2010

HETF Annual Report

Aerial view of Kiholo Bay, part of the HETF Puu Waawaa Unit
Photo by Rob Shallenberger

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List of Acronyms

DLNR - Hawaii Division of Land and Natural Resources

DOFAW - Hawaii Division of Forestry and Wildlife

FR - Forest Reserve

FBS - Forest Bird Sanctuary

HETF - Hawaii Experimental Tropical Forest

HIPPNET – Hawaii Permanent Plot Network

LAU - Laupahoehoe Unit of the Hawaii Experimental Tropical Forest

NAR - Natural Area Reserve

PWW - Puu Waawaa Unit of the Hawaii Experimental Tropical Forest

USDA - United States Department of Agriculture

Acknowledgements

The establishment and administration of the Hawaii Experimental Tropical Forest (HETF) has been successful due to the support and hard work of many individuals. First, we would like to recognize Deanna Stouder and Paul Conry for their leadership and support in 2010. The USDA Forest Service would like to thank the State of Hawaii 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 2010 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, Michael Constantinides, Betsy Gagne, Lisa Hadway, Roger Imoto, Lyman Perry, Hans Sin, and Charlene Unoki. Mahalo to Colleen Cole, Bob Masuda, and Elliot Parsons for their work with the HETF Planning Group and beyond. Special thanks to the additional USDA Forest Service employees who have tirelessly worked to support the HETF's success in their respective capacities in 2010 including: Hao Tran, Jerry Carlson, Tom Cole, Susan Cordell, Marti Dodds, Christian Giardina, Christine Hansen, Pamela Holton, Julie Laufman, Casey Matsunaga, Veronica Moreland, William Nielson, Cheyenne Perry, Paul Scowcroft, John Slown, Randy Shrank, Molly Murphy, Wendy Powell and Tabetha Block.

Introduction

The Hawaii Experimental Tropical Forest (HETF) was established in 2007 and includes two Units: the Laupahoehoe Wet Forest, totaling 12,343 acres, and the Puu Waawaa Dry Forest, totaling 38,885 acres (See Figure 1). The HETF overlays existing State of Hawaii, Department of Land and Natural Resources (DLNR) owned and managed lands and include the following land designations: Forest Reserve and Natural Area Reserve in Laupahoehoe and Wildlife Sanctuary (Forest Bird Sanctuary), Forest Reserve and State Parks in Puu Waawaa. The USDA Forest Service, Pacific Southwest Research Station in Hilo, works with the DLNR – Division of Forestry and Wildlife (DOFAW) and State Parks to manage research and education activities within the HETF. The HETF is part of a network of Experimental Forest and Range units across the continental United States (http://www.fs.fed.us/research/efr/).

The HETF's mission is to provide landscapes, facilities, and data/information for those wishing to conduct research and education activities contributing to a better understanding of the biological diversity and functioning of tropical forests and riparian ecosystems and their 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 HETF is currently in a planning phase relating to its research and education facilities as well as its vision. As these plans progress they will be included in future annual reports. Additional information regarding the HETF's history, future plans and the 2007-2009 Annual Report as well as other resource documents can be found online at www.hetf.us.

The report information herein is focused on the research and education activities that took place within the HETF in 2010 including annual reports received from researchers. Activity data from previous years is included in graphical data where relevant. Also included are the concerns, comments, and challenges that took place relating to the HETF operations.

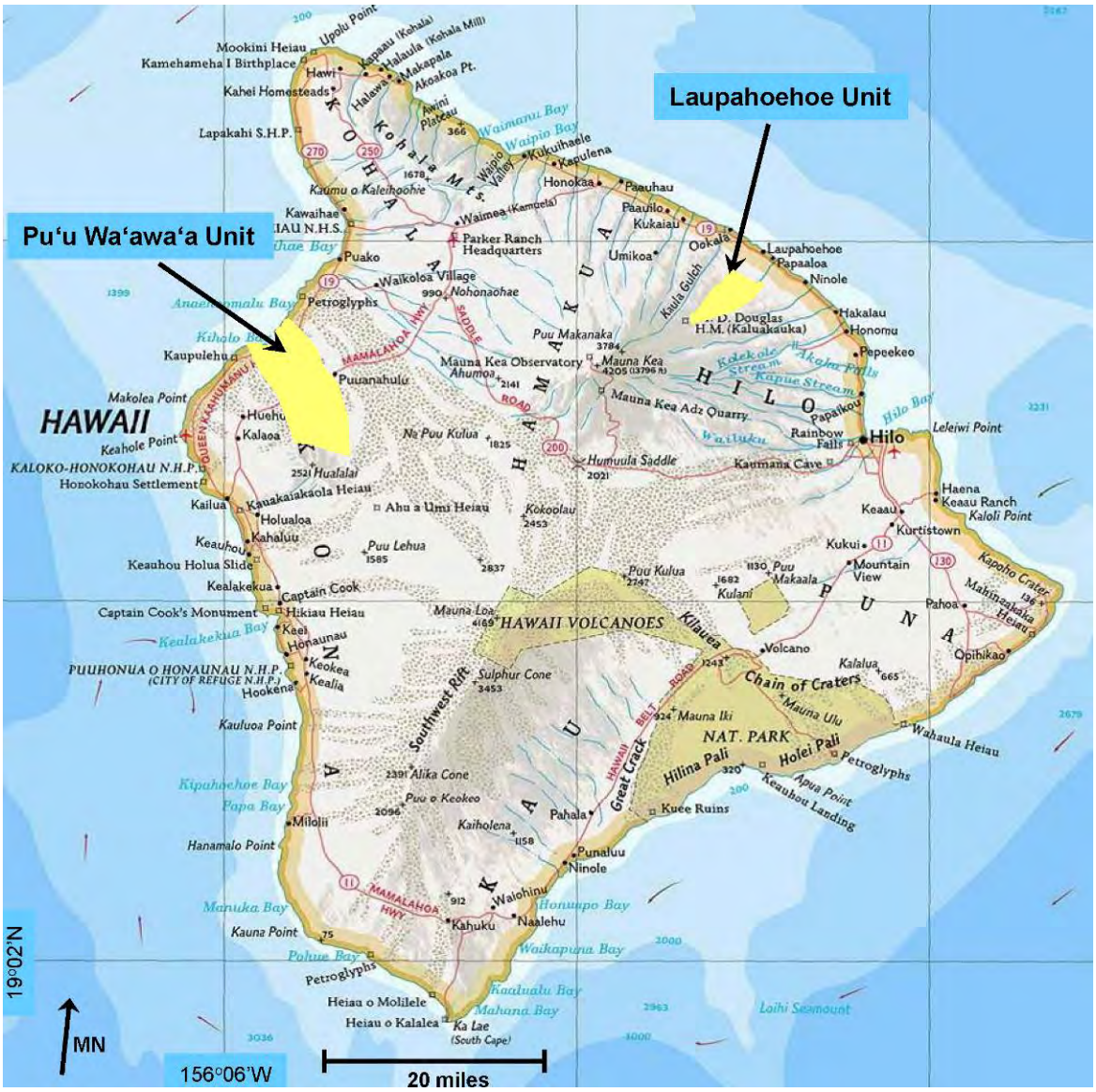


Figure 1: Map of Hawaii Island showing both the Puu Waawaa and Laupahoehoe Units of the HETF.

2010 Research Summary

Nineteen research permit applications were submitted and approved in 2010. Eighteen projects were initiated (11 renewals and seven new). A few of these projects are highlighted here. A new project initiated in Puu Waawaa by Dr. Mark McCoy from the University of Otago, in New Zealand, studied volcanic glass and its use for lithic tool manufacture in an effort to better understand ancient Hawaiian social interactions before European contact. Dr. McCoy concludes that the natural distribution of volcanic glass was strictly limited to geographic range and that Hawaiian's rarely accessed these sources beyond a short distance, perhaps 50km. A project in its fourth year, led by Dr. Frank Bonaccorso with the US Geological Survey, involves the study of the Hawaiian Hoary Bat in the Laupahoehoe Unit. Dr. Bonaccorso has noted consistent seasonal patterns of bat activity and occupancy amongst the Ohia and Koa dominated forest. He considers the Laupahoehoe Natural Area Reserve "the jewel" in the crown of Hawaiian Hoary bat habitat on the island of Hawaii. Also in the Laupahoehoe Unit, Dr. Susan Cordell with the USDA Forest Service, team members and affiliates of the Hawaii Permanent Plot Network (HIPPNET) continue work within their established long term plot in the Natural Area Reserve. Research conducted here will enable world-class advancement in the studies of global change, ecohydrology, ecosystem services, remote sensing, restoration, community structure and organization, population genetics, comparative forest ecology and biogeochemical processes. Finally, Dr. Karl Magnacca continues his work in Puu Waawaa and Laupahoehoe on the Moore Foundation Hawaiian Barcoding Project. This project is aimed at examining DNA sequencing data from several endemic groups of plants and insects on Hawaii Island (as well as other islands). Using the new approach of 454 pyrosequencing, variations useful for "delineating populations, species and inter-species hybrids will be revealed". Dr. Magnacca plans to complete his project in October of 2011.

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. The Laupahoehoe Unit recorded eight research projects and the Puu Waawaa Unit recorded nine research projects in 2010, with one research project conducted in both Units (Table 1). Of the eight research projects occurring in the Laupahoehoe Unit, seven occurred in both the Forest Reserve and the Natural Area Reserve (Figure 2). One research project conducted in Puu Waawaa occurred in both the Forest Reserve and Forest Bird Sanctuary (Figure 2). Figure 4 shows research affiliation for projects within the HETF from 2007-2010. See Appendix A for more detailed information regarding the research projects. Details concerning the one uninitiated/unfinished project are provided at the end of this section.

HETF-related journal articles were published in *Soil Biology and Biochemistry, Biotropica: The Journal of Tropical Biology and Conservation, Functional Ecology, Issues in Ecology* and more (see section "HETF Related Citations" of this report).

Table 1: Total number of research projects initiated in the HETF per year and grouped by Unit from 2007-2010.

Year	Laupahoehoe Unit only	Puu Waawaa Unit only	Both HETF Units	Total # of projects initiated
2010	8 (44%)	9 (50%)	1 (6%)	18
2009	10 (59%)	6 (35%)	1 (6%)	17
2008	6 (46%)	5 (39%)	2 (15%)	13
2007	1 (33%)	0	2 (67%)	3

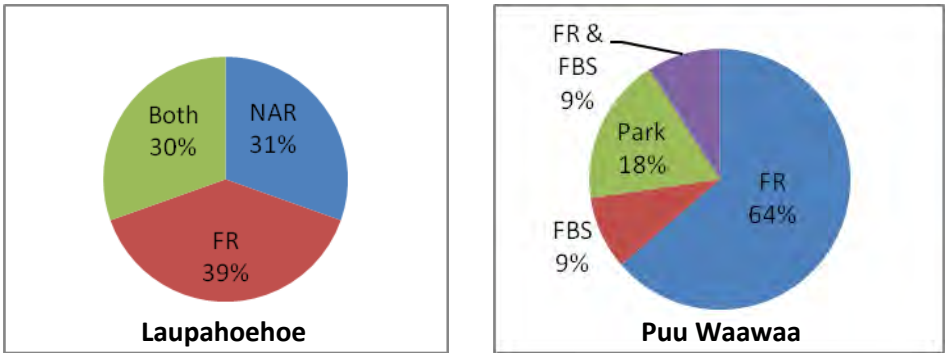


Figure 2: Percentage of HETF research project grouped by State land designations in 2010 (NAR=Natural Area Reserve, FR=Forest Reserve, FBS=Forest Bird Sanctuary, and Park=State Parks)

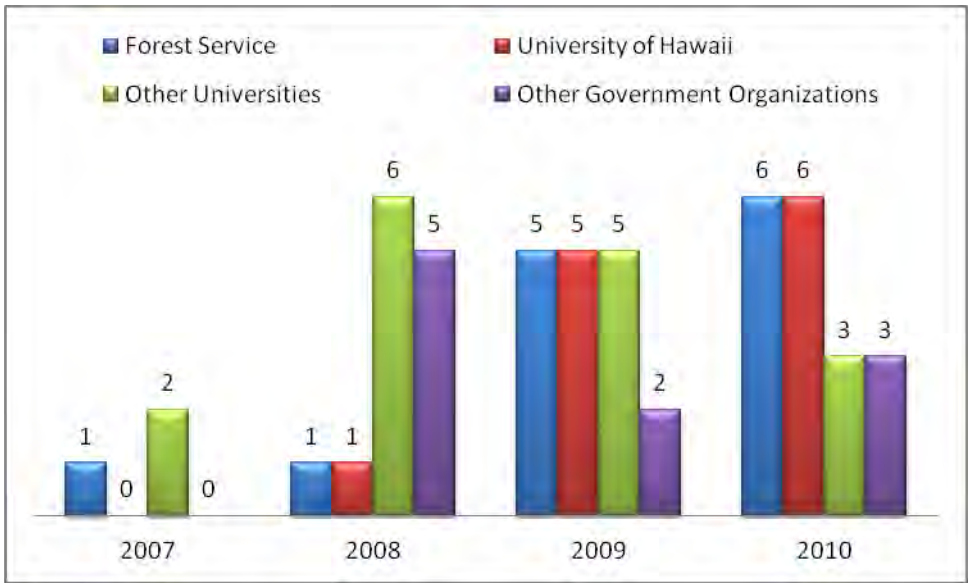


Figure 3: Research affiliation for research projects initiated and ongoing within the HETF from 2007-2010.

Uninitiated/Unfinished Projects

- Robert Pattison was unable to begin his research project entitled “Inventory of Hawaii Forests”, due to inclement weather during his available time frame. This project is not included in the graphical data reported above.

2010 Education, Service, and Other (Access, etc.) Summary

Laupahoehoe Unit

One hundred and twenty participants on six trips visited the Laupahoehoe Unit in 2010 (Table 2, Figure 4). A breakdown of trip affiliation and type is detailed in Figure 5. Susan Cordell of the USDA Forest Service took the Montreal Process Group, a group of international foresters, into the Unit to discuss native forest issues in Hawaii; points of interest included the HETF facilities and the HIPPNET climate station and plot. The Pacific Internship Programs for Exploring Science (PIPES) took a group of UH Hilo student interns on an educational field trip into the Forest Reserve, subject areas discussed were Hawaiian culture, Natural Resource Management and the role of science and weather stations. Sixteen students from Ryukoku University in Otsu, Japan, visited the Laupahoehoe Forest Reserve and NAR to discuss Hawaiian Forest Dynamics. Christine Kornet of UH Hilo took her Conservation Biology class on an educational field trip to the NAR to take a look at the changes in invasive/exotic species dominance and their impact on native species.

Table 2: Education/service/other trips taken into the HETF Laupahoehoe Unit in 2010.

Organization	Event	Contact	Date	Group #
Forest Service	Engineer Survey	Randy Schrank	6/2010	2
Forest Service	Field trip	Susan Cordell	6/3/2010	35
Forest Service	Engineer Survey	Jerry Carlson	7/2010	2
PIPES	Education/Field Trip	Noelani Puniwai	7/3/2010	50
Ryukoku University	Field trip	Thomas Lei	8/30/2010	16
UH Hilo	Education/Field Class	Christine Kornet	12/4/2010	15

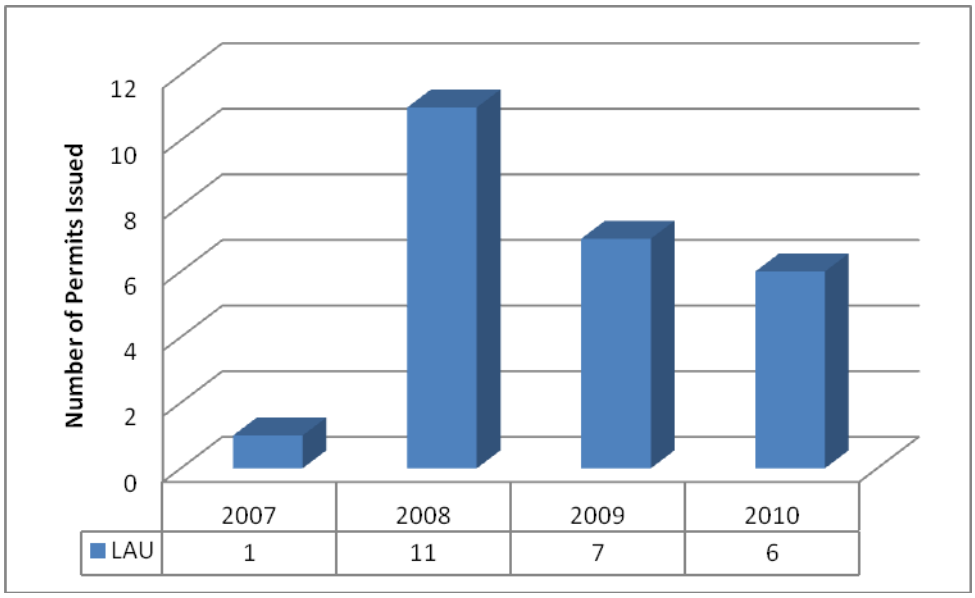


Figure 4: Total number of education/service/other trips taken per year in the HETF Laupahoehoe Unit from 2007-2010.

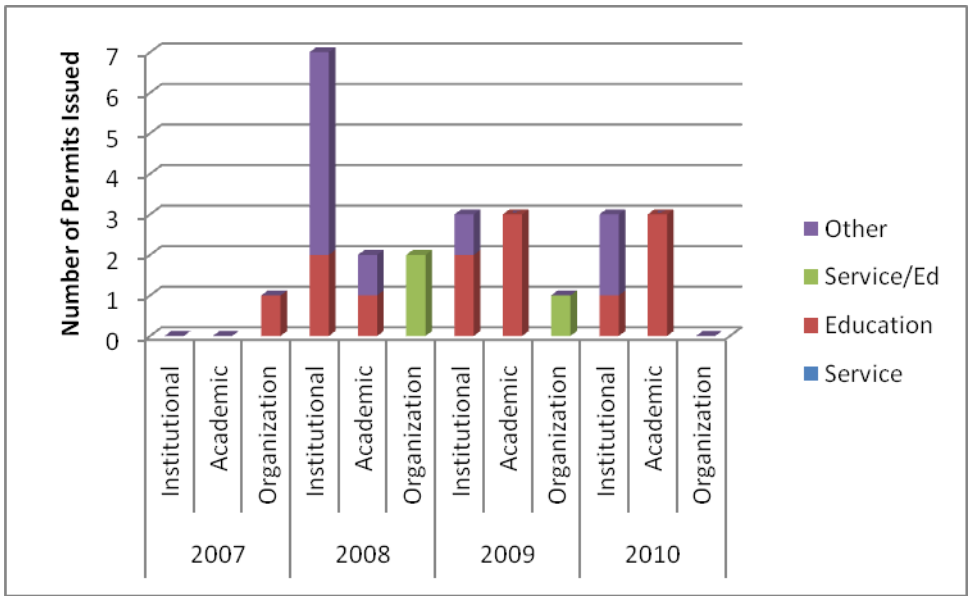


Figure 5: Trip affiliation and type for education/service/other trips taken in the HETF Laupahoehoe Unit from 2007-2010.

Puu Waawaa Unit

Fifty nine participants on seven trips visited Puu Waawaa in 2010 (Table 3, Figure 6). A further breakdown of trip affiliation and type is detailed in Figure 7. Jerry Carlson, Lou Liebbrand, Randy Schrank and Bill Nielson, of the USDA Forest Service visited the Quarry site to conduct Forest Service surveys related to proposed future construction activities. Cheyenne Perry of the USDA Forest Service accompanied an archaeological survey in the area of the proposed weather station in the Forest Bird Sanctuary unit. Alan Nakagawa of Digital Science Solutions, as part of his five day "Pacific Science Challenge 2010", took a group of 19 students into the Forest Reserve on "day two" of the challenge, where they engaged in using GIS and GPS technology to learn about their environment. Twenty five members of the Kona Hiking Club went on a hiking trip to the top of the Puu, chaperoned by Elliot Parsons. The Forest Inventory Analysis (FIA) team was escorted by Dr. Flint Hughes on a scoping tour. Rick Camp of the US Geological Survey (USGS), along with Elliot Parsons, Puu Waawaa Coordinator, escorted a visiting researcher through the HETF Unit to look for endangered Hawaiian Hawks; five hawks were spotted that day.

Table 3: Information relating to education/service/other trips taken in the HETF Puu Waawaa Unit in 2010.

Organization	Event	Contact	Date	Group #
Forest Service	Engineer Survey	Randy Schrank	Jun-10	2
Forest Service	Engineer Survey	Jerry Carlson	Jul-10	2
Forest Service	Archaeological Survey	Cheyenne Perry	9/22/10	3
Pacific Science Challenge	GIS Class	Alan Nakagawa	10/5/10	19
Kona Hiking Club	Field Trip	Kathleen Johnson	10/16/10	25
Forest Inventory Analysis	Plot Survey	Flint Hughes	11/16/10	5
USGS	Hawk Survey	Rick Camp	12/23/10	3

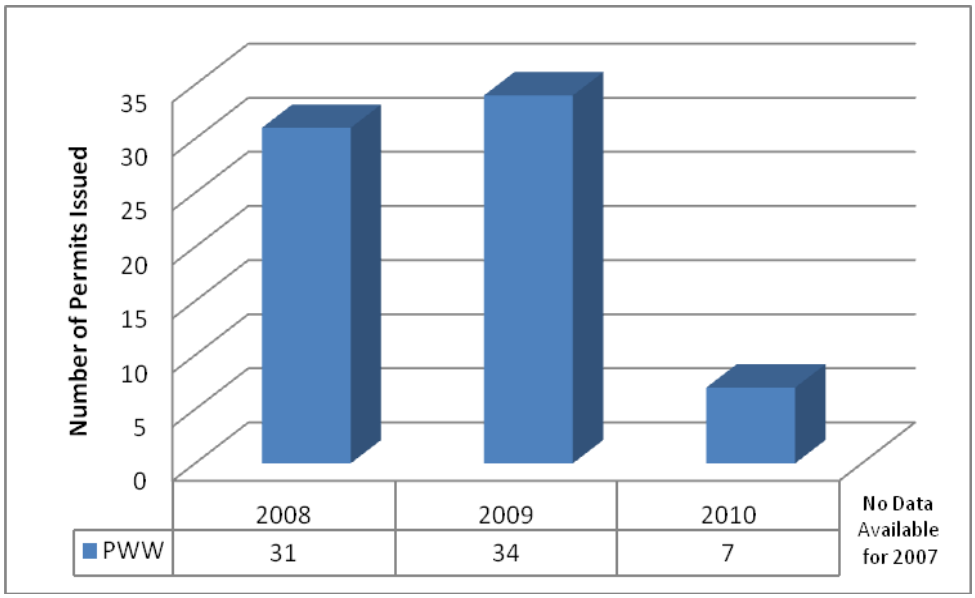


Figure 6: Total number of education/service/other trips taken per year in the HETF Puu Waawaa Unit from 2007-2010.

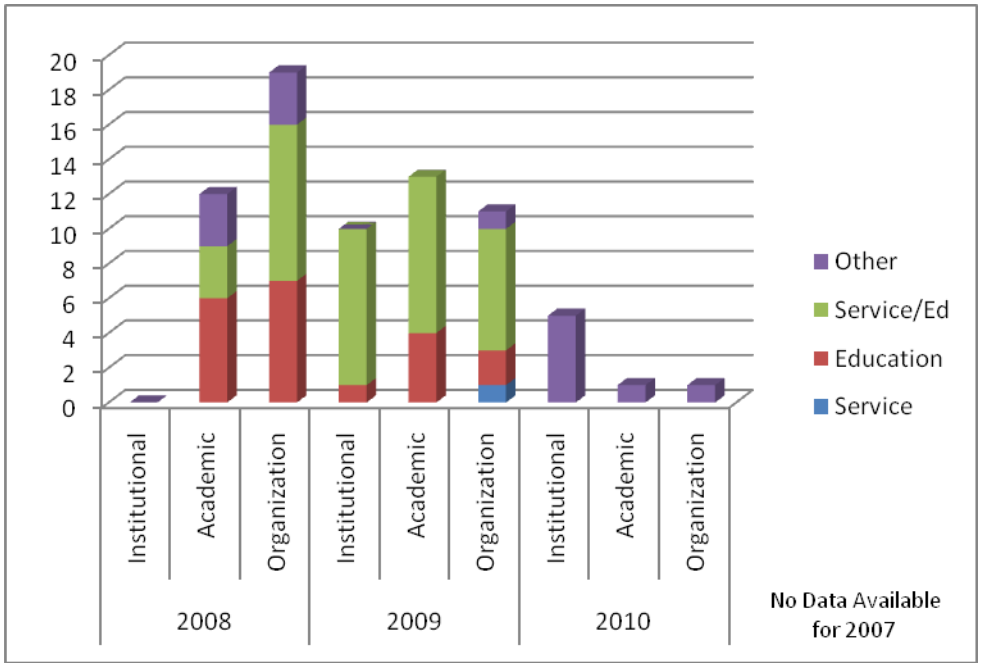


Figure 7: Trip affiliation and type for education/service/other trips taken in the HETF Puu Waawaa Unit from 2007-2010.

2010 HETF Concerns, Comments, and Challenges

Reported in 2010

- Researcher request that keys be available to check out for the duration of their project field work, rather than checking them in and out of the Hilo DOFAW office which can become an inconvenience.
- Criteria are needed to determine when a project is considered research versus a State management activity. State management activities do not require an HETF permit. Example activities include: Naio thrip and gall wasp monitoring.

Prior HETF Concerns, Comments, and Challenges still ongoing

- Clarity is needed on how management and monitoring actions by the State could be reported to the USDA Forest Service for overall HETF tracking.
- A Management Plan is needed for the Laupahoehoe Unit in order to guide decision making.
- No system is in place for the USFS to know if permits were signed and if the permittee had picked up the permit from DOFAW.

Prior HETF Concerns, Comments and Challenges that were addressed in 2010

- Full time staff is needed to help manage the permit system, track decisions and policies instituted by the HETF Planning Group, and ensure the completion of the legal requirements per the Cooperative Agreement and permit to use State lands.
  - *A full time HETF Coordinator was hired in July 2010 in a two year term position.*
- Few annual reports were received from researchers.
  - *Annual Reports became a condition of the permit renewal process as of November 2010, also reminders are sent to those not renewing.*
- Some research projects in the Laupahoehoe NAR were not initially captured due to confusion on which entity (NAR System Commission or HETF) should handle and approve permits.
  - *Problem has not reoccurred in 2010 since the initial discussions regarding this problem.*
- An advisory council for the Laupahoehoe Unit is needed to fulfill the requirements of the Cooperative Agreement and to make recommendations for the Management Plan.
  - *The Laupahoehoe Advisory Council (LAC) was officially formed in December 2010.*
- No system is in place to remind permit holders that their permit would expire, increasing the likelihood that ongoing project permits would lapse.
  - *The HETF Administrator now sends email reminders to researchers two months before permit expiration.*
- There were complaints from forest users (non-researchers) concerning PVC, equipment, and rebar in the forest. They were concerned about safety issues and no public notice that these materials and equipment would be placed in the forest.
  - *Rebar is no longer allowed in the HETF, a decision made in early 2010. A timeline has been implemented where all existing rebar must be removed from research plots by October 1, 2010. PVC must now be painted with green or brown paint and capped.*
- No clear valid permit dates indicated on permits.
  - *Modified the permit content so that valid permit dates were clear. All permits are now valid for only one year after being signed by the DOFAW branch manager.*

- A systematic close out plan is needed to ascertain that no equipment is left behind in the HETF after project completion.
  - *A detailed research close out plan is now required on the permit application.*

2010 Annual Reports Received

Annual reports received from researchers are listed alphabetically in this section. Annual reports are due within one year of project initiation. As of November 2010 all new and renewal permit applicants were required to submit an annual report regardless of the HETF Sub-unit. Until this time only projects taking place within the Natural Area Reserve (NAR) were required to submit annual reports. Given the timing of this change and whether a project took place in the NAR, a renewed permit may not have an accompanying annual report. The included annual reports were submitted with renewal applications and pertain to the previous year's work with the exception of Dr. Mark McCoy who submitted his annual report within one month of permit issue as his project was complete.

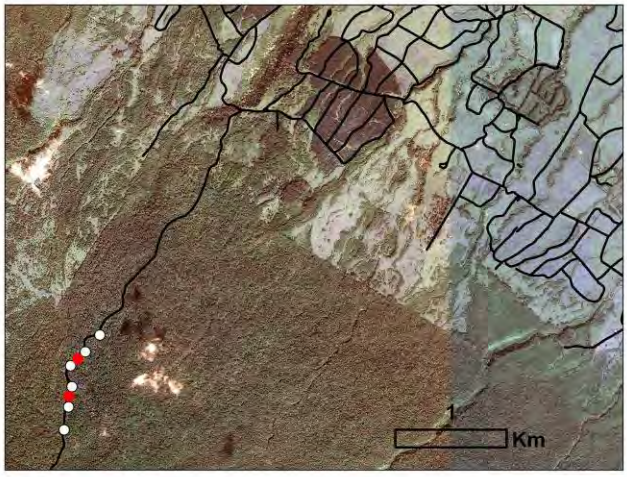
Bonaccorso, Dr. Frank

Submitted: October 2010

For the fourth consecutive year, a microphone and data logger array to record the vocalizations of Hawaiian hoary bats has been deployed along Blair Road in Laupahoehoe NAR (Fig 1. map of study area). A microphone array consists of 6 total microphone and recording units spaced at 400 meter intervals along approximately 2.5 kilometers of Blair Road in 2009/2010. The geo-coordinates of each bat microphone/recorder are found in Table 1 (*Table 1 - has been removed but is available upon request*). Under the coverage of the immediate past permit, microphone/recorders were deployed for periods of one week in December of 2009, and in February, April, June, and August of 2010. The levels of bat detectability (an index of bat habitat occupancy and flight/foraging activity) is shown in Figure 2 for the sum total of all four years of bat research at Laupahoehoe NAR.

It is notable that a consistent seasonal pattern of bat activity is indicated in Fig. 2. Bat activity is highest from June through early November in each year. There is relatively low bat activity from late November through March each year, a time that much of the bat population occupies elevations above 1500 m at other sites upslope from Laupahoehoe NAR. In April and May, bat activity begins to increase until it peaks again in the summer and early fall months to repeat the annual cycle.

Bat occupancy from June through August represents the reproductive season for adult females with birthing and lactation of dependent young bats. Young bats fledge in August. By September, a large population of receptive females and males with descended, large testis evidenced by mist-net captures (Table 2) at Laupahoehoe strongly suggest that fall mating activity is occurring at this site. It is believed that females either store sperm over winter or that a delayed implantation or embryonic development occurs over the winter but this aspect of hoary bat reproduction has not been investigated in Hawaii.



The high levels of bat detectability and the large numbers of bat calls (up to 12,000 call files) recorded in the summer-fall months, including calls with “feeding buzzes” of increased pulse repetition, also indicate that Laupahoehoe NARS is an extremely important foraging for Hawaiian hoary bats. Although our methodology does not permit a numerical estimate of the bat population, the data do indicate prolonged and intense use of the ohia-koa dominated forest by bats at Laupahoehoe for both reproduction and foraging. Laupahoehoe NAR may be considered the “jewel” in the crown of Hawaiian hoary bat habitat on the island of Hawaii.

Fig. 1 (above) Map of the 6 bat microphone/recording arrays (white dots) and two ultraviolet light traps for insect collection at Laupahoehoe NAR. Mist-netting sites are also along Blair Road with the boundaries of the microphone arrays.

Fig. 2. Hawaiian Hoary Bat detection probability from 2007 to 2010. Detection probability of 1.0 represents all microphones detecting bats every night of sampling, whereas 0 would be no detections on any microphones throughout a sample (note there never has been a 0 detection at Laupahoehoe, blank spaces in the graph represent no sampling conducted. Each sample represents 6 microphones recording for one week within the sample month. Error bars equal one standard error.

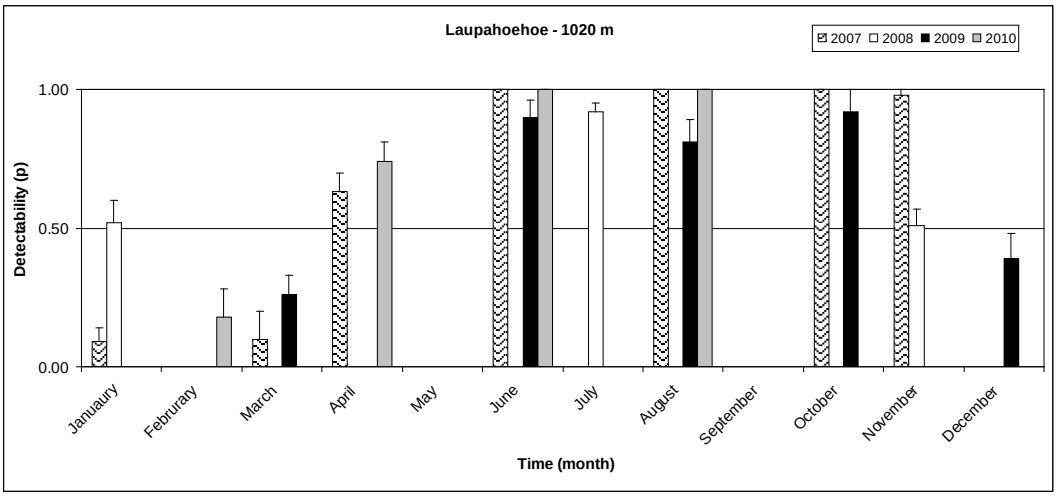


Table 2. Records of Bat Capture and Release at Laupahoehoe NAR in 2010.

Bat #	Date	Time	Sex	Age	Band	forearm	weight	reprod. Condition
810	26-Jun-10	1:20	F	ADULT	none/RedYellow	48.8	23.5	pregnant
910	1-Jul-10	21:45	F	ADULT	none/Red	50.7	19	Lactating
1010	1-Jul-10	21:45	F	ADULT	none/Purple	50.8	20.3	Post-lactating
1110	27-Aug-10	18:56	M	JUV	LightBlue/none	47.6	12	not reproductive
1210	27-Aug-10	19:23	F	ADULT	none/LightBlueWhite	50	16.75	not reproductive
1310	27-Aug-10	19:23	F	JUV	none/RedWhite	50.2	16.25	not reproductive
1410	27-Aug-10	20:48	F	ADULT	none/DarkBlueWhite	50.1	17.25	Post-lactating
1510	27-Aug-10	21:30	F	JUV	none/DarkBlue	50.5	15.5	not reproductive
1610	27-Aug-10	23:02	M	JUV	none/DarkBlueYellow	48.25	14.5	not reproductive
1710	27-Aug-10	23:37	F	ADULT	none/WhiteGreen	51.6	19.5	not reproductive
1810	27-Aug-10	23:56	M	ADULT	none/Grey	46.7	15.5	scrotal/testes descended
1910	2-Sep-10	19:09	F	ADULT	none/OrangeYellow	49.8	20.5	Post-lactating
2010	2-Sep-10	22:45	M	ADULT	none/Green	48.9	13.3	scrotal/testes descended
2110	2-Sep-10	23:05	F	ADULT	none/Orange	49.98	15.8	Post-lactating
2211	24-Sep-10	18:46	F	ADULT	none/Salmon	50.4	16	?
2212	24-Sep-10	18:40	F	ADULT	DarkBlue/none	50.5	16.75	?
2213	24-Sep-10	18:49	M	ADULT	Purple/none	50.1	15.5	scrotal/testes descended

Broadbent, Eben

Submitted: March 2010

Research progress update for 2010: Field data collection is on-going and will continue throughout this year and in 2011. Data entry and analysis to begin after collection is complete, therefore no significant findings thus far, as analysis has not yet occurred.

Project and Ph.D. timeline.

	2007				2008				2009				2010				2011		
Events	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su
PhD																			
Graduate classes																			
Preliminary field work																			
Set up project																			
Field data collection																			
Data entry and analysis																			
Writing																			
Defend and graduate																			

W = Winter quarter: January - March
Sp = Spring quarter: April - June
Su = Summer quarter: June – September
F = Fall quarter: September - December

Cordell, Dr. Susan and colleagues

Submitted: March 2010

The Hawaii Permanent Plot Network (HIPPNET) was established with the following research areas and goals in mind:

Research areas:

- Global change
- Ecohydrology
- Ecosystem services
- Remote sensing
- Restoration
- Comparative forest ecology
- Population genetics and evolutionary ecology of forest plants
- Biogeochemical processes

Goals:

- Establish 4-ha plots across natural gradients in Hawaii
- Study long-term forest dynamics
- Facilitate research
- Develop interagency and community partnerships

Locations included intact native-dominated forests with a history of ecosystem-level research. Two locations on Hawaii Island were chosen: Palamanui, a tropical lowland dry forest; and Laupahoehoe, a tropical montane rain forest. The Laupāhoehoe site is within the Hawai'i Experimental Tropical Forest. The project is a collaboration between UH, the Institute of Pacific Islands Forestry (US Forest Service), and UCLA.

During the course of this project, researchers have precisely measured 20 x 20 m grid over 4 ha. Every tree with a diameter greater than 1 cm. has been tagged, mapped, identified and measured. Both plots now have a complete first census (completed summer 2009). HIPPNET personnel have also created a web site (http://www.hippnet.hawaii.edu/) where information on access, data policies, publications, and methods can be found. Woody weed species ≥1 cm DBH within each plot were identified, mapped, measured and then removed. Woody weeds at Laupahoehoe included *Fraxinus uhdei*, *Psidium cattleianum*, and *Rubus ellipticus*.

In addition to the research conducted and enabled, there has been a large amount of training enabled by this project. A total of six technicians and plot supervisors have been trained and are passing on their knowledge to students, other researchers, and interns. The pool of interns numbers 14, with three of them being from the local area. UH Hilo student interns likewise number three, all of them from Hawaii. Hawaii Community College Forest TEAM has engaged five student employees, again all from Hawaii. There were a total of 15 UH Hilo class visits to the site.

This work has resulted in collaborations among Hawaii researchers and the Smithsonian Tropical Research Institute's Center for Tropical Forest Science (CTFS). CTFS is a network of 33 forest plots around the world (www.ctfs.si.edu). HIPPNET is now an official site of the network. The Permanent Plot Supervisor attended a workshop on database management in Panama and the HIPPNET site has been

visited by the CTFS center's Director, Dr. Stuart Davies. HIPPNET personnel also attended the CTFS Workshop at the 2009 Ecological Society of America meeting.

Another meaningful collaboration has grown from this project with the Carnegie Airborne Observatory at the Carnegie Institution, Stanford University. Researchers at the CAO and from HIPPNET are working to answer research questions using remote sensing data.

Future plans include re-censusing a portion of the plot in 2010 (a complete re-census is planned in 2014) and completion of the climate tower (the tower is in place – but not fully operational). We are currently in the initial stages of measuring seedling establishment, growth and survival, seed rain, and understory light at the Laupahoehoe plot. These measurements allow us to understand tree regeneration dynamics in Hawaii. Our goal is to continue this work in 2010. Currently we are processing data from the first census which will be available in manuscript form in 2010. See attached pdf outlining our preliminary results from the first census.

Project Coordinators for HIPPNET include:

- Dr. Rebecca Ostertag, University of Hawaii-Hilo, ostertag@hawaii.edu
- Dr. Susan Cordell, IPIF-USDA Forest Service, scordell01@fs.fed.us
- Dr. Christian Giardina, IPIF-USDA Forest Service, cgiardina@fs.fed.us
- Dr. Lawren Sack, UCLA, lawrensack@ucla.edu

Former permanent Plot Supervisor Faith Inman Narahari ohia@ucla.edu, is currently a graduate student at UCLA pursuing her PhD. Her research on seed, seedling and forest dynamics will continue to be focused on the HIPPNET plots.

McCoy, Dr. Mark
Submitted: November 2010

Social Interaction in Ancient Hawai'i: New research on volcanic glass use in the era before European contact.

Project Description:

The development of Hawaiian culture and society began with the colonization of the archipelago by a small founding group of Eastern Polynesians around 1000 A.D. By 1200 A.D. there is evidence of established populations on the major islands and by 1400 A.D. status differences are evident in the construction style and sizes of house sites and other architecture. When Europeans first came in 1778 A.D. they described a complex hierarchical society that was later classified by anthropologists as a paramount chiefdom or archaic state society. The population was organized in large polities, the largest spanning several islands. Strict rules (*kapu*) defined how elites and commoners interacted with one another and elites held nearly absolute control over land and natural resources.

The goal of this project is to use archaeological data (artifact analysis) to reconstruct social interaction in the past to better understand the development of Hawaiian society. To date, I have used non-destructive XRF (x-ray florescence) to create a spatial dataset of hundreds of volcanic glass archaeological artifacts from Hawai'i Island tentatively matched to their natural geological source by comparing the chemical composition of artifacts to a database of possible geological sources. One of the major early results has centered on the circulation of artifacts that appear to be Pu'u Wa'awa'a Trachyte - a type of volcanic glass associated with the volcanic events (92-114,000 year old) that produced the Pu'u and surrounding flows. If source assignments are correct, then it appears Hawaiians did not regularly access it beyond a short distance from the source, perhaps 50 km. While this is in line with previous archaeological studies, this pattern is in stark contrast to other Polynesian groups who at times made regular use of sources hundreds of kilometers away.

The goal of the research described here was to collect geological samples of Pu'u Wa'awa'a tractyte to better determine the chemical variation within this natural source of volcanic glass. While there are a few previous studies that have examined the chemical composition of Pu'u Wa'awa'a tractyte this aspect of the project is critical to making a definitive assignment of archaeological artifacts to source, and thus confirm the early results of the study.

Methods:

A pedestrian survey was conducted to identify and collect geological samples of natural volcanic glass at locations along two transects spanning the north slope and to the base of Pu'u Wa'awa'a (Figure 1). Collection locations were GPS'ed (Trimble GeoXT and Juno) (Table 1). No excavations were conducted; samples were removed from naturally exposed cuts or from the ground surface. No archaeological sites were modified and great care was taken not to disturb flora or fauna, or interfere with other ongoing management or research activities in the area. Total fieldwork time was only four hours.

Samples are now part of the geological reference collections housed at the University of Otago archaeological laboratories. This collection is one of the world's most complete collections of volcanic glasses used by Polynesians. All samples in our collection are treated with the appropriate degree of respect due to material often considered sacred to Pacific peoples.

Major Accomplishments:

Volcanic glass nodules were discovered at each of the locations noted along the two transects (Figure 1; Table 1). These appear to be a good representation of the range in size and quality of material available for lithic tool manufacture in the past. The natural distribution of volcanic glass was found to be strictly limited in geographic range (i.e., few examples were noted in the colluvial zone at the base of the north face). No significant challenges were met in this brief collection visit and we have no incidental observations to report.

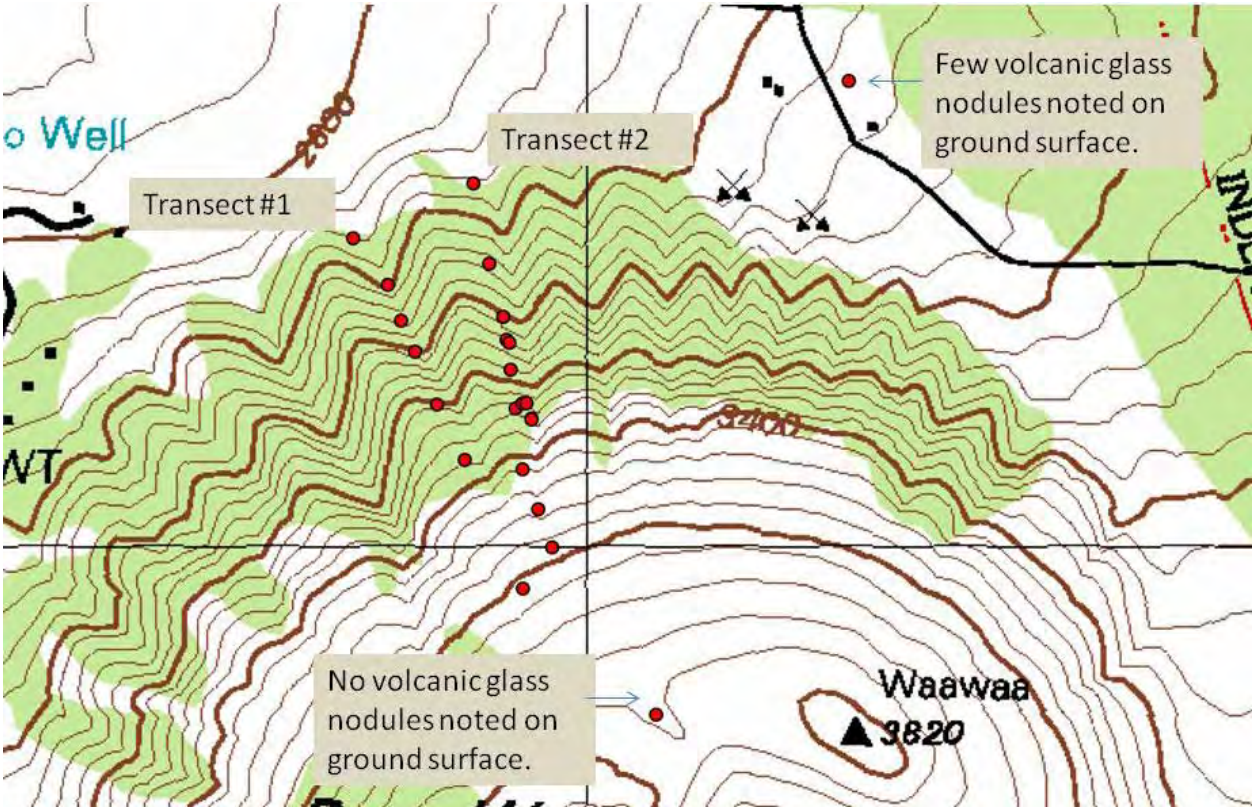


Figure 1. Geological Sampling Transects Showing Collection Locations.

Table 1. GPS locations of Sample Collections Locations (NAD 83, UTM, Zone 5N)

Transect	Location	Gully	Easting	Northing
1	1	1	202843	2189109
1	2	1	202808	2189181
1	3	1	202780	2189249
1	4	1	202762	2189289
1	5	1	202745	2189335
1	6	1	202700	2189395
2	1	2	202917	2189182
2	1	3	202929	2189161
2	2	3	202923	2189182
2	3	3	202902	2189225
2	4	3	202900	2189260
2	5	3	202893	2189294
2	6	3	202875	2189362

Acknowledgements

This research was supported by a grant from the University of Otago. Thanks to Alan Carpenter¸ Paul Conry, Mel Dean, Theresa Donham, Roger Imoto, Thegn Ladefoged, Jim Mathieu, Elliot Parsons, Chris Stevenson, and Molly Winters.

Vitousek, Dr. Peter and colleagues

Submitted: March 2010

We report progress in two areas of research – ongoing studies of the structure and biogeochemistry of Hawaiian forests, which our group has been working on at Laupahoehoe since 1990, and a new NSF funded project on forest structure and history. For the ongoing work, our major products in the past year have been 1) an analysis of forest structure and biogeochemistry in the landscape around our long-term site at Laupahoehoe (and similar sites in Volcano, Kohala, and Kokee-Kaua`i); this work is published in Ecology (Vitousek et al.) and Pacific Science; and 2) a comparative study of forest structure at Laupahoehoe versus La Selva Biological Station, in the Atlantic lowland of Costa Rica; this work is published in Ecology Letters (Kellner and Asner in press).

For the newer NSF-funded research, the Laupahoehoe landscape was stratified based on the Carnegie Airborne Observatory LIDAR and hyperspectral data into three distinct landscape zones between 3000 and 5000 feet elevation on the 4000-14000 years and 1400-65000 years old substrate age classes. The "Mauna kea" zone spans 3000-3800 feet and is characterized by extremely tall koa and ohia trees with a upper canopy height mode from 20 to 30 meters and a single lower canopy height mode at 7.5 meters. The "Laupahoehoe" zone spans 3800-4400 feet elevation and shows a distinctive three mode canopy height distribution with modes at 5, 11, and 19 meters. The "Montane" landscape zone spans 4400-5000 feet elevation and is characterized by patches of koa forest and extensive upper canopy dieback showing a single flat mode in canopy height from 10 to 20 meters.The correspondence between the forest structure observed in the aerial imagery and the whole plant community composition of each zone was assessed with an extensive spatially explicit ground survey. Within each landscape zone a single 980 meter long rhythmically sampled transect produced n = 180 quadrats (nested 0.25, 1, and 4 square meters in size) and copious observations at various spatial lags. Each transect is arranged from the NW to the SE across the dominant slope contour. Transects occur at ~3200, ~ 4200, and ~4500 feet elevation. Data collection is complete on the "Mauna Kea" and "Laupahoehoe" zones. Preliminary analysis of the "Laupahoehoe" zone survey indicates that substrate type (ash or pahoehoe), surface hydrology, and wind throw gap disturbance have an influence on plant community species composition. There is also unexplained spatial autocorrelation spanning lag distances from 0 to 10 meters. This implies an important role for spatial processes like dispersal in creating community spatial mosaics or the possibility of successional dynamics following individual wind throw disturbances. The recent dynamics of the forest through time are being explored through the use of sediment cores from small areas of sediment deposition ('forest hollows'). Lead-210 chronologies of the first suite of sediment cores demonstrate some hollows are unsuitable for paleoecological analysis due to un-interpretable lead-210 profiles. However three cores, two from the "Laupahoehoe" and one from the "Montane" zones, have intact lead profiles and are being processed for pollen analysis. The spatial community analysis suggests that species of Peperomia (`ala `ala wai nui), Cibotium (hapu`u), Rubus hawaiiensis (akala), and Ilex anomala (kawa`u) all respond to windthrow disturbance and will be able to provide a temporal signature of disturbance dynamics in pollen and spore analysis.

We have matched that on-the-ground sampling with a continuing analysis of forest turnover in the HETF. LiDAR imagery was obtained over Laupahoehoe twice (2007 and 2009), and with careful processing it has been possible to match the images such that any change that occurred between the samples – even the fall of a canopy branch – can be detected. From this analysis we have the first data-based landscape-level analysis of forest turnover as a function of zone within Laupahoehoe, and along a developmental gradient from young forests on Kilauea through multiple zones in Laupahoehoe to the older forests of Kohala Volcano. The first product of that analysis was just submitted for publication in Ecology.

HETF Related Citations

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Appendix A - 2010 Research Detail

Projects are listed alphabetically under each Unit or Sub-unit in which they occur. Therefore projects that took place within more than one Unit or Sub-unit will be listed multiple times. As of November 2010 all new and renewal permit applicants were required to submit an annual report regardless of the HETF Sub-unit. Until this time only projects taking place within the Natural Area Reserve (NAR) were required to submit annual reports within one year of project completion. Given the timing of this change and whether a project took place in the NAR, a renewed permit may not have an accompanying annual report.

Acronyms in this section include: LAU=Laupahoehoe, NAR=Natural Area Reserve, FR=Forest Reserve, FBS=Forest Bird Sanctuary, PWW=Puu Waawaa.

Laupahoehoe

Laupahoehoe Forest Reserve Sub-unit:

Principle Investigator: Bonaccorso, Frank	**Permit Duration:** Nov 2010 – Nov 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Hawaiian Hoary Bat habitat occupancy, reproduction and diet	
Affiliation: USGS	
PI Contact Info: 808-985-6126 or 808-967-8568; fbonaccorso@usgs.gov	
Dates of Anticipated Results: Nov 2011	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report – Not Required, Received: Yes ☒ No ☐	

Principle Investigator: Bradford, Mark	**Permit Duration:** Nov 2010 – Nov 2011
New Permit ☒ **Renewal** ☐ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☐ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Do expected evolutionary trade-offs in enzyme activities manifest at the level of microbial community function?	
Affiliation: Yale University	
PI Contact Info: School of Forestry and Environmental Studies, Yale University, 370 Prospect St., New Haven, CT 06511; 203-285-4921	
Dates of Anticipated Results: Oct 2013	**Publications, etc. Received:** New Permit
Annual Report – Not Required, Received: Yes ☐ No ☒	

Laupahoehoe Forest Reserve Sub-unit (continued):

Principle Investigator: Broadbent, Eben	**Permit Duration:** June 2010 – June 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Influence of forest architecture on carbon assimilation along an elevational gradient in Hawaii: linking field measurements, airborne LiDAR and modeling.	
Affiliation: Stanford University and Department of Global Ecology, Carnegie Institution of Washington	
PI Contact Info: eben@stanford.edu; cell phone 1-650-704-2065	
Dates of Anticipated Results: June 2011	**Publications, etc. Received:** Yes ☐ No ☒ (no publications yet)
Annual Report - Not Required, Received: Yes ☒ No ☐	

Principle Investigator: Cordell, Susan	**Permit Duration:** June 2010 – June 2011
New Permit ☐ **Renewal** ☐ **Permanent (contingent upon approval)** ☒ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Hawaii Permanent Plot Network (HIPPNET)	
Affiliation: US Forest Service; Institute of Pacific Islands Forestry	
PI Contact Info: 808-854-2628; scordell01@fs.fed.us	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report - Not Required, Received: Yes ☒ No ☐	

Principle Investigator: Friday, JB	**Permit Duration:** Sept 2010 – Sept 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Investigating productivity of Koa forests on different substrates and climate zones. Long-term plots.	
Affiliation: UH Manoa College of Tropical Agriculture and Human Resources, Cooperative Extension Service	
PI Contact Info: 808-981-8266; jbfriday@hawaii.edu	
Dates of Anticipated Results: Sept 2011	**Publications, etc. Received:** Yes ☐ No ☒
Annual Report - Not Required, Received: Yes ☐ No ☒	

Laupahoehoe Forest Reserve Sub-unit (continued):

Principle Investigator: Hughes, Flint	**Permit Duration:** Sept 2010 – Sept 2011
New Permit ☐ **Renewal** ☐ **Permanent (contingent upon approval)** ☒ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Assessing forest structure, community composition, diversity, carbon mass, and biomass on a landscape scale in the Hawaii Experimental Tropical Forest.	
Affiliation: IPIF, PSW-USDA Forest Service	
PI Contact Info: 808-933-8121 ext 177; fhughes@fs.fed.us	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report - Not Required, Received: Yes ☐ No ☒	

Principle Investigator: Litton, Creighton	**Permit Duration:** May 2010 – May 2011
New Permit ☐ **Renewal** ☐ **Permanent (contingent upon approval)** ☒ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: An experimental test on the impacts of rising temperature on carbon input, allocation, and loss in model forests.	
Affiliation: UH Manoa, Department of Natural Resources and Environmental Management	
PI Contact Info: 808-956-6004; litton@hawaii.edu	
Dates of Anticipated Results: May 2011	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report - Not Required, Received: Yes ☐ No ☒	

Principle Investigator: Magnacca, Karl	**Permit Duration:** Oct 2010 – Oct 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☒ PWW-FBS ☒ PWW-Park ☐	
Research Title: Moore Foundation Hawaiian Barcoding Project	
Affiliation: University of Hawaii at Hilo	
PI Contact Info: (808) 756-4631	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** Yes ☐ No ☒
Annual Report - Not Required, Received: Yes ☐ No ☒	

Laupahoehoe Forest Reserve Sub-unit (continued):

Principle Investigator: Vitousek, Peter	**Permit Duration:** Oct 2010 – Oct 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Sources and fates of nutrients on a substrate age gradient across the Hawaiian archipelago and their consequences for forest dynamics.	
Affiliation: Stanford University	
PI Contact Info: (605) 814-6812; vitousek@stanford.edu	
Dates of Anticipated Results: June 2011	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report - Not Required, Received: Yes ☒ No ☐	

Laupahoehoe Natural Area Reserve Sub-unit:

Principle Investigator: Bonaccorso, Frank	**Permit Duration:** Nov 2010 – Nov 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Hawaiian Hoary Bat habitat occupancy, reproduction and diet	
Affiliation: USGS	
PI Contact Info: 808-985-6126 or 808-967-8568; fbonaccorso@usgs.gov	
Dates of Anticipated Results: Nov 2011	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report - Required, Received: Yes ☒ No ☐	

Principle Investigator: Broadbent, Eben	**Permit Duration:** June 2010 – June 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Influence of forest architecture on carbon assimilation along an elevational gradient in Hawaii: linking field measurements, airborne LiDAR and modeling.	
Affiliation: Stanford University and Department of Global Ecology, Carnegie Institution of Washington	
PI Contact Info: eben@stanford.edu; cell phone 1-650-704-2065	
Dates of Anticipated Results: June 2011	**Publications, etc. Received:** Yes ☐ No ☒ (no publications yet)
Annual Report - Required, Received: Yes ☒ No ☐	

Principle Investigator: Cordell, Susan	**Permit Duration:** June 2010 – June 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☒ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Hawaii Permanent Plot Network (HIPPNET)	
Affiliation: US Forest Service; Institute of Pacific Islands Forestry	
PI Contact Info: 808-854-2628; scordell01@fs.fed.us	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report - Required, Received: Yes ☒ No ☐	

Laupahoehoe Natural Area Reserve Sub-unit (continued):

Principle Investigator: Hughes, Flint	**Permit Duration:** Sept 2010 – Sept 2011
New Permit ☐ **Renewal** ☐ **Permanent (contingent upon approval)** ☒ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Assessing forest structure, community composition, diversity, carbon mass, and biomass on a landscape scale in the Hawaii Experimental Tropical Forest.	
Affiliation: IPIF, PSW-USDA Forest Service	
PI Contact Info: 808-933-8121 ext 177; fhughes@fs.fed.us	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report - Required, Received: Yes ☐ No ☒	

Principle Investigator: Litton, Creighton	**Permit Duration:** May 2010 – May 2011
New Permit ☐ **Renewal** ☐ **Permanent (contingent upon approval)** ☒ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: An experimental test on the impacts of rising temperature on carbon input, allocation, and loss in model forests.	
Affiliation: UH Manoa, Department of Natural Resources and Environmental Management	
PI Contact Info: 808-956-6004; litton@hawaii.edu	
Dates of Anticipated Results: May 2011	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report - Required, Received: Yes ☐ No ☒	

Principle Investigator: Magnacca, Karl	**Permit Duration:** Oct 2010 – Oct 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☒ PWW-FBS ☒ PWW-Park ☐	
Research Title: Moore Foundation Hawaiian Barcoding Project	
Affiliation: University of Hawaii at Hilo	
PI Contact Info: (808) 756-4631	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** Yes ☐ No ☒
Annual Report - Required, Received: Yes ☐ No ☒	

Laupahoehoe Natural Area Reserve Sub-unit (continued):

Principle Investigator: Vitousek, Peter	**Permit Duration:** Oct 2010 – Oct 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☐	
Research Title: Sources and fates of nutrients on a substrate age gradient across the Hawaiian archipelago and their consequences for forest dynamics.	
Affiliation: Stanford University	
PI Contact Info: (605) 814-6812; vitousek@stanford.edu	
Dates of Anticipated Results: June 2011	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report - Required, Received: Yes ☒ No ☐	

Puu Waawaa

Puu Waawaa Forest Reserve Sub-unit:

Principle Investigator: Cordell, Susan	**Permit Duration:** Oct 2010 – Oct 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☐ LAU-FR ☐ PWW-FR ☒ PWW-FBS ☐ PWW-Park ☐	
Research Title: The potential for restoration to break the grass/fire cycle in dryland ecosystems in Hawaii.	
Affiliation: USDA Forest Service; IPIF	
PI Contact Info: (808) 933-8121 ext 128; scordell01@fs.fed.us	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** Yes ☒ No ☐
Annual Report - Not Required, Received: Yes ☐ No ☒	

Principle Investigator: Cordell, Susan	**Permit Duration:** Dec 2010 – Dec 2011
New Permit ☒ **Renewal** ☐ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☐ LAU-FR ☐ PWW-FR ☒ PWW-FBS ☐ PWW-Park ☐	
Research Title: Hawaii Permanent Plot Network – Puu Waawaa Sites	
Affiliation: USDA Forest Service; IPIF	
PI Contact Info: (808) 933-8121 ext 128; scordell01@fs.fed.us	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** New Permit
Annual Report - Not Required, Received: New Permit	

Principle Investigator: Hess, Steven	**Permit Duration:** Sept 2010 – Sept 2011
New Permit ☒ **Renewal** ☐ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☐ LAU-FR ☐ PWW-FR ☒ PWW-FBS ☐ PWW-Park ☐	
Research Title: Nēnē Habitat Use and Movements on the Island of Hawai'i	
Affiliation: USGS Pacific Island Ecosystems Research Center	
PI Contact Info: 808-967-7396 ext 286	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** New Permit
Annual Report - Not Required, Received: New Permit	

Puu Waawaa Forest Reserve Sub-unit (continued):

Principle Investigator: James, Helen	**Permit Duration:** May 2010 – May 2011
New Permit ☒ **Renewal** ☐ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☐ LAU-FR ☐ PWW-FR ☒ PWW-FBS ☐ PWW-Park ☐	
Research Title: The Former Ecological Role of the Endangered Hawaiian Petrel in the Pu`u Wa`awa`a Experimental Forest and Beyond	
Affiliation: Smithsonian Institution	
PI Contact Info: jamesh@si.edu; 703-403-0166	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** New Permit
Annual Report - Not Required, Received: New Permit	

Principle Investigator: Kaufman, Leyla	**Permit Duration:** Dec 2010 – Dec 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☒	
Project Location(s): LAU-NAR ☐ LAU-FR ☐ PWW-FR ☒ PWW-FBS ☐ PWW-Park ☐	
Research Title: Study of infestation of and biocontrol on *Erythrina sandwichensis.*	
Affiliation: UH-Manoa, Hawaii Department of Agriculture	
PI Contact Info: (808) 956-2450; leyla@hawaii.edu	
Dates of Anticipated Results: December 2011	**Publications, etc. Received:** Yes ☐ No ☒
Annual Report - Not Required, Received: Yes ☐ No ☒ ***Note:** State Access Permit- Managed by DOFAW	

Principle Investigator: Magnacca, Karl	**Permit Duration:** Oct 2010 – Oct 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☒ PWW-FBS ☒ PWW-Park ☐	
Research Title: Moore Foundation Hawaiian Barcoding Project	
Affiliation: University of Hawaii at Hilo	
PI Contact Info: (808) 756-4631	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** Yes ☐ No ☒
Annual Report - Not Required, Received: Yes ☐ No ☒	

Puu Waawaa Forest Reserve Sub-unit (continued):

Principle Investigator: McCoy, Marc	**Permit Duration:** Oct 2010 – Oct 2011
New Permit ☒ **Renewal** ☐ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☐ LAU-FR ☐ PWW-FR ☒ PWW-FBS ☐ PWW-Park ☐	
Research Title: Solar interaction in Ancient Hawaii: New research on volcanic glass	
Affiliation: University of Otago, New Zealand	
PI Contact Info: mark.mccoy@otago.ac.nz	
Dates of Anticipated Results: November 2010	**Publications, etc. Received:** New Permit
Annual Report - Not Required, Received: Yes ☒ No ☐ **Note**: New permit but annual report received one month after permit issue and included in the annual reports provided within this document.	

Principle Investigator: Price, Jonathan	**Permit Duration:** Dec 2010 – Dec 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☐ LAU-FR ☐ PWW-FR ☒ PWW-FBS ☐ PWW-Park ☐	
Research Title: Hawaiian Forest Structure and Growth with Respect to Bird Habitat	
Affiliation: UH Hilo, Department of Geography and Environmental Studies	
PI Contact Info: 808-974-7547; jpprice@hawaii.edu	
Dates of Anticipated Results: Dec 2011	**Publications, etc. Received:** Yes ☐ No ☒
Annual Report - Not Required, Received: Yes ☐ No ☒	

Puu Waawaa Forest Bird Sanctuary Sub-unit:

Principle Investigator: Magnacca, Karl	**Permit Duration:** Oct 2010 – Oct 2011
New Permit ☐ **Renewal** ☒ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☒ LAU-FR ☒ PWW-FR ☒ PWW-FBS ☒ PWW-Park ☐	
Research Title: Moore Foundation Hawaiian Barcoding Project	
Affiliation: University of Hawaii at Hilo	
PI Contact Info: (808) 756-4631	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** Yes ☐ No ☒
Annual Report - Not Required, Received: Yes ☐ No ☒	

Puu Waawaa State Park (Kiholo) Sub-unit:

Principle Investigator: Glenn, Craig	**Permit Duration:** Dec 2010 – Dec 2011
New Permit ☒ **Renewal** ☐ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☐ LAU-FR ☐ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☒	
Research Title: Experimental Program to Stimulate Competitive Research (EPSCoR) – Environmental Dynamics and Ecosystem Response (ENDER)	
Affiliation: UH Manoa, Department of Geology and Geophysics	
PI Contact Info: 808-956-2200; glenn@soest.hawaii.edu	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** New Permit
Annual Report - Not Required, Received: New Permit	

Principle Investigator: Hughes, Flint	**Permit Duration:** April 2010 – April 2011
New Permit ☒ **Renewal** ☐ **Permanent (contingent upon approval)** ☐ **No Valid Permit** ☐	
Project Location(s): LAU-NAR ☐ LAU-FR ☐ PWW-FR ☐ PWW-FBS ☐ PWW-Park ☒	
Research Title: Quantifying the Dynamics and Magnitude of Water Loss from Kiawe Forests in North Kona	
Affiliation: USDA-FS, PSW IPIF	
PI Contact Info: 808-933-8121 ext 177; fhughes@fs.fed.us	
Dates of Anticipated Results: TBA	**Publications, etc. Received:** New Permit
Annual Report - Not Required, Received: New Permit	

Appendix B - Metadata

- Research affiliations are broken down into four groups: Forest Service, University of Hawaii (Hilo and Manoa campuses), other Universities and other government organizations.
- Educational permits are grouped into three categories: academic, institution and organization. Within these 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).
- Existing permits that were valid for more than one year were treated as renewals.
- As of November 2010 all new and renewal permit applicants were required to submit an annual report regardless of the HETF Sub-unit. Until this time only projects taking place within the Natural Area Reserve (NAR) were required to submit annual reports. Given the timing of this change and whether a project took place in the NAR, a renewed permit may not have an accompanying annual report.
- The included annual reports were submitted with renewal applications and pertain to the previous year's work with the exception of Dr. Mark McCoy.