



# EMP

## Ecosystem Management Program Bulletin

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### The 2013 Cave Survey Project for the Pōhakuloa Training Area, Island of Hawai'i

By Jahkotta Burrell Lewis and Dr. Julie Taomia

PRIOR TO CAPTAIN James Cook's arrival to the Hawaiian Islands in 1778, Hawaiians used lava tubes (volcanic caves) as temporary shelters, water collection areas, burial sites and as refuges during times of war. These practices continued into the historic period (1800s to 1900s) as well. Today, Hawaiian cave archaeological sites are one of the most prevalent archaeological resources found within the Pōhakuloa Training Area (PTA).

Located on the island of Hawai'i, PTA consists of 134,000 acres between two massive volcanoes: Mauna Kea and Mauna Loa. PTA is 4,030 to 8,650

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feet above sea level. Of PTA's 83,000 acres of accessible areas (impact areas are off limits), 64% have been surveyed for archaeological resources, and some reclaimed portions of the impact area have also been surveyed.

Many of PTA's cave systems were used as temporary shelters or campsites. Some of these cave dwellings contain high concentrations of archaeological items associated with higher elevation pre-Contact Hawaiian activities. Predominately resource driven, early Hawaiian activities in this area included: bird hunting, basalt quarrying, and water collection (from active drips in caves).

Archaeological resources found at PTA must be managed in accordance with federal laws and regulations. In keeping with these laws, PTA's Cultural Resources Management Program (CRMP) documents archaeological sites and conducts an annual, intensive archaeological cave survey.

#### **PTA's Cave Survey Project**

The Cave Survey Project (CSP) assists PTA's CRMP in the conservation and protection of its cultural resources in lava tubes. As a data collection tool, the CSP helps Army archaeologists understand higher elevation land use patterns. This understanding of PTA's cultural resources improves management policies.

Initially instituted in 2004, the CSP utilizes the expertise of contracted cave specialists, as well as archaeologists, in the documentation of PTA's cave



Jeff Yamauchi, an archaeologist with the Pōhakuloa Training Area's (PTA) Cultural Resources Management Program, explores the interior of a cave system at PTA. Photo by PTA CRMP staff



Jeffrey Syrop and Alysia Curdts, archaeologists with the Pōhakuloa Training Area Cultural Resources Management Program, taking a break from cave mapping and exploration during the 2013 Cave Survey Project. Photo by PTA CRMP staff

archaeology. The CSP consists of four main elements:

- **Extensive surveys of each cave system.** All accessible cave passages are explored for archaeological features, which are recorded using standardized site and feature forms.
- **Intensive mapping of each cave system.** The lava tubes are mapped by recording distance and bearing measurements from the established master datum and between mapping stations. This azimuth station-based method of mapping creates a baseline or established reference frame. At each mapping station measurements are taken to the ceiling, floor and walls of the lava tube. The reference frame is used to record archaeological resources as well as features of the lava tube. The result is a comprehensive map showing the distribution of archaeological resources throughout a cave system. After data is collected in the field, it is entered into a computer program called Compass, "...which produces a map of the lava

tube system, as well as three dimensional characterizations when x, y and z coordinates are taken at the station points"<sup>1</sup>. From the Compass program, a three dimensional image is generated, which can be geo-referenced (accurately located on a map using the master datum) in a Geographic Information System program.

- **Laboratory analysis.** Datable cultural material, such as charcoal from a fire pit, is sent to a contracted laboratory to determine in what time period a cave was inhabited. This is done using radiocarbon dating techniques. Additionally, plant and animal samples are identified and analyzed to determine what inhabitants were eating or using during their stay within a cave system.
- **Photo documentation.** Each archaeological feature found in PTA's caves are individually photographed utilizing high definition digital cameras. This data is utilized in comparative studies looking at the condition of caves' archaeological environment over time.

### ***Results of the 2013 Cave Survey Project***

PTA's 2013 CSP resulted in the recordation of six archaeological cave systems. These caves were explored during planning for a proposed 2,000-acre Infantry Platoon Battle Course.

Many of the archaeological features discovered during this survey suggest that these caves were used as temporary shelters during the pre-Contact period. (Found items are described in detail on page three.)

### ***What Happens Next?***

The data collected during the 2013 CSP is ultimately used to determine which sites are eligible for the National Register of Historic Places (NRHP), a federal list of significant sites deemed worthy of preservation. The Army, as a federal land manager, is required to manage those sites that are eligible for the NRHP and carry out mitigation when projects will have an adverse effect on NRHP-eligible sites. With approximately 36% of the training area still requiring

*Continued on page 4*

<sup>1</sup>Taomia, J. M.E, n.d. Evaluation of Lava Tubes for National Register of Historic Places Eligibility in the Infantry Platoon Battle Area, Pōhakuloa Training Area, Ka'ohē Ahupua'a, Hamakua District, Hawai'i Island, Hawai'i TMK (3) 4-4-016-001. U.S., (Hawai'i: Army Garrison- Pōhakuloa, 2013) 8.



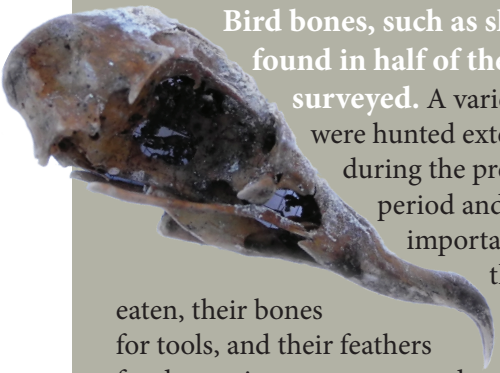
# Surveys of six cave systems during the 2013 Cave Survey Project at Pōhakuloa Training Area reveal key features that **suggest the caves were once used as temporary shelters.**

Gourds (*Ipu*) were encountered in one of the six caves recorded. Gourds found in caves were typically used by Hawaiians as water collection vessels. Water was scarce in the area, and thus individuals gathering higher elevation resources (e.g., birds), or individuals who were using high elevation routes to access other parts of the island, had to rely on the active drips found within caves for water. Some gourds were also used to carry supplies or feathers.



Bird bones, such as skulls, were found in half of the caves surveyed. A variety of birds were hunted extensively during the pre-Contact period and "... were an important resource;

they were eaten, their bones were used for tools, and their feathers were used for decorating ornaments and cloaks."<sup>2</sup> The bird bones recorded during the 2013 CSP have not been officially identified to a type of bird, but might belong to the endangered Hawaiian Dark-rumped Petrel (*Pterodroma sandwichensis*) or 'ua'u, a prized pre-Contact Hawaiian delicacy that was extensively hunted in this region of Hawai'i.



Charcoal deposits and/or torch-related materials (burnt sticks, kindling stashes and torch remnants) were encountered in all of the caves surveyed. Charcoal samples are currently awaiting species identification and will also be radio carbon dated to determine cave occupation periods.



The strong and sharp-edged 'opihi shells (*Cellana* sp.) are useful, portable tools, and the limpet snail found inside (eaten raw) is still a favorite food in Hawai'i. Photo from [www.aceuhmanoa.wordpress.com](http://www.aceuhmanoa.wordpress.com)

Midden deposits (old trash remnants) found in one cave consisted of fairly sparse concentrations of kukui (*Aleurites moluccana*) nut fragments as well as 'opihi (*Cellana* sp.) shells.



Additional features such as hearths and ash deposits (found in three caves) along with rock alignments, depressions, and rock walls (found in two of the six caves) provide further evidence that these caves were utilized as temporary shelters.

All photos on this page by PTA CRMP staff unless otherwise noted.

<sup>2</sup>Moniz Nakamura, J, The Archaeology of Human Foraging and Bird Resources on the Island of Hawai'i: The Evolutionary Ecology of Avian predation, Resource Intensification, Extirpation, and Extinction (Hawai'i: University of Hawai'i, 1999) 45.





Interior view of one of the many caves surveyed during the 2013 Cave Survey Project at Pōhakuloa Training Area. Photo by PTA CRMP staff

archaeological surveys, CSP will continue to be used as an effective management tool of PTA's archaeological caves. •

Jahkotta Burrell Lewis is an archaeologist with the PTA Cultural Resources Management Program.

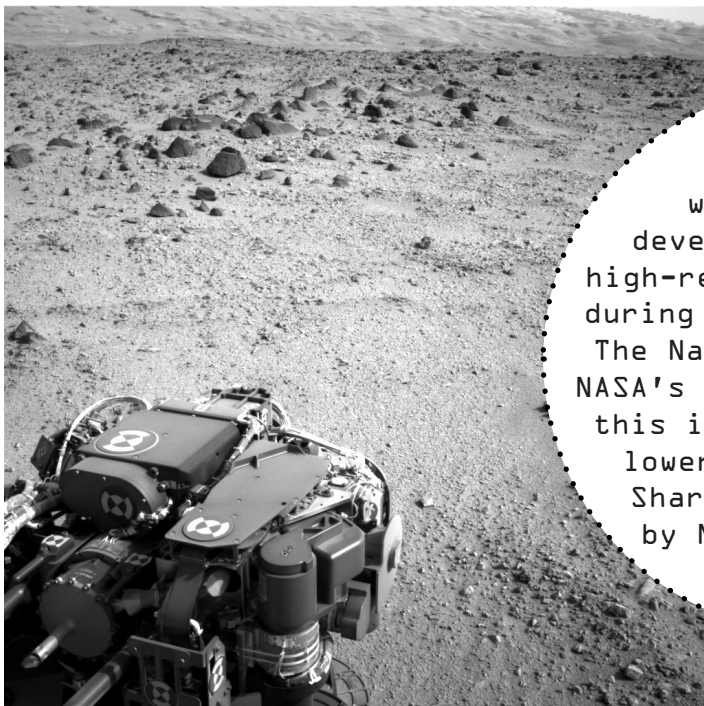
Dr. Julie Taomia is an archeologist with the U.S. Army Garrison, PTA, Hawai'i.

## Robots Document Change in the Forest

By Lalasia Bialic-Murphy

THE O'AHU ARMY Natural Resources Program's (OANRP) primary mission is to minimize any negative impact that military training on O'ahu might have on endangered species. A vital component of endangered species stabilization is protecting appropriate habitat. As part of this effort, OANRP staff monitors indices of habitat health and survey for incipient invasive weeds. To increase the efficiency of this process, OANRP has started using Gigapan Robotic technology for data collection purposes.

This technology was developed in 2008 through collaboration between Carnegie Mellon University and the National Aeronautics and Space Administration's (NASA) Ames Research Center to capture high-resolution panoramas during Mars explorations. To capture a panorama, the robot is attached to a tripod and a camera is secured to the robotic mounting platform. The user manually sets the boundaries of the panorama and adjusts the camera setting to optimize image quality. Once these parameters are set, the robot automatically determines the number of images to capture and controls image acquisition in an organized fashion. The images are then merged together using Gigapan Stitch, a panorama stitching software, to create a high-resolution megapixel panoramic images.



Gigapan was originally developed to capture high-resolution panoramas during Mars explorations. The Navigation Camera on NASA's Mars rover captured this image (left) of the lower slopes of Mount Sharp on Mars. Photo by NASA/JPL-Caltech

Using these panoramas to quantify long-term trends requires a series of steps. First, the photographer takes a series of panoramas of a given area over time. Second, a subset of points is randomly selected within each panorama, points are visually analyzed, and data on the vegetation of interest is recorded. These data are then used to analyze trends and determine if the vegetation of interest has changed in either geographical distribution or percent cover over time.





Lalasia Bialic-Murphy, monitoring specialist with OANRP, sets up her camera on the Gigapan EPIC 100 panoramic tripod head to capture high resolution panorama at Ka'ala. Photo by OANRP staff

Natural resource managers are finding that Gigapan robotic technology has cut the time and costs of collecting monitoring data dramatically. A project that once took two weeks of data collection now only takes a day. This time-saving technology allows staff to spend less time collecting data and more time doing what they love: actively protecting endangered species and the habitat they call home. •

Lalasia Bialic-Murphy is a monitoring specialist with the O'ahu Army Natural Resources Program.

# Monitoring with Gigapan



Zooming in on the Gigapan image, the stitching software reveals an invasive fountain grass (*Pennisetum setaceum*) plant, saving staff survey time on the steep cliffs above Mākua. Photo by OANRP staff





## **Reflections** on Summer Internships at OANRP

"Although the job is physically demanding, it has taught me discipline and the value of hard work. Resource management is not an easy job, and through working hard, I've learned to push through and persevere to accomplish things... Not only has this internship helped me with identifying Hawaiian plants, but I've also learned the names of weeds, which is an important part of conservation that is often overlooked."

*On the challenges of working in conservation,*

**Chelsea Osaki** (pictured left)

**"Working closely with OANRP staff created a lasting impression. This program has helped me to realize my potential in the conservation community and I would like to see more local people getting involved in this kind of work. This [conservation] should be everyone's job!"**

*On what she took away from the internship,*

**Emily Long**

"I think the biggest monitoring project was at 'Ōhikilolo when we monitored all the loulou outplants—I think around 200! This was really amazing because we got to monitor these endangered plants that had been outplanted quite some time ago and really see firsthand how successful rare plant reintroductions can be. There were many that were doing really well and even producing seeds."

*On monitoring endangered plants in the forest,*

**Tess Tarling**

"The weather did not permit flying into to the Ko'olau summit that day, so we hiked into 'Ōpae'ula and then walked the fenceline until reaching the cabin at 6:30 p.m. It was the most difficult hike I had ever done because of the length, and it was also rainy, cold, and some of the time [was spent] ankle deep in mud and water. There were also a couple difficult spots to get through."

I believe that experience made me a better hiker and gave me an opportunity to test my abilities and improve my confidence."

*On the biggest challenge of the internship,*

**Matthew Brittain**



**"Due to bad weather, we were unable to get our staff and gear choppered into 'Ōhikilolo safely, so the operation was cancelled. We are often at the mercy of weather and I learned it is necessary to be patient. After a lot of commuting time and then more waiting, it was really satisfying to get flown into this remote area and be productive and do meaningful work!"**

*On the challenges of working in remote areas,*

**Robert Lau**



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FROM LEFT: Matthew Brittain, Robert Lau, Emily Long, Tess Tarling and Chelsea Osaki prepare for weed control at 'Ōhikilolo. Photo by OANRP staff



## E 'Tis the Season...

To say mahalo to our amazing five interns for their work efforts throughout the summer. From June through September, OANRP staff welcomed the additional energy and enthusiasm from interns Emily Long, Matthew Brittain, Chelsea Osaki, Tess Tarling and Robert Lau. From invasive weed and predator control, to rare plant monitoring and nursery maintenance, to rare snail surveys and ungulate fence checks, these five individuals experienced a wide array of natural resource management activities that we hope will help them on their way to becoming the next generation of conservation professionals. A hui hou gang!

## VOLUNTEER Opportunities



The O'ahu Army Natural Resources Program offers monthly volunteer service trips to protect populations of rare and endangered plants and animals.

For information on how to get involved, email [outreach@oanrp.com](mailto:outreach@oanrp.com) or call 656-7741.

### SIGN-UP INFORMATION

Already filled out your volunteer paperwork? Visit [www.oanrp.ivolunteer.com](http://www.oanrp.ivolunteer.com) to sign up for volunteer trips. Please note that volunteer spots are offered on a first-come, first-served basis.

# EMP *Bulletin*

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*The success of this newsletter depends on article contributions from the staff of the O'ahu Army Natural Resources Program, O'ahu Army Cultural Resources Program, PTA Army Natural Resources Program, and PTA Army Cultural Resources Program. Mahalo to all staff who contributed to this issue.*



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[http://www.garrison.hawaii.army.mil/sustainability/  
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