNET).

Hawai'i Conservation Conference, August 2011, Honolulu: Inman-Narahari, Faith, Ostertag, Rebecca, Cordell, Susan, Giardina, Christian, Murphy, Molly, Wailani-Nihipali, Kahealani, Sack, Lawren. What's going down and what's coming up: seed rain and seedling establishment of native species in Hawaiian wet forest.

Nāhelehele Dry Forest Symposium, February 2011, Keauhou: Inman-Narahari, Faith, Ostertag, Rebecca, Cordell, Susan, Giardina, Christian, Murphy, Molly, Wailani-Nihipali, Kahealani, Sack, Lawren, Pālanui: a native dominated dry forest.

Botanical Society of America, August 2010, Providence, RI: Inman-Narahari, Faith, Ostertag, Rebecca, Cordell, Susan, Giardina, Christian, Sack, Lawren. Hawai'i permanent plot network: first census results and ongoing research.

Botanical Society of America, August 2010, Providence, RI: Inman-Narahari, Faith, Ostertag, Rebecca, Cordell, Susan, Giardina, Christian, Sack, Lawren. Seedling dynamics in native dominated Hawaiian rain forest.

Hawai'i Ecosystems Meeting, July, 2010, Hilo: Inman-Narahari, Faith, Ostertag, Rebecca, Cordell, Susan, Giardina, Christian, Sack, Lawren. Tree regeneration and physiology across forest types.

Ecological Society of America, August 2009, Albuquerque, NM: Nelson-Kaula, Kehauwealani, Inman-Narahari, Faith, Ostertag, Rebecca, Giardina, Christian, Cordell, Susan, Sack, Lawren. Electronic data collection methods for tree and seedling census data in forest dynamics plots.

Ecological Society of America, August 2009, Albuquerque, NM: Inman-Narahari, Faith, Nelson-Kaula, Kehauwealani, Ostertag, Rebecca, Cordell, Susan, Giardina, Christian Sack, Lawren. Regeneration patterns in a native dominated Hawaiian montane wet forest.

*Publications:*

Murphy, M.J., Inman-Narahari, F., Ostertag, R., Litton, C.M. 2014. Invasive feral pigs impact native tree ferns and woody seedlings in Hawaiian forest. *Biological Invasions* 16:63-71.

Inman-Narahari, F., R. Ostertag, S. Cordell, C. Giardina, K. Nelson-Kaula, and L. Sack. 2013. Do seedling recruitment factors shift with ecosystem properties? Tests in low-diversity Hawaiian wet forest and global comparisons among tropical forests. *Ecosphere* 4(2):24. <http://dx.doi.org/10.1890/ES12-00164.1>.

Inman-Narahari, F., Giardina, C., Ostertag, R., Cordell, S. and Sack, L. 2010. Digital data collection in forest plots. *Methods in Ecology and Evolution* 1: 274-279.

Sack, L., Inman-Narahari, F., Cordell, S., Giardina, C., and Ostertag, B. 2010. Forest Dynamics Plots Established in Hawai'i to Track Tree Regeneration Patterns and Climate Change Responses. UCLA Institute of the Environment, Center for Tropical Science Newsletter. <http://www.ioe.ucla.edu/ctr/news/article.asp?parentID=6406>

## Cordell, Susan - The Potential for Restoration to Break the Grass / Fire Cycle in Dryland Ecosystems in Hawaii

Submitted: May 2013

**Project Location(s):** Puu Waawaa Forest Reserve

**HETF Annual Report for Project Period:** 06/2012-06/2013

### **Status Update** (*including any significant findings*):

Our study continues to provide basic scientific information and practical tools for managing and restoring tropical dry forest landscapes on military lands in the Pacific. Results benefit natural resource land managers in the Pacific by increasing capacity and knowledge to restore native forests, thereby reducing wildfire and enhancing habitat for threatened and endangered species. Through remote sensing we have assessed the historical and current condition of the two major dry forest landscapes on the island of Hawaii and have created high resolution restoration potential maps to help guide land managers to more efficiently and effectively use resources to reduce fire and enhance biodiversity across the landscape. Products developed this past year include the development of a revised topographic suitability index to guide restoration and management in tropical dry forests. The topographic habitat suitability model is also capable of predicting the locations of some threatened and endangered species at PTA, ecosystem productivity, and ungulate movement patterns. Products from this suitability model effort include a publication (now in preparation) and an ESTCP award to further validate the approach and model using field demonstrations and readily available satellite imagery. To improve our understanding of altered fire regimes and devise methods to break the grass/wildfire cycle, we are using both remote sensing and field based experiments. At the landscape scale, we have developed the use of high temporal frequency satellite imagery to monitor near real-time fire fuel conditions. This product is available as a web tool and was introduced to DoD and other Hawaii based land managers through a one day workshop held in November 2011. Results from this project have also catalyzed 2 important efforts related to altered fire regimes; 1) we have secured funding to expand our fire modeling efforts at PTA to include scenario building comprising the anticipated role of climate change on fire in dry systems in Hawaii (led by post-doctoral researcher Dr. Andrew Pierce); and 2) the formation of the Pacific Fire Science Consortium – A means of transferring knowledge between scientists, resource managers, decision-makers, fire suppression agencies, and communities in Hawaii and the U.S. affiliated Pacific and a structured forum and process for identifying and prioritizing critical new areas of fire research. The consortium was recently funded (December 2011) by the Joint Fire Science Program. Field experiments now underway will provide baseline information on small-scale fuel conditions and potential fire behavior within a range of remnant dry forest community types. Field experiments are designed to simultaneously develop strategies for restoration of native species and test the effectiveness of restoration as a tool to reduce fine fuel loads and potential fire danger. Several of these studies are in the monitoring phase (greenstrip and restoration experiment) and several are in the analysis stage (post fire burn study, fire history/successional study). However, early results point to a long history of fire (pre-human contact) as a driver of dry forest succession in Hawaii. Our post-fire seeding project (following a devastating fire in 2010) indicates that water may not be the only limiting resource for native forest restoration. Finally, through this project we have provided numerous opportunities for local students and volunteers. We will support several interns this summer through HCC. Our student hire Kealoha Kinney is now a PhD student at the University of Maryland and is submitting a publication on our collaborative work on tropical dry forest succession and the natural and anthropogenic role of fire. SERDP funded post-docs Erin Questad and Jim Kellner have recently both obtained jobs; Erin as an Assistant Professor, in the Biological Sciences Department from California State Polytechnic University,

Pomona; and Jim, as an Assistant Professor, in the Department of Geography, from the University of Maryland.

**Timeline** (*including overall expected completion date*):

We have secured funding to expand the scope of this project to include an endangered species outplanting demonstration. Our current research will end 12/2013 - but with our additional project we anticipate using the site until 2016.

**Changes to Methodology** (*or other aspects of the project*):

As mentioned above - new methodology will include outplanting of threatened and endangered species into high and low suitability habitat.

**Noteworthy Observations** (*including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area*):

none to date

**Challenges** (*encountered while working in the HETF*):

Aside from the prolonged drought we have face no challenges.

**Bibliography of Publications** (Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):

2008

Cordell, S. Asner, G.P., Thaxton, J., Kellner, J.R., Knapp, D.E., Kennedy-Bowdoin, T., Ambagis, S. Kinney, K.M., Questad, E., Selvig, M., Biggs, M., and Johansen, J. 2008. The Potential for Restoration to Break the Grass/Fire Cycle in Dryland Ecosystems in Hawai'i. SERDP/ ESTCP Partners in Environmental Technology Technical Symposium & Workshop, December 2-4. Washington D.C. (Published Abstract)

2009

Cordell, S., Asner, G.P., Thaxton, J. The Potential for Restoration to Break the Grass/Fire Cycle in Dryland Ecosystems in Hawai'i. SERDP 2009 Annual Report. Submitted February 12, 2009

Kellner, J.R., Asner, G.P., Kinney, K.M., Loarie, S.R., Knapp, D.E., Kennedy-Bowdoin, T., Questad, E., Cordell, S., and Thaxton, J.M. 2009. Seasonal dynamics and woodland community type regulate the fire fuel properties of the invasive grass *Pennisetum setaceum*. SERDP/ ESTCP Partners in Environmental Technology Technical Symposium & Workshop, December 1-3. Washington D.C. (Published Abstract)

Questad, E.J., S. Cordell, and D. Sandquist. Functional diversity and invasive species in Hawaiian forests. The 10th International Congress of Ecology. Brisbane, Australia. August 16-21, 2009. (Published Abstract)

2010

Chynoweth, M.W., Litton, C.M., Lepczyk, C.A., Cordell, S., and Kellner, J.R. 2010. Movement Ecology of Nonnative Feral Goats in Hawaiian Dryland Ecosystems. The Wildlife Society Conference, Snowbird, UT (Poster Presentation)

-Vertebrate Pest Conference: February 2010, Sacramento, CA. (Published Abstract)

-Tester Symposium: March 2010, University of Hawai'i at Manoa, HI

-Ecology Evolution and Conservation Biology Evoluncheon, University of Hawaii at Manoa, HI (Oral Presentation)

-CTAHR Symposium: April 2010, University of Hawai'i at Manoa, HI

-Hawai'i Conservation Conference: August, 2010, Honolulu, HI (Published Abstract).

Cordell, S., Asner, G.P., Thaxton, J. The Potential for Restoration to Break the Grass/Fire Cycle in Dryland Ecosystems in Hawai'i. SERDP 2009 Annual Report. Submitted February 1, 2010

Cordell, S., Kellner, J.R. 2010. The Potential for Restoration to Break the Grass/Fire Cycle in Dryland Ecosystems in Hawai'i. DoD Pacific Islands Threatened, Endangered, and At-Risk Species Workshop II, February 2-4, 2010. Honolulu, HI (Published Abstract)

Cordell, S. Restoration of ecosystems invaded by arid perennial grasses. Western Society of Weed Science, 2010 Annual Meeting. Waikoloa, HI. (Invited oral presentation).

Kellner, J.R. 2010. Remote sensing landscape fuel loads and an annual forb invasion. Western Society of Weed Science, 2010 Annual Meeting. Waikoloa, HI. (Invited oral presentation).

Kinney, K.M., Kellner, J.R., Selvig, M., Asner, G.P., Cordell, S., Questad, E., Thaxton, J.M. Knapp, D.E., Kennedy-Bowdoin, T. 2010. An Eye on Restoration: New Remote Sensing Approaches that Change the Way We See Dryland Ecosystem Restoration in Hawai'i. Environmental Management Publication. Volume 49, pg 4-5. (Non-Refereed Article)

Kinney, K.M., Asner, G.P. Kellner, J.R., Knapp, D.E., Kennedy-Bowdoin, T., Questad, E.J., Cordell, S., Thaxton, J.M. Remote sensing of potential restoration in a Hawaiian subalpine dry forest. Ecological Society of America Annual Meeting (2010), Pittsburgh, PA. (Published Abstract)

Moseley, R., Selvig, M., Questad, E., Cordell, S., and Thaxton, J. Restoration Potential of Three Hawaiian Dryland Ecosystems. 2010. Hawaii Conservation Conference, Honolulu, HI, (Published Abstract)

Questad, E.J., J. Kellner, K. Kinney, S. Cordell, J. Thaxton, and G. Asner. 2010. Increasing the impact and success of ecological restoration in Hawaiian dryland ecosystems. Partners in environmental technology technical symposium, US Department of Defense (Published Abstract).

Questad, E.J., J. Thaxton, and S. Cordell. 2009. Invasion resistance in Hawaiian tropical dry forests. Ecological Society of America (Published abstract).

Thaxton, J.M., Cole, T.C., Cordell, S., Cabin, R.J., Sandquist, D.R., and Litton, C.M. 2010. Native species regeneration following ungulate exclusion and non-native grass removal in remnant Hawaiian Dry Forest. Pacific Science. 64, 533-544. (Refereed Journal Article)

2011

Chynoweth, Mark; Litton, Creighton M.; Lepczyk, Christopher A.; Cordell, Susan. 2010. Feral goats in the Hawaiian Islands: understanding the behavioral ecology of nonnative ungulates with GPS and remote sensing technology. In: Timm, R.M.; Fagerstone, K.A., eds. Proceedings of the 24th Vertebrate Pest Conference; 2010, 41-45. (Refereed Journal Article)

Chynoweth, Mark W.; Litton, Creighton M.; Lepczyk, C.A.; Cordell, Susan; Asner, Greg P.; Kellner, James 2011. Habitat use by nonnative feral goats in Hawaiian dryland montane landscapes. Hawai'i Ecosystems Meeting, June 30-July 1, 2011, Hilo, HI (Oral presentation).

Chynoweth, Mark W.; Lepczyk, Chris A.; Litton, Creighton M.; Cordell, Susan. 2011. Movement patterns and habitat utilization of nonnative feral goats in Hawaiian dryland montane landscapes. Ecological Society of America Annual Meeting; 2011 August 7-12; Austin, TX. (Published abstract)

-Hawaii Conservation Conference--Island Ecosystems: The Year of the Forest; 2011 August 2-4; Honolulu, HI. Honolulu, HI: Hawaii Conservation Alliance: 39. (Oral Presentation). \*awarded best student presentation of the conference

- Tester Symposium, March 16-18, 2011, University of Hawaii Honolulu, HI (Oral presentation).

- University of Hawaii, College of Tropical Agriculture and Human Resources Student Symposium, April 8-9, 2011, Honolulu, HI (Oral presentation).

-US Chapter of the International Association for Landscape Ecology 2011 Annual Symposium; 2011 April 3-7; Portland OR. Frostburg, MD; US-International Association for Landscape Ecology. (Published abstract)

Chynoweth, Mark 2011. Feral goats in Hawaiian dryland ecosystems - ecology and impacts. Nahelehele Dry Forest Symposium, February 25, 2011, Kailua-Kona, HI (Invited oral presentation).

Cordell, Susan; Questad, Erin J.; Kinney, Kealoha; Kellner, James R.; Thaxton, Jarrod; Asner, Greg P. 2011. Guiding ecological restoration in invaded landscapes. In: 96th Ecological Society of America Annual Meeting, 2011 August 7-12; Austin, TX. Poster abstract.

- Hawai'i Ecosystems Meeting, June 30-July 1, 2011, Hilo, HI (Oral presentation).

Cordell, Susan; Asner, Greg P.; Thaxton, Jarrod 2011. The potential for restoration to break the grass/fire cycle in dryland ecosystems in Hawai'i. SERDP 2010 Annual Report.

Cordell, Susan; Giardina, Christian; Nakahara, Miles; \*Pickett Fee, Elizabeth; Stewart, Carolyn 2011. Development of Hawaii and U.S. Affiliated Pacific Island Fire Science Consortium. In: 2011 Hawaii Conservation Conference--Island Ecosystems: The Year of the Forest; 2011 August 2-4; Honolulu, HI. Honolulu, HI: Hawaii Conservation Alliance: 73. (Poster Abstract).

Kellner, J.R. Asner, G.P., Ambagis, S., Cordell, S., Thaxton, J, Kinney, K.M., Kennedy-Bowdoin, T., Knapp, T., Questad, T. In press Potential and limitations of historical aerial photography to quantify vegetation dynamics in a tropical dry forest in Hawaii. Pacific Science. (Refereed Journal Article)

Kellner, J.R., Asner, G.P., Kinney, K.M., Loarie, S.R., Knapp, D.E., Kennedy-Bowdoin, T., Questad, E., Cordell, S., and Thaxton, J.M. 2011. Remote analysis of biological invasion and the impact of enemy release. Ecological Applications. 21(6) 2094-2104. (Refereed Journal Article)

Questad, Erin J. 2011. Restoration: the only hope for native plants in invaded drylands? Nahelehele Dry Forest Symposium, February 25, 2011, Kailua-Kona, HI (Invited oral presentation).

Questad, Erin J.; Cordell, Susan; Kinney, Kealoha; Kellner, James R.; Thaxton, Jarrod; Asner, Greg P. 2011. Guiding ecological restoration in invaded landscapes. In: US Chapter of the International Association for

Landscape Ecology 2011 Annual Symposium; 2011 April 3-7; Portland OR. Frostburg, MD; US-International Association for Landscape Ecology. (Published abstract).

Questad, Erin J.; Cordell, Susan; Thaxton, Jarrod. 2011. Invasion and native species loss through local extinction. In: 96th Ecological Society of America Annual Meeting, 2011 August 7-12; Austin, TX. (Published abstract)

Questad, E.J.; Cordell, Susan; Uowolo, Amanda; 2011. A test of invasion mechanisms and restoration strategies in a subalpine dryland forest following a fire. Hawai'i Ecosystems Meeting, June 30-July 1, 2011, Hilo, HI (Oral presentation).

Thaxton, J.M., Cordell, S., Cabin, R.J., Sandquist, D.R. In press Non-native grass *Pennisetum setaceum* decreases water availability and seedling performance during Hawaiian dry forest restoration. *Restoration Ecology*. doi: 10.1111/j.1526-100X.2011.00793. (Refereed Journal Article)

2012

Thaxton, J.M., Cordell, S., Cabin, R.J., Sandquist, D.R. 2012. Non-native grass removal and shade increase soil moisture and seedling performance during Hawaiian dry forest restoration. *Restoration Ecology* 20(4): 475-482

Questad, E., J. Thaxton, J.M., Cordell, S. 2012. Patterns and consequences of re-invasion into a Hawaiian dry forest restoration. *Biological Invasions*. 14:2573-2586.

Kellner, J.R. Asner, G.P., Ambagis, S., Cordell, S., Thaxton, J, Kinney, K.M., Kennedy-Bowdoin, T., Knapp, T., Questad, E. In press. Potential and limitations of historical aerial photography to quantify vegetation dynamics in a tropical dry forest in Hawaii. *Pacific Science*.

Chynoweth, M.W., C.M. Litton, C.A. Lepczyk, S.C. Hess, and S. Cordell. In press. Biology and Impacts of Pacific Island Invasive Species. *Capra hircus*, the Feral Goat, (Mammalia: Bovidae). *Pacific Science*.

Kinney, K., Kellner, J., Cordell, S., Asner, G.P., Thaxton, J., Questad, E., Knapp, D., Kennedy-Bowdoin, T., and Hall, L. 2012. Detecting a prehistoric fire regime in a Hawaiian sub-alpine dry forest. *Ecological Society of America Annual Conference*; August 5-10. Portland OR. (Published abstract)

Inman-Narahari, F., Ostertag, R., Cordell, S., Giardina, C., Hubbell, S., and Sack, L. 2012. Density-dependent seedling mortality varies with light availability and species abundance in wet and dry tropical forests. *Ecological Society of America Annual Conference*; August 5-10. Portland OR. (Published abstract)

Giardina, C., Cordell, S., Litton, C., Pickett Fee, E. 2012. Pacific Fire Science Consortium- The hottest partnership in the Pacific. *Hawaii Conservation Conference*, July 31-Aug.2. Honolulu, HI. (Published abstract)

Questad, E., Cordell, S., Kellner, J., Brooks, S. 2012. Habitat suitability modeling for the restoration of threatened, endangered, and at-risk plant species in dryland ecosystems of Hawaii and Southern California. *Hawaii Conservation Conference*, July 31-Aug.2. Honolulu, HI. (Published abstract)

2012. *Natural Inquirer*, Hawaii and Pacific Islands Issue. Dr. Cordell Contributed and participated as a Dry Forest Research Expert in the "Left High and Dry" segment of the Issue. The dry forest mural highlighted above was featured in the cover photo of the N.I.

Cordell, S. Kellner, J., and Questad, E. 2012. Remote Sensing Technology for Threatened and Endangered Plant Species Recovery. Tropical Conservation Biology & Environmental Science Program at UH Hilo. April 12; Hilo, HI (Invited Oral Presentation)

2012. Honolulu, HI. January. The Pacific Islands Regional Climate Assessment (PIRCA), a collaborative endeavor involving nearly 100 independent experts. In support of the National Climate Assessment (NCA), the report assesses the state of climate knowledge, impacts, and adaptive capacity in three main sub-regions: (1) the Western North Pacific (Commonwealth of the Northern Mariana Islands, Guam, Republic of Palau, Federated States of Micronesia, Republic of Marshall Islands); (2) the Central North Pacific (Hawai'i); and (3) the Central South Pacific (American Samoa). The framework for the assessment included three main focus areas: (1) fresh water and drought; (2) sea-level rise and coastal inundation; and (3) aquatic and terrestrial ecosystems. Dr. Cordell was an invited expert.

2012. Las Cruces, Costa Rica. August. Organization for Tropical Studies (OTS) Workshop titled "Tropical Forest Responses to Warming: Effects of Warmer Soils on Above- and Belowground Processes." I was an invited participant. The objectives of this workshop is to determine how tropical plants and soils respond to warmer soil temperatures; how mycorrhizae may mediate plant responses; and how these terrestrial ecosystem responses to warmer soils may feedback to affect climate. The results of this workshop will be a collaborative multi-agency grant proposal(s) submitted to U.S. funding agencies from whom we have successfully received support in the past (NSF, DOE). The ultimate results from these proposals will be some of the first answers as to how tropical forest plants, soils, and microbes will respond to a warming climate. Dr. Cordell participated as an invited expert in tropical ecosystem ecology.

2013

A manuscript describing the relationship between vegetation and substrate age was submitted in early spring (2013) to Ecology Letters. Kinney K.M., Kellner, J., Asner, G., Chadwick, O., Cordell, S., Heckman, K., Hotchkiss, S. Jeraj, M., Kennedy-Bowdoin, T., Knapp, D., Questad, E., Thaxton, J., Trusdell, F. Pre-mature decline of ecosystem structure and Phosphorus limitation along an arid Hawaiian chronosequences. This work takes a novel approach using remotely sensed vegetation patterns across a complex array of substrate ages to depict successional trajectories of tropical dry forest in Hawaii.

In addition, a manuscript describing and proposing a habitat suitability model to accurately predict habitat suitability for TES species has been submitted to Ecological Applications. The editor requested specific changes to the manuscript before sending to review. We anticipate incorporating these changes and resubmitting in May 2013. Questad, E., Kellner, J.R., Kinney, K., Cordell, S., Asner, G.P., Thaxton, J., Diep, J., Uowolo, A., Brooks, S., Inman-Narahari, N., Evans, S., and Tucker, B. Mapping habitat suitability for at-risk plants and its implications for restoration and reintroduction. Once the model passes through peer review land managers at PTA are eager to incorporate it into their regional and strategic planning for endangered species management.

Tools:

Asner, Greg; Kellner, James; Cordell, Susan; Questad, Erin; Kinney, Kealoha; Thaxton, Jarrod. 2011. Hawaii vegetation fire risk web tool. <http://hawaiiifire.stanford.edu/>.

## Gillespie, Rosemary - Adaptive radiation in Hawaiian spiders

Submitted: May, 2013

**Project Location(s):** Laupahoehoe Forest Reserve and NAR; Pu'u Wa'awa'a Forest Reserve and Wildlife Sanctuary

**HETF Annual Report for Project Period:** 05/2012 - 02/2013

### **Status Update** *(including any significant findings):*

All the Tetragnatha samples collected by Darko Cotoras since he started field work (August 2010) were re identified and reorganized by species. It gave a total count of 14 species (see Collection list 2011-2012).

Related with genetic work, the Restriction-site Associated DNA (RAD) technique ended up been technically too difficult to complete, so during 2012 we decided to change to a different approach (Exon Capture). The Exon Capture approach was developed by researchers in the Museum of Vertebrate Zoology at UC Berkeley. Currently we are developing of the laboratory work necessary to apply this method.

As a first trial we are working just with one species (*T. brevignatha*), but it is our intention to extend this work to other species of interest. Based on old samples we extracted RNA and did a de novo assembly of a whole body transcriptome. That information was used to design a hybridization chip necessary for the Exon capture experiment. As a complement to this we tested several primers to use them as positive and negative controls. The chip as been already sent to the company to be built and it should be back in early April. In the main time we will develop the DNA libraries for around 30 specimens of *T. brevignatha*. They will be used in the experiment.

In parallel, we did DNA extractions for all our collected specimens of *T. brevignatha*, *T. waikamoi* and *T. anuenue*. We PCR amplified and we are in the process of getting the sequences of a series of mitochondrial genes (COI, ND1, Cytb and tRNA\_Ile). For *T. anuenue* it wasn't possible to get ND1. This information will be used as a preliminary data set to plan in a more efficient way future Exon Capture experiments.

Also as part of our fieldwork we took pictures of the dorsum of all the specimens indicated in the collection list. In many cases we have more than one angle for the same individual. Currently we are looking for ways to analyze these data.

In all the sites visited in June 2012 we recorded observations of plants where the spiders were collected. In collaboration with Erin Wilson (UC Riverside) we are looking for ways to analyze these data in combination with her data set from the Kipuka Area.

During June 2012 we also collected species of *Mecaphesa*, *Papiopalus* and *Pedinopistha*. These specimens are actively being identified and curated for later molecular analysis. Specimens and sequence data, particularly for *Ariamnes*, *Mecaphesa* and *Tetragnatha*, from previous collecting trips are being reorganized and archived to make them more accessible for future analyses. We are also developing quantitative methods to better estimate past speciation and extinction dynamics from phylogenomic data. We are currently testing these methods with data previously collected by our lab group on several different arthropod lineages across the Hawaiian Islands.

### **Timeline** *(including overall expected completion date):*

The dissertation project of Darko Cotoras should be finished by May 2014, so we expect to have the final publications of that work later on that year.

Andrew Rominger's fieldwork should be completed by May 2015 with submission of final manuscripts following by May 2016.

**Changes to Methodology** (*or other aspects of the project*):

The field work followed the methodology indicated in the permit application.

**Noteworthy Observations** (including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):

No T&E species observed, no new observations of invasive species or human disturbance.

**Challenges** (encountered while working in the HETF):

We did not find any significant challenge working in the HETF, beside the fact that a 4WD is necessary to access many points of the reserve.

**Bibliography of Publications** (*Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.*):

Croucher, P.J.P., Oxford, G.S., Lam, A., Mody, N., Gillespie, R.G. 2012. Colonization history and population genetics of the exuberantly color polymorphic Hawaiian happy-face spider *Theridion grallator* (Araneae, Theridiidae). *Evolution* 66: 2815-2833.

## Havran, J. Christopher - Geographic and ecological patterns of leaf and flower morphological variation in *Planchonella sandwichensis*.

Submitted: March 2013

**Project Location(s):** Pu'u Wa'awa'a Forest Reserve

**HETF Annual Report for Project Period:** 04/2012 - 04/2013

### **Status Update** *(including any significant findings):*

In summer 2012 seven populations of *Planchonella sandwichensis* were surveyed across Kauai, Oahu, Molokai, Maui, and Hawaii. To date we have completed studies of leaf shape, fruit shape, and several leaf functional traits. Preliminary results are summarized below:

**Morphometry:** Morphometric analyses of leaf shape indicate that leaf shape, independent of size, does not vary greatly across the archipelago. In terms of overall leaf shape the individuals surveyed from Pu'uwa'awa'a differed significantly from all other populations in terms of leaf symmetry. Specimens from Pu'uwa'awa'a tended to be more asymmetrical than populations from other islands.

**Fruit Shape:** Fruits and seeds from interisland populations were dissected and measured. We show that fruit shape (length/width) is significantly correlated with rainfall but not elevation. We also show that embryo morphology and seed size do not vary between interisland populations. In addition, we show that seed number does not covary with fruit size.

**Leaf Functional Traits:** Leaves were collected from the exposed portion of the canopy from 39 trees across the archipelago. Leaves from individuals were scanned to measure area and were subsequently dried or preserved. Dried leaves were measured to determine mass. Preserved leaves were investigated anatomically to estimate stomatal density. Dried leaf mass was used to calculate specific leaf area (SLA) of the lamina. Across the archipelago SLA exhibited a significant positive correlation with rainfall but not elevation. This is not inconsistent with previous studies that demonstrate higher SLA in resource-rich ecosystems. Stomatal density also exhibited a significant positive correlation with rainfall but not elevation. Specimens from Pu'uwa'awa'a typically possessed a lower SLA and stomatal density than specimens from wetter populations.

### **Timeline** *(including overall expected completion date):*

Studies of lamina anatomy and biochemical composition will continue through summer 2013 and spring 2014. We expect to complete our analyses of specimens from Pu'uwa'awa'a in summer 2014.

### **Changes to Methodology** *(or other aspects of the project):*

Our initial proposal included a goal to study the population genetic diversity and variation in flower morphology in *P. sandwichensis* across the archipelago. Additional samples are required to complete the population genetic study. That component of the project is not anticipated to be completed by 2014. Unfortunately few individuals we visited were flowering in summer 2012. A lack of flowers will prevent us from conducting a thorough study of variation in flower structure. Fruits were also lacking from many of the individuals we visited. All results from fruit studies will have to remain preliminary as we did not have a robust sampling size.

### **Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

None.

**Challenges** (*encountered while working in the HETF*):

None. The HETF representatives were incredibly helpful in locating and collecting specimens for our studies.

**Bibliography of Publications** (*Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.*):

The research conducted during the current permitting period will be presented in a series of posters at the upcoming meeting of the Association of Southeastern Biologists in Charleston, WV. Citations for the poster presentations are listed below. Copies of posters will be provided to the HETF after the conference in mid-April. Full abstracts for the posters are available at:

<http://www.sebiologists.org/resources/ASB2013/Abstracts-3-19-13.pdf>

**Citations:**

Blankenship, C.L, and J.C. Havran. 2013. Preliminary analysis of fruit and seed variation of *Planchonella sandwicensis* across the Hawaiian Islands. Annual Meeting of the Association of Southeastern Biologists, Charleston, WV. Poster.

Westergaard, S.L., J. B. Vaughan, and J.C. Havran. 2013. Interisland variation in leaf shape of *Planchonella sandwicensis* (Sapotaceae), an endemic Hawaiian tree. Annual Meeting of the Association of Southeastern Biologists, Charleston, WV. Poster.

Craven, R.L, M.C. Fonvielle, and J.C. Havran. 2013. Functional trait diversity of *Planchonella sandwicensis* (Sapotaceae), a Hawaiian endemic tree. Annual Meeting of the Association of Southeastern Biologists, Charleston, WV. Poster.

## Hughes, R Flint and colleagues - Quantifying dynamics and magnitude of water loss from Kiawe forests in North Kona - Kiholo Bay.

Submitted: August 2013

**Project Location(s):** Pu'u Wa'awa'a Forest Reserve and State Park

**HETF Annual Report for Project Period:** 08/2013-08/2013

### **Status Update** (including any significant findings):

The vast majority of the field work has been completed by B. Dudley and company. Significant findings include a holistic understanding of precipitation and groundwater constraints on *Prosopis pallida* primary productivity, water use, physiological dynamics, and nutrient and carbon cycling. They also include a deeper understanding of the interactions among terrestrial vegetation, pond chemistry, and pond biota. Remaining work entails additional inventory of *Prosopis* stands extending from the coast up to the drier upland areas, and continuation of the litter decomposition study.

### **Timeline** (including overall expected completion date):

We anticipate that we will be completed with all field research by the end of 2014.

### **Changes to Methodology** (or other aspects of the project):

We do not have any changes to methodology to report.

### **Noteworthy Observations** (including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):

Abundance of feral, goats. Camping rule changes have resulted in much better management of people. As was the case with the previous year, this has been an incredibly dry year - winter in particular was virtually precipitation free.

### **Challenges** (encountered while working in the HETF):

None of any note.

### **Bibliography of Publications** (Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):

All publications are currently in press, in review, or in preparation.

#### Relevant Presentations:

Dudley B, Hughes RF, Ostertag R, Cordell S. 2011. Groundwater availability alters soil nitrogen inputs in a leeward stand of Kiawe (*Prosopis pallida*). Paper, Hawai'i Ecosystems Meeting, Hilo, HI (06/30/11). Also presented at the Hawaii Conservation Conference, Honolulu, HI (08/03/11)

Nelson-Kaula K, Hughes RF, Ostertag R. 2011. Determining the influence of kiawe and milo on nutrient loads of anchialine ponds. Paper, Hawaii Ecosystems Meeting, Hilo, HI (06/30/11).

Nelson-Kaula K, Hughes RF, Ostertag R. 2011. Influences of kiawe and milo on nutrient loads in anchialine ponds. Paper, Queen Lili'uokalani Children's Center, Kona, HI. (06/28/11). Also presented at Water Resources Meeting, Hilo, HI (03/21/11).

## Hughes, Flint - FIA Inventory of Hawaii's Forests

Submitted: August 2013 by Lori Tango

**Project Location(s):** Laupahoehoe Forest Reserve and NAR; Pu'u Wa'awa'a Forest Reserve, State Park, and Wildlife Sanctuary

**HETF Annual Report for Project Period:** 02/2012 - 08/2013

### **Status Update** *(including any significant findings):*

A total of 66 plots were installed and measured in the HETF. Plot location breakdown is as follows: Laupahoehoe Forest Reserve = 12 plots, Laupahoehoe Natural Area Reserve = 17 plots, Puu Waawaa Forest Reserve = 8 plots, Puu Waawaa Forest Bird Sanctuary = 27 plots, and Puu Waawaa State Parks = 2 plots. An additional 3 plots were scheduled for installation in the Laupahoehoe NAR but due to remoteness the crew was unable to safely access and measure these plots. All plots measured in the Laupahoehoe HETF were considered accessible forest land containing at least 10 percent crown cover by trees of any size. At the Puu Waawaa HETF, 20 plots were considered assessible forest land and 17 plots were non-forest (non-stocked, usually less than 10 percent tree cover). Seven non-forest plots were measured in Puu Waawaa Forest Reserve, 8 non-forest plots were measured in Puu Waawaa Forest Bird Sanctuary, and all two plots measured at Puu Waawaa State Parks were non-forest. At the Laupahoehoe HETF, 29 tally tree species (DBH > 5 inches), 16 sapling species (DBH between 1 and 4.9 inches), and 24 seedling species (DBH < 1 inch, height > 1 foot) were observed. The dominant tally tree species were *Metrosideros polymorpha*, *Cheirodendron trigynum*, and *Acacia koa*, the dominant sapling species were *Psidium cattleianum*, *Metrosideros polymorpha*, and *Cheirodendron trigynum*, and the dominant seedling species were *Cibotium glaucum*, *Melicope clusiifolia*, and *Metrosideros polymorpha*. Eight invasive species were observed with *Passiflora mollissima*, *Psidium cattleianum*, and *Clidemia hirta* noted as the most common species. Evidence of pig presence (e.g., wallows, tracks, and scat) was also noted on 29 of the 32 plots measured. At Puu Waawaa, 21 tally tree species, 7 sapling species, and 8 seedling species were observed. The dominant tally tree species were *Metrosideros polymorpha*, *Acacia koa*, and *Diospyros sandwicensis*, the dominant saplings species were *Metrosideros polymorpha*, *Coprosma* spp., and *Myoporum sandwicense*, and the dominant seedling species were *Metrosideros polymorpha*, *Sophora chrysophylla*, and *Acacia koa*. Five invasive species were observed with *Pennisetum setaceum*, *Passiflora mollissima*, and *Lantana camara* noted as the most common species. Evidence of pig presence was also noted on all plots measured.

### **Timeline** *(including overall expected completion date):*

All FIA plots scheduled to be installed and measured have been successfully completed as of 10/24/2012.

### **Changes to Methodology** *(or other aspects of the project):*

No changes

### **Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

Noteworthy observations are forthcoming once we begin analysis of HETF FIA dataset.

### **Challenges** *(encountered while working in the HETF):*

Challenges stem from safely accessing the remote regions in the HETF.

### **Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

Tango LKK and Murphy M. 2013. Monitoring Hawaii's forests with Forest Inventory and Analysis. Presentation, Three Mountain Alliance Quarterly Meeting at DOFAW in Hilo, HI (02/27/2013).

Tango LKK. 2013. Monitoring Hawaii's forests with Forest Inventory and Analysis. Presentation, Hilo Seminar Series at IPIF in Hilo, HI (01/08/2013).

Tango LKK, Hughes RF, Hiraoka K, Murphy M, Cantan A. 2012. Recruitment of the dominant native Hawaiian tree, *Metrosideros polymorpha*, limited by alien invaders. Paper, Ecological Society of America in Portland, OR (08/06/2012)

Hughes, RF, Asner GP, Uowolo A, Mascaro J. 2011. Determining forest carbon across the Hawaiian Islands: Use of FIA plots and LiDAR. Paper, Society of American Foresters Convention in Honolulu, HI (11/06/2011).

Tango, LKK, Franklin H, Hiraoka K, Murphy M, Hughes RF. 2011. Forest Inventory and Analysis: Witnessing forest change. Paper, Hawaii Conservation Conference in Honolulu, HI (08/03/2011).

Hughes RF, Asner GP, Uowolo A, Mascaro J. 2011. Determining forest carbon across the Hawaiian Islands: Use of FIA plots and remote sensing (LiDAR) approaches. Paper, Hawaii Conservation Conference in Honolulu, HI (08/03/2011)

Franklin H, Tango LKK, Hiraoka K, Murphy M, Hughes RF. 2011. Forest Inventory and Analysis: Witnessing forest change. Paper, Hawaii Ecosystems Meeting in Hilo, HI (06/30/2011).

## **LaPointe, Dennis - Assessment of mosquito-borne avian disease risk in non-breeding habitat for foraging iiwi (*Vestiaria coccinea*) adjacent to Hakalau Forest NWR.**

Submitted: November 2013

**Project Location(s):** Laupahoehoe Forest Reserve  
**HETF Annual Report for Project Period:** 06/1/2013-present

### **Status Update** *(including any significant findings):*

We have caught 322 birds total at our two sites in Laupahoehoe FR. All of the 322 are banded. We have caught and banded 130 native birds and 192 non-native birds. We have collected blood, serum and blood smears from all newly banded birds. All samples are stored in the diagnostic laboratory at Kilauea Field Station. We do not have avian malaria prevalence results to date for these samples. We have not found any birds exhibiting knemidoptic mange at either site.

### **Timeline** *(including overall expected completion date):*

We plan to finish mist-netting in Laupahoehoe by Spring, 2014. We will finish mosquito trapping and transects by Spring, 2014. All diagnostics will be completed by Winter, 2015 and a final report will be submitted by Spring, 2015.

### **Changes to Methodology** *(or other aspects of the project):*

There have been no changes to the methods.

### **Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

We have caught a re-capture IIWI not banded by us, which means it may have been banded at another land tract nearby such as Piha or Hakalau. While we have not caught any birds with mange, we have had 8 birds with some sign of pox.

### **Challenges** *(encountered while working in the HETF):*

Gear has been moved, removed, guylines have been cut for our poles at the lower site. Also we have had one attempted theft of gear in the back of our pickup truck.

### **Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

We have not yet presented or published data from this site.

## **LaPointe, Dennis - Distribution and prevalence of knemidokoptic mange in Hawaii amakihi on the Island of Hawaii.**

Submitted: November 2013

**Project Location(s):** Pu'u Wa'awa'a Wildlife Sanctuary

**HETF Annual Report for Project Period:** January 2014 - January 2015

### **Status Update** *(including any significant findings):*

We do not have any updates to report. We have not yet made it to Puu Waawaa to collect data. We have made necessary arrangements to begin data collection in Puu Waawaa during the second week of December, 2013.

### **Timeline** *(including overall expected completion date):*

Data Collection: December, 2013 - Spring, 2014.

Blood diagnostics for malaria: Spring - Summer, 2014

Data Analysis and Report Writing: Fall - Winter, 2014

Report Submission: Early 2015

### **Changes to Methodology** *(or other aspects of the project):*

There are no changes to the submitted methods in the renewal application.

### **Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

We have no observations to report, to date.

### **Challenges** *(encountered while working in the HETF):*

We have no challenges to report.

### **Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

We have no publications to list, to date.

## Litton, Creighton M and Christian P. Giardina - An experimental test of the impacts of rising temperature on carbon input, allocation, and loss in model forests.

Submitted: May 2013

**Project Location(s):** Laupahoehoe Forest Reserve and NAR  
**HETF Annual Report for Project Period:** 06/2012 - 06/2013

### **Status Update** *(including any significant findings):*

Results from this study are providing an increasingly detailed picture of how carbon cycling in tropical wet forest will respond to rising mean annual temperature. First, we found that total carbon input (GPP) increases with mean annual temperature, which supports several prior global, cross-site analyses. Second, we found that all component carbon fluxes increase with mean annual temperature. Third, we found that as temperature increases, the fraction of GPP that is partitioned to belowground decreases, most likely in response to an increase in nutrient cycling and availability at higher mean annual temperatures. This is important because carbon that is partitioned belowground has the greatest chance of being stabilized as long-lived soil carbon, where it can reside for hundreds to thousands of years and buffer atmospheric CO<sub>2</sub> concentrations. One common prediction of the impact of rising temperature for terrestrial carbon cycling has been that rising temperatures will increase soil carbon decomposition, and thus result in a positive feedback between warming and increased decomposition of soil carbon. Soil carbon is a particularly important component of forest carbon cycling because soils store more carbon than vegetation and the atmosphere combined on a global scale and, thus, soils are critical in regulating global climate. Importantly, we found that the flux of carbon into (litterfall; belowground carbon flux) and out of (soil respiration) soil increases with mean annual temperature, indicating that soil carbon cycling will increase as temperature rises. However, contrary to prior predictions we found that soil carbon storage does not vary with mean annual temperature, indicating that rising temperature will not result in increased soil carbon decomposition and a positive feedback to climate change, at least in tropical wet forests.

### **Timeline** *(including overall expected completion date):*

The research being conducted with this permit is long-term, and ongoing. As such, no specific completion date for the research exists at this point.

### **Changes to Methodology** *(or other aspects of the project):*

No changes in methodology or other aspects of the project are anticipated.

### **Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

No noteworthy observations or challenges were observed during the past year of research.

### **Challenges** *(encountered while working in the HETF):*

Nothing noteworthy.

### **Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

Publications To Date (Reverse Chronological Order)

Giardina, C.P., Litton, C.M., Crow, S.E., and Asner, G.P. Increased total belowground carbon flux, and not soil carbon loss, drives temperature related increases in soil respiration. *Nature Climate Change*: In review.

Iwashita, D.K., Litton, C.M., Giardina, C.P. 2013. Coarse woody debris carbon storage across a mean annual temperature gradient in tropical montane wet forest. *Forest Ecology and Management* 291:336-343.

Murphy-Winters, M., Inman-Narahari, F., Ostertag, R., Litton, C.M. 2013. Invasive feral pigs reduce tree fern growth and survival in a native-dominated Hawaiian montane wet forest. *Biological Invasions* In press.

Litton, C.M., Giardina, C.P., Albano, J.K., Long, M.S., Asner, G.P. 2011. The magnitude and variability of soil-surface CO<sub>2</sub> efflux increase with temperature in Hawaiian tropical montane wet forests. *Soil Biology & Biochemistry* 43:2315-2323.

Mascaro, J., Litton, C.M., Hughes, R.F., Uowolo, A., Schnitzer, S.A. 2011. Minimizing bias in biomass allometry: Model selection and log-transformation of data. *Biotropica* 43:649-653.

McKinley, D.C., M. G. Ryan, R.A. Birdsey, C.P. Giardina, M.E. Harmon, L.S. Heath, R.A. Houghton, R. B. Jackson, J.F. Morrison, B. C. Murray, D. E. Pataki, K. E. Skog. A synthesis of current knowledge on forests and carbon storage in the United States. *Ecological Applications* 21:1902-1924.

Giardina, C. 2011. Carbon dynamics: processes, pools and fluxes, and regional differences. A Carbon Management Short Course for Land Managers. (<http://www.fs.fed.us/ccrc/>).

Ryan, M. G., M. E. Harmon, R. A. Birdsey, C. Giardina, L. S. Heath, R. A. Houghton, R. B. Jackson, D. C. McKinley, J. F. Morrison, B. C. Murray, D. E. Pataki, K. E. Skog. 2010. A Synthesis of the Science on Forests and Carbon for US Forests. *Issues in Ecology*, Report Number 13.

Giardina, C. 2008. Forests. *Encyclopedia of Global Warming and Climate Change*. Sage Publications, Inc, 1552 p. (Invited; Refereed).

Giardina, C. 2008. Gross Primary Production. *Encyclopedia of Global Warming and Climate Change*. Sage Publications, Inc, 1552 p. (Invited; Refereed).

Giardina, C. 2008. Soil Organic Carbon. *Encyclopedia of Global Warming and Climate Change*. Sage Publications, Inc, 1552 p. (Invited; Refereed).

Litton, C.M., Giardina, C.P., 2008. Below-ground carbon flux and partitioning: Global patterns and response to temperature. *Functional Ecology* 22, 941-954.

Litton, C.M., Kauffman, J.B., 2008. Allometric models for predicting aboveground biomass in two widespread woody plants in Hawaii. *Biotropica* 40, 313-320.

Conference Presentations To Date (Reverse Chronological Order)

Litton, C.M., Freeman, K.R., Giardina, C.P. and Selmants, P.C. 2013. Effect of mean annual temperature on nutrient return via litterfall in Hawaiian tropical montane wet forest. American Geophysical Union Annual Meeting, San Francisco, CA

Selmants, P.C., Giardina, C.P. and Litton, C.M. 2013. Ecosystem carbon storage does not vary with increasing mean annual temperature in Hawaiian montane wet forests. 5th Annual Tropical Conservation Biology and Environmental Science Research Symposium, Hilo, HI.

Selmants, P.C., Giardina, C.P. and Litton, C.M. 2012. Ecosystem carbon storage does not vary across a 5.2°C mean annual temperature gradient in Hawaiian tropical montane wet forests. Ecological Society of America Annual Meeting, Portland, OR

Selmants, P.C., Giardina, C.P. and Litton, C.M. 2012. Carbon cycling and storage along a mean annual temperature gradient in Hawaiian wet tropical forests. Hawaii Ecosystems Meeting, Hilo, HI

Giardina, C.P., Litton, C.M. and Crow, S.E. 2011. Response of total belowground carbon flux and soil organic carbon storage to increasing mean annual temperature in Hawaiian tropical montane wet forest. American Geophysical Union Annual Meeting, San Francisco, CA

Giardina, C. 2011. Overview of Research being conducted in the Laupahoehoe unit of the Hawaii Experimental Tropical Forest. Quarterly Meeting of the Laupahoehoe Advisory Council, Laupahoehoe, HI.

Giardina, C. 2011. Carbon dynamics: processes, pools and fluxes, and regional differences. USFS Workshop on Forest and Grassland Carbon in North America: a Carbon Management Short Course for Land Managers. Slade, Kentucky.

Iwashita, D., Litton, C.M., and Giardina C. 2011. Does temperature impact coarse woody debris and dead tree fern biomass in Hawaiian tropical montane wet forests? Ecological Society of America Annual Meeting, Austin, TX

Iwashita, D., Litton, C.M., and Giardina C. 2011. Role of coarse woody debris and dead tree ferns in Hawaiian tropical montane wet forests. Hawai'i Conservation Conference, Honolulu, HI

Iwashita, D., Litton, C.M., and Giardina C. 2011. Temperature impacts on native plant diversity and regeneration in Hawaiian tropical montane wet forests. College of Tropical Agriculture and Human Resources Student Symposium, University of Hawaii at Manoa, HI

Litton, C.M. and Giardina, C.P. 2011. The magnitude and variability of soil-surface CO<sub>2</sub> efflux increase with mean annual temperature in Hawaiian tropical montane wet forest. American Geophysical Union Annual Meeting, San Francisco, CA

Litton, C.M., Giardina, C. and Crow, S.E. 2011. Soil carbon storage does not vary with temperature along a 5.2°C mean annual temperature gradient in Hawaiian tropical montane wet forests. Ecological Society of America Annual Meeting, Austin, TX

Litton, C.M. and Giardina, C. 2011. Increased carbon flux to belowground drives increased soil respiration with rising mean annual temperature. Hawaii Ecosystems Meeting, Hilo, HI

- Freeman, K.R., Litton, C.M. and Giardina, C. 2010. Litterfall and soil respiration across a 5°C MAT gradient in Hawaiian Wet Forest. Hawaii Ecosystems Annual Meeting, Hilo, HI
- Giardina, C. 2010. Model systems for ecological research: some new ones for Hawaii researchers. University of Hawaii at Hilo – the Tropical Conservation Biology and Environmental Science Lecture Series, Hilo, HI.
- Giardina, C. 2010. Next generation model systems in Hawaii for asking ecological and socio-ecological questions. University of Hawaii at Manoa – Botany Department Lecture Series, Honolulu, HI.
- Giardina, C. 2010. Where are we and where are we going? Future experiments for understanding soil carbon decomposition responses to climate change. Soil Carbon Processes Workshop, Golden, CO.
- Iwashita, D., Litton, C.M., and Giardina C. 2010. Impact of mean annual temperature on native wet forest structure and biodiversity in Hawai'i. Tester Symposium, University of Hawaii at Manoa, HI
- Iwashita, D., Litton, C.M., and Giardina C. 2010. Impact of mean annual temperature on native wet forest structure and biodiversity in Hawai'i. College of Tropical Agriculture and Human Resources Student Symposium, University of Hawaii at Manoa, HI
- Iwashita, D., Litton, C.M., and Giardina C. 2010. Temperature impacts on native wet forest structure and biodiversity in Hawai'i. Hawai'i Conservation Conference, Honolulu, HI
- Iwashita, D., Litton, C.M., and Giardina C. 2010. Biodiversity, coarse woody debris, and seedling establishment across a 5°C mean annual temperature gradient in Hawaiian wet forests. Hawaii Ecosystems Annual Meeting, Hilo, HI
- Litton, C.M. and Giardina, C. 2010. Carbon input and partitioning across a 5°C mean annual temperature gradient in Hawaiian wet tropical forests. Ecological Society of America Annual Meeting, Pittsburgh, PA
- Litton, C.M. 2010. Carbon input and partitioning along a 5°C mean annual temperature gradient in Hawaiian wet tropical forests. University of Hawaii at Manoa, Department of Geography, Departmental Seminar Series, Honolulu, HI
- Litton, C.M. and Giardina, C. 2010. Carbon partitioning across a 5°C mean annual temperature gradient in Hawaiian wet tropical forests. Hawaii Ecosystems Meeting, Hilo, HI
- Giardina, C. 2009. Methods for examining soil carbon decomposition to climate change: strengths and weaknesses. International Soil Organic Matter Workshop, Colorado Springs, CO.
- Litton, C.M. and Giardina, C.P. 2009. Carbon input and partitioning across a 5°C mean annual temperature gradient in Hawaiian wet tropical forests. American Geophysical Union Annual Meeting, San Francisco, CA
- Litton, C.M., Sandquist, D.R. and Cordell, S. 2009. Impacts of nonnative grass invasion and precipitation variability on carbon partitioning in a Hawaiian tropical dry forest. Ecological Society of America Annual Meeting, Albuquerque, NM

Litton, C.M. and Giardina, C.P. 2009. Impact of MAT on ecosystem carbon storage, flux and partitioning in native Hawaiian wet forests. Hawaii Ecosystems Meeting, Hilo, HI

Litton, C.M. and Giardina, C.P. 2008. Belowground carbon flux and partitioning: Global patterns and response to temperature. American Geophysical Union Annual Meeting, San Francisco, CA

Litton, C.M. and Giardina, C.P. 2008. Impacts of climate change on terrestrial carbon cycling: Infrastructure and research in the Hawaii Experimental Tropical Forest, Laupahoehoe. Hawaii Ecosystems Meeting, Hilo, HI

## Medville, Douglas - Lava tube location, survey, and resource evaluation on Pu'u Wa'awa'a and Pu'u Anahulu

Submitted: October 2013

**Project Location(s):** Pu'u Wa'awa'a Forest Reserve and Wildlife Sanctuary  
**HETF Annual Report for Project Period:** 01/2013-12/2013

### **Status Update** *(including any significant findings):*

In 2013, surveys were conducted in 24 caves having a combined length of 26,464 feet (5.01 miles). The caves are in four general areas in accordance with the permit.

1. Forest Bird Sanctuary (FBS), HETF. Surveys continued in mauka end of the Hapu'u/Pig Fence/Delissea cave complex as well as in the makai end of Ambigua Cave, where over 1,500 feet of passages were surveyed, extending this cave makai toward the FBS boundary. The cave now contains over 9,500 feet of surveyed passages and exceeds 1,000 feet in vertical relief. Another 1,500 feet of passage was surveyed in another large complex on the east side of the FBR: Upper Owl Cave, containing nearly 2 miles of passages.
2. Mauka subunit, HETF. This area, extending from the vicinity of Pu'u Iki mauka to the makai boundary of the Sanctuary subunit, contains a very high concentration of cave entrances and voluminous lava tube caves in a 3000-5000 year old flow. A substantial cave located 2,000 feet makai of Pu'u Iki was discovered and surveyed. This cave, called Branta Rhuax Cave contains well preserved skeletal remains of the extinct Hawaiian Goose (Branta Rhuax). Pictures of the goose skeleton were provided to HETF, DOFAW, and Dr. Helen James at the Smithsonian Institution, who identified the remains. This cave also contains archaeological features such as floor to ceiling walls and ramps leading down into an entrance. To date, 3,950 feet of passages have been surveyed in this cave.
3. Makai Subunit, HETF. Access is via the Old Kiholo Road on the makai side of Rt. 190. In 2013, 1.6 miles of passages were surveyed in 13 caves located in two flows. The largest of these caves, Big Ahu Cave with 2,200 feet of passages, contains various archaeological features, including a 5 foot high ahu in a skylight entrance and stone steps leading down into another entrance. A nearby cave (Stone Wall Cave) contains a 1.5 meter high, 10 meter long stone wall across the passage. There was no evidence of burials in these or the other caves in this flow.
4. Pu'u Anahulu flow. A 3,000-5,000 year old flow extends for five miles from the makai side of Rt. 190 to Rt. 19. The flow is bounded by the 1859 flow on the west and the Puu Anahulu Cooperative Game Management Area on the east. In 2013, surveys were conducted in two caves in this flow. One of these, Going Concern Cave, is located 0.5 miles on the makai side of Rt. 190 and consists of a network of low passages that branch and rejoin. We completed the survey of this cave, adding 1,335 feet of passages to it, and found that it ended mauka and makai in lava seals. The second cave, Hive Cave, named for a large beehive in its entrance, is halfway between Rt 190 and Rt. 19. The cave contains over 3,000 feet of large passages, up to 60 feet wide and 20 feet high in places but no evidence of previous human visitation or use of this cave was seen. This cave ends mauka and makai where the adjacent 1859 flow passes over it, sealing its passages.

### **Timeline** *(including overall expected completion date):*

January 2014-December 2014; actual completion date is open ended; depending on the needs of the HETF.

**Changes to Methodology** *(or other aspects of the project):*

No changes were made to the methodology used to locate, document, and survey the caves or to that used to produce cave maps and overlays. If HETF uses GIS tools, then the cave entrance locations and map outlines can be used as layers on ArcView.

**Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

We did not see any threatened or endangered species in the lava tubes but did observe, as expected for the area, fossil bird bones including the nearly intact articulated skeleton of an extinct goose, and in places, slimes on the passage walls, indicative of microbial activity. As noted above, evidence of prior use was seen in several of the caves and it is recommended that further studies of the sealed walls and stone ramps in Branta Rhuax Cave be carried out by qualified archaeologists.

**Challenges** *(encountered while working in the HETF):*

Routine natural challenges encountered include accessing the cave entrances, avoiding native vegetation when traversing the flows, not disturbing bird bones and other features in the caves while surveying, and working within constraints imposed by poor weather, property closures due to fire danger and drought, and other HETF constraints on access.

**Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

The focus of the work conducted is on the documentation of the extent and contents of the caves on Pu'u Wa'awa'a through the completion of cartographic surveys, topographic map and air photo overlays, additions to a spreadsheet of cave names, locations, and features, and written descriptions of the caves surveyed. This information, including images is provided to the HETF, DOFAW and SHPD on a periodic basis.

## MacKenzie, Rich and Ayron Strauch - Quantifying the effects of ungulate and vegetation on the hydrology of Hawaiian tropical forests.

Submitted: June 2013

**Project Location(s):** Laupahoehoe Forest Reserve and NAR  
**HETF Annual Report for Project Period:** 07/2012-07/2013

**Status Update** *(including any significant findings, please limit to 600 words):*

Paired (fenced and unfenced) runoff plots were installed July-Sept 2012 with runoff collectors, connectors, and buckets. Throughfall gages were installed on fence posts to monitor throughfall at each plot. Plot activation occurred monthly from Oct 2012 to June 2012. Soil samples were taken for bacterial analysis bimonthly. Successful runoff collection occurred during storm events in December, February, March, and May with too little rainfall during activation for all other months. Runoff volume, turbidity, and bacteria analyzed. No analyses or conclusions have been made because too few data points exist.

**Timeline** *(including overall expected completion date):*

Study will continue for the foreseeable future (at least until 07/2014) with monthly activation and data collection. Project is anticipated to continue to 2020.

**Changes to Methodology** *(or other aspects of the project):*

No changes to the methodology have been made

**Noteworthy Observations** *(including the presence of T&E species, new observations of invasive species, and/or human activity or disturbances in the area):*

none

**Challenges** *(encountered while working in the HETF):*

Getting through all four gates by oneself can be cumbersome.

**Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

None

## Michler, Charles H. - Acacia koa genetic improvement program.

Submitted: November 2013

**Project Location(s):** Laupahoehoe Forest Reserve

**HETF Annual Report for Project Period:** 07/02/2012-07/02/2013

### **Status Update** *(including any significant findings):*

Twenty eight of the best looking Acacia koa trees have been located based on their morphological characteristics such as total height, height to first fork, straightness, DBH, number of stems and crown class. The GPS coordinates were recorded, and the selected trees were marked with spray paint and flagging as mentioned. Unfortunately the production of seed that year was not good for the species in general so we were not able to collect seeds from them. As mentioned in the project description, no equipment was left in the site and the only trace left from the project was the label on the twenty eight selected trees, which can easily be removed if desired. Therefore our findings in this area were limited to the location of morphologically superior Acacia koa parent trees that could be used for the improvement program of the species in the future. However for the terms of this particular permit our job is done and we thank HETF for their support.

### **Timeline** *(including overall expected completion date):*

For this particular permit our job is done.

### **Changes to Methodology** *(or other aspects of the project):*

None

### **Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

None

### **Challenges** *(encountered while working in the HETF):*

Terrain is hard to navigate.

### **Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

None

## **Pang-Ching, Joshua - Documenting Acoustic Variability and Loss of Song Complexity in Hawaiian Honeycreepers.**

Submitted: February 2013

**Project Location(s) (check all that apply):** Pu'u Wa'awa'a Wildlife Sanctuary  
**HETF Annual Report for Project Period:** 04/2013-05/2013

**Status Update** *(including any significant findings):*

Analyses of forest acoustic recordings gathered using automatic sound recorders within the Puuwaawaa Wildlife Sanctuary have yet to yield any evidence of the Hawaii Creeper and Hawaii Akepa. We have only gone through 4 days worth of recording thus far and still have many more to go. We are hopeful, however, that the birds are there. Still, the automatic recorders have shown that there is still an established community of native hawaiian honeycreepers as well as other forest birds. Based on the acoustic recordings, it seems that 'Amakihi are the most dominant. We will continue to analyze the recordings in search of Hawaii Creeper and Akepa evidence.

**Timeline** *(including overall expected completion date):*

Recordings will continue to be surveyed for Hawaii Creeper and Hawaii Akepa vocalizations. I project that all should be analysed by the end of this year.

**Changes to Methodology** *(or other aspects of the project):*

Methodologies have remained the same

**Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

We have not observed any threatened or endangered species nor any new observations of invasive species unknown to experts.

**Challenges** *(encountered while working in the HETF):*

It takes an extensive time to analyze each recording. It involves prolonged visual and listening surveys.

**Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

N/A

**Pitt, William C. - To understand how invasive reptiles and amphibians contribute to and alter the flow of energetic resources- their role as scavengers as well as a source of sequestered energy when consumed by vertebrate scavengers in the island ecosystem of Hawai'i.**

Submitted: August 2013

**Project Location(s):** Laupahoehoe Forest Reserve and Pu'u Wa'awa'a Forest Reserve  
**HETF Annual Report for Project Period:** 06/2013 - 06/2014

**Status Update** *(including any significant findings):*

The field study was not initiated in the HETF sites this summer. Alternate sites, at Hawaii Volcanoes National Park and Puu Makaala (NARS) which were closer to the researchers' home base, were selected for this season's research project. We would like to keep the permit open as a potential site for next season's (summer 2014) field work. A permit renewal request will be forwarded prior to the current permit's expiration date if the HETF is selected for the 2014 season.

The proposed study, hosted by the NWRC Hawaii Field Station, was a collaborative research project with co-investigators from the University of Georgia Savannah River Ecology Laboratory. The lead field investigator, Ms. Erin Abernethy, is a Master's candidate at the University of Georgia Odum School of Ecology.

**Timeline** *(including overall expected completion date):*

We would like to keep the permit open as a potential site for next season's (summer 2014) field work.

**Changes to Methodology** *(or other aspects of the project):*

The field study was not initiated in the HETF sites this summer.

**Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

N/A

**Challenges** *(encountered while working in the HETF):*

N/A

**Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

N/A

## **Vitousek, Peter - Sources and fates of nutrients on a substrate age gradient across the Hawaiian archipelago and their consequences for forest dynamics.**

Submitted: December 2012

**Project Location(s):** Laupahoehoe Forest Reserve  
**HETF Annual Report for Project Period:** 1/1/12 - 12/31/12

### **Status Update** *(including any significant findings):*

Because of family issues, we did not get into the sites in 2012 - so have nothing new to report in that regard. We do plan to continue the research in 2013, with measurements of tree growth and the responses of microbial communities to fertilizer additions. Previously conducted research has continued to move towards publication, including a detailed analysis of substrate-vegetation associations by Hotchkiss' postdoctoral fellow Michael Tweiten.

### **Timeline** *(including overall expected completion date):*

The work is ongoing; we initiated it in 1990, established our core site in 1991 and the ongoing fertilizer experiment in 1993; I anticipate continuing it until I retire, perhaps in 2020.

### **Changes to Methodology** *(or other aspects of the project):*

We plan to make a new trial of root ingrowth cores in the coming year, using root growth responses to nutrient supply as an index of physiological responses to nutrient limitation. This will involve placing mesh bags containing enriched soil in the rooting zone of ca 20 ohia trees in the neighborhood of our core site.

**Noteworthy Observations** *(including the presence of T&E species, new observances of invasive species, and/or human activity or disturbances in the area):*

**Challenges** *(encountered while working in the HETF):*

**Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

Nothing new has reached print; several papers are in the process, and we have sent all earlier publications to HETF.

## Yeh, Aileen - Forest Disease Monitoring for Rust Disease affecting Ohia Lehua.

Submitted: February 2013

**Project Location(s):** Laupahoehoe Forest Reserve and NAR

**HETF Annual Report for Project Period:** 7/2012-02/2013

### **Status Update** *(including any significant findings):*

This project is ongoing and is funded through June 2013. Other than roseapple, there has been no mortality seen which could be directly attributed to the fungus *Puccinia psidii*. In other parts of the island, ohia has been observed to be affected by the rust in South Kona at elevations of 4,000 feet in the wet areas, but infection is light. These Kona areas also have roseapple which in some cases are severely affected, but in other cases, not. No rust on ohia has been observed in Manuka, Ka'u, Wood Valley, or Kapapala. Some spotting is observed on roseapple in those areas, but not on ohia. There has been more rust occurrences in 2012, probably due to the increase in rainfall on the east side. Certain areas in lower Puna have had large numbers of ohia die quickly, although it is not thought to be due to *Puccinia*. These areas are being monitored more closely and frequently, as new epicormic shoots on the old ohia trees are infected quite often by the rust. Also along Stainback highway, much more ohia is infected by rust, although it is not noticeable except up close. Bird Park sites have had some rust on a few small saplings, but rust is very rare there.

### **Timeline** *(including overall expected completion date):*

July 2013 if further funding is not obtained.

### **Changes to Methodology** *(or other aspects of the project):*

Plots have been set up to include mature trees. Previously, only seedlings and small trees were being monitored. A rating for canopy vigor of larger trees is included in this year's project for future reference to see whether these mature trees start to die. At Puu Kaliu (Puna) two separate plots have been set up to monitor tree health. One plot with healthy trees, compared to one plot with trees which are alive, but showing signs of decline in the same area. All other sites have predominantly healthy trees and seedlings.

### **Noteworthy Observations** *(including the presence of T&E species, new observations of invasive species, and/or human activity or disturbances in the area):*

None at Laupahoehoe Forest

### **Challenges** *(encountered while working in the HETF):*

None

### **Bibliography of Publications** *(Publications should include work that was done in the HETF, including gray literature, conference presentations/posters, etc.):*

None

## HETF Related Citations

Citations listed below have been submitted since the publication of the 2012 HETF Annual Report through either project annual reports or direct submission. Only published research is listed below; see specific researcher annual reports for publication in press or preparation, presentations, poster information, etc. Visit the HETF website ([http://www.hetf.us/page/major\\_topics/](http://www.hetf.us/page/major_topics/)) for a complete list of citations received to date.

Chynoweth, M.W., C.M. Litton, C.A. Lepczyk, S.C. Hess, and S. Cordell. Biology and Impacts of Pacific Island Invasive Species. *Capra hircus*, the Feral Goat, (Mammalia: Bovidae). Pacific Science.

Croucher, P.J.P., Oxford, G.S., Lam, A., Mody, N., Gillespie, R.G. 2012. Colonization history and population genetics of the exuberantly color polymorphic Hawaiian happy-face spider *Theridion grallator* (Araneae, Theridiidae). *Evolution* 66: 2815-2833.

Inman-Narahari, Faith, Rebecca Ostertag, Susan Cordell, Christian P. Giardina, Kehauwealani Nelson-Kaula, and Lawren Sack 2013. Seedling recruitment factors in low-diversity Hawaiian wet forest: towards global comparisons among tropical forests. *Ecosphere* 4:art24.

Iwashita, D.K., Litton, C.M., Giardina, C.P. 2013. Coarse woody debris carbon storage across a mean annual temperature gradient in tropical montane wet forest. *Forest Ecology and Management* 291:336-343.

Murphy-Winters, M., Inman-Narahari, F., Ostertag, R., Litton, C.M. 2013. Invasive feral pigs reduce tree fern growth and survival in a native-dominated Hawaiian montane wet forest. *Biological Invasions* 16:63–71; DOI 10.1007/s10530-013-0503-2.

Tango LKK, Hughes RF, Hiraoka K, Murphy M, Cantan A. 2012. Recruitment of the dominant native Hawaiian tree, *Metrosideros polymorpha*, limited by alien invaders. Paper, Ecological Society of America in Portland, OR (08/06/2012)

Vitousek, Peter M., and Oliver A. Chadwick. 2013. "Pedogenic Thresholds and Soil Process Domains in Basalt-Derived Soils." *Ecosystems* 16.8: 1379-395. DOI: 10.1007/s10021-013-9690-z

## Appendix A – 2013 Research Detail

### Laupāhoehoe Unit

#### *Laupāhoehoe Forest Reserve Sub-Unit*

<b>Principle Investigator:</b> Benca, Jeffrey	<b>Permit Duration:</b> Apr 30, 2013 to Apr 29, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Climatic influences on Lycopsid and fern leaf physiognomy	
<b>Affiliation:</b> University of California, Berkeley	
<b>PI Contact Info:</b> <a href="mailto:jbenca@berkeley.edu">jbenca@berkeley.edu</a> ; (206) 795-4136	
<b>Dates of Anticipated Results:</b> June 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Cordell, Susan	<b>Permit Duration:</b> Feb 26, 2013 to Feb 25, 2014
<input type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input checked="" type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input checked="" type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Hawaii Permanent Plot Network	
<b>Affiliation:</b> USDA Forest Service	
<b>PI Contact Info:</b> <a href="mailto:scordell01@fs.fed.us">scordell01@fs.fed.us</a> ; (808) 854-2628	
<b>Dates of Anticipated Results:</b> Indefinite	<b>Publications, etc. Received:</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Gillespie, Rosemary	<b>Permit Duration:</b> June 25, 2013 to June 24, 2014
<input type="checkbox"/> <b>New Permit</b> <input checked="" type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
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<b>Research Title:</b> Adaptive Radiation in Hawaiian Spiders	
<b>Affiliation:</b> University of California, Berkeley	
<b>PI Contact Info:</b> <a href="mailto:gillespie@berkeley.edu">gillespie@berkeley.edu</a> ; (510) 642-3445	
<b>Dates of Anticipated Results:</b> June 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Husby, Chad	<b>Permit Duration:</b> Apr 30, 2013 to Apr 29, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
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<b>Research Title:</b> Relationships within the Psilotum complanatum complex	
<b>Affiliation:</b> Montgomery Botanical Center, Collections Development Department	
<b>PI Contact Info:</b> <a href="mailto:chad@montgomerybotanical.org">chad@montgomerybotanical.org</a> ; (305) 667-3800 ext. 102	
<b>Dates of Anticipated Results:</b> June 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Kettwich, Scarlett	<b>Permit Duration:</b> Oct 24, 2013 to Oct 23, 2014
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<b>Research Title:</b> Epiphytes as an indicator of climate change in Hawaii	
<b>Affiliation:</b> University of Hawai'i at Hilo, TCBES Graduate Student	
<b>PI Contact Info:</b> <a href="mailto:Kettwich@hawaii.edu">Kettwich@hawaii.edu</a> ; (808) 756-6337	
<b>Dates of Anticipated Results:</b> Sept 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> LaPointe, Dennis	<b>Permit Duration:</b> Feb 26, 2013 to Feb 25, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
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<b>Research Title:</b> Assessment of mosquito-borne avian disease risk in non-breeding habitat for foraging iiwi (Vestiaria coccinea) adjacent to Hakalau Forest NWR	
<b>Affiliation:</b> USGS – Pacific Island Ecosystems Research Center (PIERC)	
<b>PI Contact Info:</b> <a href="mailto:dlapointe@usgs.gov">dlapointe@usgs.gov</a> ; (808) 985-6413	
<b>Dates of Anticipated Results:</b> Feb 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Litton, Creighton et al.	<b>Permit Duration:</b> June 25, 2013 to June 24, 2014
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<b>Research Title:</b> An Experimental Test of the impacts of rising temp on C input, allocation, and loss in model forests	
<b>Affiliation:</b> University of Hawai'i at Mānoa, Department of Natural Resources and Environmental Management	
<b>PI Contact Info:</b> <a href="mailto:litton@hawaii.edu">litton@hawaii.edu</a> ; (808) 956-6004	
<b>Dates of Anticipated Results:</b> June 2014	<b>Publications, etc. Received:</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> MacKenzie, Rich et al.	<b>Permit Duration:</b> July 23, 2013 to July 22, 2014
<input type="checkbox"/> <b>New Permit</b> <input checked="" type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
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<b>Research Title:</b> Quantifying the effects of ungulate and vegetation on the hydrology of Hawaiian tropical forests	
<b>Affiliation:</b> USDA Forest Service	
<b>PI Contact Info:</b> <a href="mailto:rmackenzie@fs.fed.us">rmackenzie@fs.fed.us</a> ; (808) 933-8121 ext. 116	
<b>Dates of Anticipated Results:</b> July 2020	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Michler, Charles	<b>Permit Duration:</b> Dec 19, 2013 to Dec 18, 2014
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<b>Research Title:</b> Acacia Koa environment genomics	
<b>Affiliation:</b> USDA Forest Service, Department of Forestry and Natural Resources, Purdue University; Director of the Hardwood Tree Improvement and Regeneration Center (HTIRC)	
<b>PI Contact Info:</b> <a href="mailto:michler@purdue.edu">michler@purdue.edu</a> ; (765) 496-6016	
<b>Dates of Anticipated Results:</b> Dec 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Peck, Robert		<b>Permit Duration:</b> Mar 27, 2013 to Mar 26, 2014	
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<b>Research Title:</b> Assessing the Scotorythra paludicola (Lepidoptera: Geometridae) outbreak on koa: population abundance, rates of parasitism and patterns of spread			
<b>Affiliation:</b> University of Hawai'i at Hilo, Hawai'i Cooperative Studies Unit			
<b>PI Contact Info:</b> <a href="mailto:bwpeck@usgs.gov">bwpeck@usgs.gov</a> ; (808) 985-6438			
<b>Dates of Anticipated Results:</b> Feb 2014		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Pitt, William		<b>Permit Duration:</b> Jun 25, 2013 to Jun 24, 2014	
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<b>Research Title:</b> To understand how invasive reptiles and amphibians contribute to and alter the flow of energetic resources- their role as scavengers as well as source of sequestered energy when consumed by vertebrate scavengers in the island ecosystem of Hawai'i			
<b>Affiliation:</b> USDA/APHIS National Wildlife Research Center (NWRC)			
<b>PI Contact Info:</b> <a href="mailto:will.pitt@aphis.usda.gov">will.pitt@aphis.usda.gov</a> ; (808) 961-4482, x22			
<b>Dates of Anticipated Results:</b> Dec 2013		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Price, Jonathan		<b>Permit Duration:</b> Mar 27, 2013 to Mar 26, 2014	
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<b>Research Title:</b> UH Hilo Geography and Environmental Studies Senior Seminar Projects			
<b>Affiliation:</b> : University of Hawai'i at Hilo, Geography Dept.			
<b>PI Contact Info:</b> <a href="mailto:jpprice@hawaii.edu">jpprice@hawaii.edu</a> ; (808) 932-7241			
<b>Dates of Anticipated Results:</b> Apr 2013		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input checked="" type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Vitousek, Peter	<b>Permit Duration:</b> Feb 26, 2013 to Feb 25, 2014
<input type="checkbox"/> <b>New Permit</b> <input checked="" type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Sources and fates of nutrients on a substrate age gradient across the Hawaiian archipelago and their consequences for forest dynamics	
<b>Affiliation:</b> Stanford University	
<b>PI Contact Info:</b> <a href="mailto:vitousek@stanford.edu">vitousek@stanford.edu</a> ; (650) 814-6812	
<b>Dates of Anticipated Results:</b> 2020	<b>Publications, etc. Received:</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

***Laupāhoehoe Natural Area Reserve Sub-Unit***

<b>Principle Investigator:</b> Benca, Jeffrey	<b>Permit Duration:</b> Apr 30, 2013 to Apr 29, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Climatic influences on Lycopoid and fern leaf physiognomy	
<b>Affiliation:</b> University of California, Berkeley	
<b>PI Contact Info:</b> <a href="mailto:jbenca@berkeley.edu">jbenca@berkeley.edu</a> ; (206) 795-4136	
<b>Dates of Anticipated Results:</b> June 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Bonaccorso, Frank	<b>Permit Duration:</b> June 25, 2013 to June 24, 2014
<input type="checkbox"/> <b>New Permit</b> <input checked="" type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Hawaiian Hoary Bat habitat occupancy, population demographics and diet	
<b>Affiliation:</b> United States Geological Survey	
<b>PI Contact Info:</b> <a href="mailto:fbonaccorso@usgs.gov">fbonaccorso@usgs.gov</a> ; (808) 985-6444, (808) 967-8568	
<b>Dates of Anticipated Results:</b> June 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Cordell, Susan	<b>Permit Duration:</b> Feb 26, 2013 to Feb 25, 2014
<input type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input checked="" type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input checked="" type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Hawaii Permanent Plot Network	
<b>Affiliation:</b> USDA Forest Service	
<b>PI Contact Info:</b> <a href="mailto:scordell01@fs.fed.us">scordell01@fs.fed.us</a> ; (808) 854-2628	
<b>Dates of Anticipated Results:</b> Indefinite	<b>Publications, etc. Received:</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Gillespie, Rosemary	<b>Permit Duration:</b> June 25, 2013 to June 24, 2014
<input type="checkbox"/> <b>New Permit</b> <input checked="" type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input checked="" type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Adaptive Radiation in Hawaiian Spiders	
<b>Affiliation:</b> University of California, Berkeley	
<b>PI Contact Info:</b> <a href="mailto:gillespie@berkeley.edu">gillespie@berkeley.edu</a> ; (510) 642-3445	
<b>Dates of Anticipated Results:</b> June 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Husby, Chad	<b>Permit Duration:</b> Apr 30, 2013 to Apr 29, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Relationships within the Psilotum complanatum complex	
<b>Affiliation:</b> Montgomery Botanical Center, Collections Development Department	
<b>PI Contact Info:</b> <a href="mailto:chad@montgomerybotanical.org">chad@montgomerybotanical.org</a> ; (305) 667-3800 ext. 102	
<b>Dates of Anticipated Results:</b> June 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Johnson, Tracy	<b>Permit Duration:</b> July 23, 2013 to July 22, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Impacts of strawberry guava management across a density gradient	
<b>Affiliation:</b> USDA Forest Service	
<b>PI Contact Info:</b> <a href="mailto:tracyjohnson@fs.fed.us">tracyjohnson@fs.fed.us</a> ; (808) 967-7122	
<b>Dates of Anticipated Results:</b> Sept 2028	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Litton, Creighton et al.	<b>Permit Duration:</b> June 25, 2013 to June 24, 2014
<input type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input checked="" type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> An Experimental Test of the impacts of rising temp on C input, allocation, and loss in model forests	
<b>Affiliation:</b> University of Hawai'i at Mānoa, Department of Natural Resources and Environmental Management	
<b>PI Contact Info:</b> <a href="mailto:litton@hawaii.edu">litton@hawaii.edu</a> ; (808) 956-6004	
<b>Dates of Anticipated Results:</b> June 2014	<b>Publications, etc. Received:</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> MacKenzie, Rich et al.	<b>Permit Duration:</b> July 23, 2013 to July 22, 2014
<input type="checkbox"/> <b>New Permit</b> <input checked="" type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Quantifying the effects of ungulate and vegetation on the hydrology of Hawaiian tropical forests	
<b>Affiliation:</b> USDA Forest Service	
<b>PI Contact Info:</b> <a href="mailto:rmackenzie@fs.fed.us">rmackenzie@fs.fed.us</a> ; (808) 933-8121 ext. 116	
<b>Dates of Anticipated Results:</b> July 2020	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Peck, Robert	<b>Permit Duration:</b> Mar 27, 2013 to Mar 26, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Assessing the Scotorythra paludicola (Lepidoptera: Geometridae) outbreak on koa: population abundance, rates of parasitism and patterns of spread	
<b>Affiliation:</b> University of Hawai'i at Hilo, Hawai'i Cooperative Studies Unit	
<b>PI Contact Info:</b> <a href="mailto:bwpeck@usgs.gov">bwpeck@usgs.gov</a> ; (808) 985-6438	
<b>Dates of Anticipated Results:</b> Feb 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Pitt, William	<b>Permit Duration:</b> Jun 25, 2013 to Jun 24, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> To understand how invasive reptiles and amphibians contribute to and alter the flow of energetic resources- their role as scavengers as well as source of sequestered energy when consumed by vertebrate scavengers in the island ecosystem of Hawai'i	
<b>Affiliation:</b> USDA/APHIS National Wildlife Research Center (NWRC)	
<b>PI Contact Info:</b> <a href="mailto:will.pitt@aphis.usda.gov">will.pitt@aphis.usda.gov</a> ; (808) 961-4482, x22	
<b>Dates of Anticipated Results:</b> Dec 2013	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Price, Jonathan	<b>Permit Duration:</b> Mar 27, 2013 to Mar 26, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> UH Hilo Geography and Environmental Studies Senior Seminar Projects	
<b>Affiliation:</b> : University of Hawaii at Hilo, Geography Dept.	
<b>PI Contact Info:</b> <a href="mailto:jpprice@hawaii.edu">jpprice@hawaii.edu</a> ; (808) 932-7241	
<b>Dates of Anticipated Results:</b> Apr 2013	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input checked="" type="checkbox"/> Completion <input type="checkbox"/> New Permit	

## Pu'u Wa'awa'a Unit

### *Pu'u Wa'awa'a Forest Reserve Sub-Unit*

<b>Principle Investigator:</b> Chang, Paul		<b>Permit Duration:</b> Jul 23, 2013 to Jul 22, 2014	
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>			
<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input checked="" type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park			
<b>Research Title:</b> Sandalwood Core Sampling			
<b>Affiliation:</b> USFWS Office of Law Enforcement			
<b>PI Contact Info:</b> <a href="mailto:Paul.Chang@fws.gov">Paul.Chang@fws.gov</a> ; (808) 933-6900			
<b>Dates of Anticipated Results:</b> July 2014		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Cordell, Susan		<b>Permit Duration:</b> Feb 26, 2013 to Feb 25, 2014	
<input type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input checked="" type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>			
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input checked="" type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park			
<b>Research Title:</b> Hawaii Permanent Plot Network			
<b>Affiliation:</b> USDA Forest Service			
<b>PI Contact Info:</b> <a href="mailto:scordell01@fs.fed.us">scordell01@fs.fed.us</a> ; (808) 854-2628			
<b>Dates of Anticipated Results:</b> Indefinite		<b>Publications, etc. Received:</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Cordell, Susan		<b>Permit Duration:</b> Jun 25, 2013 to Jun 24, 2014	
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<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park			
<b>Research Title:</b> The potential for restoration to break the grass/fire cycle in dryland ecosystems in Hawaii			
<b>Affiliation:</b> USDA Forest Service			
<b>PI Contact Info:</b> <a href="mailto:scordell01@fs.fed.us">scordell01@fs.fed.us</a> ; (808) 854-2628			
<b>Dates of Anticipated Results:</b> 2016		<b>Publications, etc. Received:</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Dykstra, Brian J.	<b>Permit Duration:</b> May 31, 2013 to May 30, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> The effect of pollination on fruit and seed yields of māmane ( <i>Sophora chrysophylla</i> )	
<b>Affiliation:</b> None - preliminary scoping for a potential PhD project	
<b>PI Contact Info:</b> <a href="mailto:brianjdykstra@gmail.com">brianjdykstra@gmail.com</a> ; (616) 558-0404	
<b>Dates of Anticipated Results:</b> Fall 2013	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Earnshaw, Kyle	<b>Permit Duration:</b> Jun 25, 2013 to Jun 24, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Phenotypic plasticity and adaptation of <i>Acacia koa</i> Gray along a climatic gradient using three ecotypes	
<b>Affiliation:</b> Tropical Hardwood Tree Improvement and Regeneration Center, Purdue University, West Lafayette, IN	
<b>PI Contact Info:</b> <a href="mailto:kearnsha@purdue.edu">kearnsha@purdue.edu</a>	
<b>Dates of Anticipated Results:</b> Dec 2015	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Gillespie, Rosemary	<b>Permit Duration:</b> June 25, 2013 to June 24, 2014
<input type="checkbox"/> <b>New Permit</b> <input checked="" type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input checked="" type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Adaptive Radiation in Hawaiian Spiders	
<b>Affiliation:</b> University of California, Berkeley	
<b>PI Contact Info:</b> <a href="mailto:gillespie@berkeley.edu">gillespie@berkeley.edu</a> ; (510) 642-3445	
<b>Dates of Anticipated Results:</b> June 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Hughes, R. Flint		<b>Permit Duration:</b> Aug 28, 2013 to Aug 27, 2014	
<input type="checkbox"/> <b>New Permit</b> <input checked="" type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>			
<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input checked="" type="checkbox"/> PWW-Park			
<b>Research Title:</b> Quantifying dynamics and magnitude of water loss from Kiawe forests in North Kona - Kiholo Bay.			
<b>Affiliation:</b> USDA Forest Service			
<b>PI Contact Info:</b> <a href="mailto:fhughes@fs.fed.us">fhughes@fs.fed.us</a> ; (808) 933-8121 ext 117			
<b>Dates of Anticipated Results:</b> Jun 2014		<b>Publications, etc. Received:</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Medville, Douglas		<b>Permit Duration:</b> Jan 1, 2013 to Dec 31, 2014	
<input type="checkbox"/> <b>New Permit</b> <input checked="" type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>			
<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input checked="" type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park			
<b>Research Title:</b> Lava tube location, survey, and resource evaluation on Pu'u Wa'awa'a and Pu'u Anahulu			
<b>Affiliation:</b> Hawai'i Speleological Survey			
<b>PI Contact Info:</b> <a href="mailto:medville@verizon.net">medville@verizon.net</a> ; (703) 860-0134			
<b>Dates of Anticipated Results:</b> Dec 2013		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Pang-Ching, Joshua		<b>Permit Duration:</b> Mar 27, 2013 to Mar 26, 2014	
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>			
<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input checked="" type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park			
<b>Research Title:</b> Documenting Acoustic Variability and Loss of Song Complexity in Hawaiian Honeycreepers			
<b>Affiliation:</b> University of Hawai'i at Hilo, TCBES Graduate Student			
<b>PI Contact Info:</b> <a href="mailto:joshuapc@hawaii.edu">joshuapc@hawaii.edu</a> ; (808)854-4212			
<b>Dates of Anticipated Results:</b> May 2013		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Renewal <input checked="" type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Pitt, William	<b>Permit Duration:</b> Jun 25, 2013 to Jun 24, 2014
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input checked="" type="checkbox"/> LAU-NAR <input checked="" type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> To understand how invasive reptiles and amphibians contribute to and alter the flow of energetic resources- their role as scavengers as well as source of sequestered energy when consumed by vertebrate scavengers in the island ecosystem of Hawai'i	
<b>Affiliation:</b> USDA/APHIS National Wildlife Research Center (NWRC)	
<b>PI Contact Info:</b> <a href="mailto:will.pitt@aphis.usda.gov">will.pitt@aphis.usda.gov</a> ; (808) 961-4482, x22	
<b>Dates of Anticipated Results:</b> Dec 2013	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Shea, Thomas	<b>Permit Duration:</b> Sept 25, 2013 to Sept 24, 2014
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<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park	
<b>Research Title:</b> Field investigation of the volcanic history of Pu'u Wa'awa'a	
<b>Affiliation:</b> University of Hawai'i at Manoa, Dept. of Geology & Geophysics	
<b>PI Contact Info:</b> <a href="mailto:tshea@hawaii.edu">tshea@hawaii.edu</a> ; (808) 956-9819	
<b>Dates of Anticipated Results:</b> Sept 2014	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Wasser, Mark	<b>Permit Duration:</b> Jan 24, 2013 to Jan 23, 2014
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<b>Research Title:</b> Long-term fire effects in Metrosideros dominated communities on Hawai'i Island	
<b>Affiliation:</b> University of Hawai'i Hilo	
<b>PI Contact Info:</b> <a href="mailto:mwasser@hawaii.edu">mwasser@hawaii.edu</a>	
<b>Dates of Anticipated Results:</b> Dec 2013	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

<b>Principle Investigator:</b> Yanger, Corie	<b>Permit Duration:</b> Dec 19, 2013 to Dec 18, 2014
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<b>Research Title:</b> Examining the effect of invasive thrips infestation on natural and planted Hawaiian Myoporum seedlings	
<b>Affiliation:</b> University of Hawai'i at Hilo, M.S. candidate in Tropical Conservation Biology and Environmental Science	
<b>PI Contact Info:</b> <a href="mailto:cmyanger@hawaii.edu">cmyanger@hawaii.edu</a> ; (808) 430-0913	
<b>Dates of Anticipated Results:</b> Jan 2015	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

*Pu'u Wa'awa'a Forest Bird Sanctuary Sub-Unit*

<b>Principle Investigator:</b> Chang, Paul		<b>Permit Duration:</b> Jul 23, 2014 to Jul 22, 2014	
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>			
<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input checked="" type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park			
<b>Research Title:</b> Sandalwood Core Sampling			
<b>Affiliation:</b> USFWS Office of Law Enforcement			
<b>PI Contact Info:</b> <a href="mailto:Paul_Chang@fws.gov">Paul_Chang@fws.gov</a> ; (808) 933-6900			
<b>Dates of Anticipated Results:</b> July 2014		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Cordell, Susan		<b>Permit Duration:</b> Feb 26, 2013 to Feb 25, 2014	
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<b>Research Title:</b> Hawaii Permanent Plot Network			
<b>Affiliation:</b> USDA Forest Service			
<b>PI Contact Info:</b> <a href="mailto:scordell01@fs.fed.us">scordell01@fs.fed.us</a> ; (808) 854-2628			
<b>Dates of Anticipated Results:</b> Indefinite		<b>Publications, etc. Received:</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Gillespie, Rosemary		<b>Permit Duration:</b> June 25, 2013 to June 24, 2014	
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<b>Research Title:</b> Adaptive Radiation in Hawaiian Spiders			
<b>Affiliation:</b> University of California, Berkeley			
<b>PI Contact Info:</b> <a href="mailto:gillespie@berkeley.edu">gillespie@berkeley.edu</a> ; (510) 642-3445			
<b>Dates of Anticipated Results:</b> June 2014		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> LaPointe, Dennis		<b>Permit Duration:</b> Jan 1, 2013 to Dec 31, 2013	
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<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input type="checkbox"/> PWW-FR <input checked="" type="checkbox"/> PWW-FBS <input type="checkbox"/> PWW-Park			
<b>Research Title:</b> Distribution and prevalence of knemidokoptic mange in Hawaii Amakihi on the Island of Hawaii			
<b>Affiliation:</b> USGS – Pacific Island Ecosystems Research Center (PIERC)			
<b>PI Contact Info:</b> <a href="mailto:dlapointe@usgs.gov">dlapointe@usgs.gov</a> ; (808) 985-6413			
<b>Dates of Anticipated Results:</b> Jan 2015		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Medville, Douglas		<b>Permit Duration:</b> Jan 1, 2013 to Dec 31, 2013	
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<b>Research Title:</b> Lava tube location, survey, and resource evaluation on Pu'u Wa'awa'ā and Pu'u Anahulu			
<b>Affiliation:</b> Hawai'i Speleological Survey			
<b>PI Contact Info:</b> <a href="mailto:medville@verizon.net">medville@verizon.net</a> ; (703) 860-0134			
<b>Dates of Anticipated Results:</b> Dec 2013		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Pang-Ching, Joshua		<b>Permit Duration:</b> Mar 27, 2013 to Mar 26, 2014	
<input checked="" type="checkbox"/> <b>New Permit</b> <input type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>			
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<b>Research Title:</b> Documenting Acoustic Variability and Loss of Song Complexity in Hawaiian Honeycreepers			
<b>Affiliation:</b> University of Hawai'i at Hilo, TCBES Graduate Student			
<b>PI Contact Info:</b> <a href="mailto:joshuapc@hawaii.edu">joshuapc@hawaii.edu</a> ; (808)854-4212			
<b>Dates of Anticipated Results:</b> May 2013		<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Renewal <input checked="" type="checkbox"/> Completion <input type="checkbox"/> New Permit			

<b>Principle Investigator:</b> Wasser, Mark	<b>Permit Duration:</b> Jan 24, 2013 to Jan 23, 2014
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<b>Research Title:</b> Long-term fire effects in Metrosideros dominated communities on Hawai'i Island	
<b>Affiliation:</b> University of Hawai'i Hilo	
<b>PI Contact Info:</b> <a href="mailto:mwasser@hawaii.edu">mwasser@hawaii.edu</a>	
<b>Dates of Anticipated Results:</b> Dec 2013	<b>Publications, etc. Received:</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>Annual Report Received:</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Renewal <input type="checkbox"/> Completion <input checked="" type="checkbox"/> New Permit	

***Pu'u Wa'awa'a State Park Reserve (Kiholo) Sub-Unit***

<b>Principle Investigator:</b> Hughes, R. Flint	<b>Permit Duration:</b> Aug 28, 2013 to Aug 27, 2014
<input type="checkbox"/> <b>New Permit</b> <input checked="" type="checkbox"/> <b>Renewal</b> <input type="checkbox"/> <b>Permanent (contingent upon approval)</b> <input type="checkbox"/> <b>No Valid Permit</b>	
<b>Project Location(s):</b> <input type="checkbox"/> LAU-NAR <input type="checkbox"/> LAU-FR <input checked="" type="checkbox"/> PWW-FR <input type="checkbox"/> PWW-FBS <input checked="" type="checkbox"/> PWW-Park	
<b>Research Title:</b> Quantifying dynamics and magnitude of water loss from Kiawe forests in North Kona - Kiholo Bay.	
<b>Affiliation:</b> USDA Forest Service	
<b>PI Contact Info:</b> <a href="mailto:fhughes@fs.fed.us">fhughes@fs.fed.us</a> ; (808) 933-8121 ext 117	
<b>Dates of Anticipated Results:</b> Jun 2014	<b>Publications, etc. Received:</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<b>Annual Report Received:</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Renewal <input type="checkbox"/> Completion <input type="checkbox"/> New Permit	

## Appendix B - Metadata

- All information submitted by researchers, i.e. annual reports, research affiliation, title, etc., are included as is. We do not add any diacritical marks, correct punctuation, capitalization or grammatical errors.
- Research affiliations are broken down into five groups: Forest Service, University of Hawai'i (Hilo and Mānoa campuses), other Universities, other Government Organizations, and Other. The 'other' category was added in 2011 and includes societies, organizations, museums, institutions, and clubs, etc.
- Educational permits are grouped into three categories: Academic (Universities, K-12 grade schools, home schools, etc.), Institution (all federal and state agencies) and Organization (i.e. Boy Scouts of America, Media visits, E Mau Nā Ala Hele, Three Mountain Alliance, Mauna Kea Watershed Alliance, etc.).
- Within the educational permit categories the activities include: education, service, education/service (this is when an education trip also includes a service portion) and other (which includes trainings, surveys (engineer, archaeological, plot or private) as well as site visits, tours, media visits and Hawaiian cultural practices such as Ho'olaulea).
- All new and renewal permit applicants are required to submit an annual report within one year of completion or at the time of renewal.

## Appendix C – 2013 HETF Staff and related members

### USFS Staff

*USFS-HETF Line Officer* - Dr. Ric Lopez

*USFS-HETF Science Lead* – Dr. Susan Cordell

*USFS-HETF Education Lead* – Dr. Christian Giardina

*USFS-HETF Facilities Manager* – Susan Litteral

*HETF Coordinator* – Mel Dean

*HETF Administrator* – Tabetha Block

### DOFAW Staff

*Hawai'i Island DOFAW Branch Manager*

Roger Imoto - January 1 - 15, 2013

Steve Bergfeld - January 16 - March 28, 2013 (*Acting*)

Lisa Hadway - March 29, 2013 - January 15, 2014

*Hawai'i Island Natural Area Reserves Program Manager*

Lisa Hadway - January 1 - March 28, 2013

Ian Cole & Nick Agorastos – alternated monthly, until a permanent position was filled by Nick Agorastos on January 6, 2014.

*Hawai'i Island Forestry Program Manager* – Steve Bergfeld

*East Hawai'i Island Wildlife Biologist* – Joey Mello

*West Hawai'i Island Wildlife Biologist* – Hans Sin

*Pu'u Wa'awa'a coordinator* – Elliott Parsons

*State Parks Hawai'i Island District Superintendent* – Dean Takebayashi



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# YCC

## 2013 Report Summary

**The Pacific Southwest Research Station (PSW), Institute of Pacific Islands Forestry (IPIF) & Region 5 supported a total of 20 AmeriCorps members in 3 Youth Conservation Corps programs in Hawai'i in 2013.**



AmeriCorps programs in Hawai'i are administered by **Kupu**, a nonprofit community organization ([kupu.hawaii.org](http://kupu.hawaii.org)). IPIF participates in three Kupu AmeriCorps/Youth Conservation Corps (YCC) programs: The **Gateway Program** is an 8-week summer team experience designed for young adults (ages 17-20). Team members complete hands-on fieldwork at various worksites. The **Frontiers Program** provides a more in-depth individual 8-week summer experience at a single worksite that best matches the individual's interests. The **Extended Internship Program (EIP)** offers an intensive entry-level 11-month experience in preparation for a career in the conservation field. Individuals work one-on-one with an environmental agency that best matches their interests.

**Gateway Accomplishments:**

- Team members contributed a total of **1,056 volunteer hours towards conservation and restoration activities** helping the USFS and a diverse group of partners including the Hawai'i Division of Forestry and Wildlife, Mauna Kea Watershed Alliance, Hakalau NWR, and the Office of Mauna Kea Management.
- Gateway team members also **participated in unique education and cultural experiences** through Kupu programming (example Kaho'olawe, page 5) and via IPIF and partner programs.
- **12 Hawai'i youth and 3 team leaders gained hands on work experience.**
- For an overview of their summer activities see pages 3 & 4.

**Frontier & EIP Accomplishments:**

- Members **gained valuable work experience** in research, management, and environmental education.
- For an overview of their experience see page 2.

**Awards:**

- PSW/IPIF received two awards associated with its AmeriCorps programs 1) a Kupu Host Site Award and 2) a Human Diversity award from the Organization of Biological Field Stations (OBFS).
- In addition, Kupu was selected as the USFS R5 Regional Forester's Honor Award recipient for outstanding service in Engaging Youth.

**List of Acronyms:**

<p>DOFAW - Hawai'i Division of Forestry and Wildlife</p> <p>DHHL - Department of Hawaiian Homelands</p> <p>EIP - Extended Internship Program</p> <p>HETF - Hawai'i Experimental Tropical Forest</p> <p>YCC - Youth Conservation Corps</p> <p>IPIF - Institute of Pacific Islands Forestry</p> <p>LSEC - Laupāhoehoe Science and Education Center</p> <p>MKWA - Mauna Kea Watershed Alliance</p>	<p>OMIKM - Office of Mauna Kea Management</p> <p>NWR - National Wildlife Refuge</p> <p>PSW - Pacific Southwest Research Station</p> <p>R5 - USFS Region 5</p> <p>TMA - Three Mountain Alliance</p> <p>USDA - United States Dept. of Agriculture</p> <p>USGS - United States Geological Survey</p> <p>USFS - United States Forest Service</p> <p>USFWS - United States Fish and Wildlife Service</p>
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**Contents:**

- YCC Program Overview, Accomplishments, Awards & Acronyms 1
- Frontier & EIP Member Highlights 2
- Gateway Member Highlights 3 – 5
- Budget 5



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# YCC 2013 Report Summary

## About our Frontier & EIP members:

### Riley De Mattos

Mentor: *Christian Giardina, Research Ecologist (USFS)*

As a Frontier member and now an EIP member, Riley assists with research that includes koa tree improvement, controlling problem rodents, collecting forest productivity data, surveying forest fragments for native birds, and maintaining plots. He also manages the IPIF greenhouse for an 'ōhi'a fragmentation and genetics project, as well as cares for Uliehulehu program seedlings.



### Kimberlynn Lewi

Mentor: *Elliott Parsons, Pu'u Wa'awa'a coordinator (DOFAW)*

Kimberlynn assisted with a koa looper moth monitoring experiment, mentored an intern for 1-month, helped maintain water infrastructure, controlled weeds, assisted with environmental education programs, and planted native trees in conservation units. Kimberlynn is currently an EIP member with Ka'upulehu Dry Forest.



### Kahea Nihipali

Mentor: *Tracy Johnson, Research Entomologist (USFS)*

Kahea worked with a field crew to establish sites for monitoring strawberry guava invasion and response to a new biocontrol in the HETF Laupāhoehoe Unit. She marked plot boundaries, identified native seedlings, and measured native and invasive trees. Kahea continues to work with the USFS as a field technician on a collaborative research project. Project duties include: bi-weekly checks on rat-trap stations, litterfall collection and processing, and quarterly predator tracking.



### Elsie (Aloha) Andaya-Bohal

Mentor: *Rich Mackenzie, Research Ecologist (USFS)*

Aloha assisted with water quality and native shrimp sampling from 12 streams along the North Hilo stream flow gradient. She collected water samples, insects, algae, and shrimp in the field and helped process samples back in the lab.



*The Kupu EIP program is an excellent way to get your foot in the door to many conservation agencies. Since being at IPIF I have experienced the full spectrum of conservation, from removing invasive species to native bird work. This experience has nurtured within me a strong work ethic and positive attitude that will carry me through many open doors in my future.*

—Riley, Frontier and EIP Member



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# YCC 2013 Report Summary

## Gateway Member Activities:

June 11-14

Site Hosts: USFS & DOFAW / Location: Laupāhoehoe

### Activities:

- Toured Laupāhoehoe Science and Education Center and removed onsite invasive weeds
- Controlled and eradicated weeds and provided trail maintenance in Laupāhoehoe forest
- Controlled 2.5 acres of weeds in ten acre fenced enclosure in Laupāhoehoe forest
- Cleared vegetation and repaired conservation unit perimeter
- Skirted and controlled outlier population of *Persicaria chinensis* (a new incipient weed)



June 17-20

Site Host: USFWS / Location: Hakalau Wildlife Refuge

### Activities:

- Controlled weeds
- Removed invasive species including english holly and banana poka within an approximately 100 acre area
- Out-planted 544 trees and under-story species including: 'ōhi'a, kōlea lau nui, 'āweoweo, pilo, 'ōlapa, 'ākala and pūkiawe
- Participated in a bird id/observation hike, and assisted in a hands-on USGS bird banding project



Gateway members gained hands on experience in many aspects of natural resource management, working in both units of the Hawai'i Experimental Tropical Forest, as well as other conservation areas managed by agency partners, such as the Hawai'i Division of Forestry and Wildlife, Mauna Kea Watershed Alliance and the Office of Mauna Kea Management. To compliment this, members were also exposed to unique cultural experiences as part of their YCC experience.



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# YCC 2013 Report Summary

## Gateway Member Activities:

June 24-28

Site Host: DOFAW

Location: Pu'u Wa'awa'a

### Activities:

- Maintained and watered native plants
- Built trails
- Collected native plants and seeds
- Cleared vegetation from fire-fuel breaks
- Planned and created environmental education activities for a Waikoloa Future Foresters visit at the Waikoloa Dry Forest
- Participated in environmental education activities and controlled weeds at Ka'upulehu Dryland Forest



July 1-3, Site Host: USFS / Location: Laupāhoehoe

July 5, Site Host: OMKM / Location: Hale Pohaku

### Laupāhoehoe Activities:

- Controlled weeds
- Collected and processed native seeds
- Maintained trails
- Pounded poi
- Created lei
- Shared cultural stories



### Hale Pohaku Activities:

- Controlled invasive fireweed
- Learned about management and research activities on Mauna Kea



July 8 & 9

Site Host: MKWA & DHHL

Location: Pi'i Honua

### Activities:

- Controlled weeds and mapped gorse in the Wailuku river headwaters
- Surveyed 64 acres of gorse and controlled one solid acre of gorse in 12 hours with a six person crew
- Surveyed and controlled 4.20 acres of gorse in the sugi pine understory (shade is being used to contain the main gorse infestation)
- Discussed history of Mauna Kea and surrounding area



*This was the best summer of my life and I feel so blessed by everyone I met through this program. I made incredible connections with people in the field of conservation and learned so many things. This program really changed me and I feel like I have a brighter future because of my experience with Kupu. — Pamela, Gateway Team Member*



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Institute of Pacific Islands Forestry

# YCC 2013 Report Summary

## Gateway Member Activities:

### Safety Training & Team Building

In addition to the hands-on job experience, members spend their first week at Camp Erdman on Oahu. During the week members participate in team building exercises, CPR/first aid training, a high/low ropes courses and an environmental fair and luncheon, as well as a talent show before flying to their host island.



### Kaho'olawe

As part of the Gateway team experience, members participate in a Department of Defense (DOD) funded restoration effort on Kaho'olawe Island. The entire island had been controlled by the DOD and used for military training. Decades of bombing exercises had denuded Kaho'olawe of vegetation and resulting erosion stripped much of the island's top soil. The island was placed under the management of the Kaho'olawe Island Reserve Commission, which holds the island in trust for eventual full control by a Native Hawaiian led organization. Members spend one week on the island participating in active restoration, as well as learning about the cultural geography of Kaho'olawe and natural resources focused on native Hawaiian cultural practices.



### Additional Gateway Information

PSW/IPF supported 1 Gateway team for 8 weeks (USFS team) and also supported two additional Gateway teams for 1 week each (regular teams). Regular team members worked at Pu'u Wa'awa'a for 8 days and one team joined the USFS team on July 5<sup>th</sup> with OMKM at Hale Pohaku.

#### Pu'u Wa'awa'a activities :

- Assisted with a koa looper moth study on top of Pu'u Wa'awa'a cinder cone
- Out-planted native plants
- Monitored native plants and maintained existing restoration areas



Gateway team support = Region 5 YCC (\$26K) and PSW/IPIF (\$1K)  
Frontier member support = PSW/IPIF (\$5K). EIP support = PSW/IPIF (\$14K)

## Funding: