ECOSYSTEM

MANAGEMENT PROGRAM BULLETIN

HIGHLIGHTS FROM 2021

2022 ISSUE

This O'ahu 'elepaio is part of the Monarch flycatcher family, which includes more than 100 worldwide species of insectivorous songbirds. Fiercely territorial and generally monogamous, these endemic O'ahu birds were listed as endangered species on April 18, 2000. ON THE COVER **'Elepaio GPAR arrives to feed its nestlings. For monitoring purposes Army biologists add colored leg bands to identify these endangered birds from a distance. From top to bottom, left leg then right leg, this 'elepaio is green/pink, aluminum/red, or GPAR.**

INTRODUCTION

MOVING FORWARD TOGETHER

The Hawaiian Islands are the most geographically isolated group of islands on Earth. They are also home to more than 500 federally listed threatened and endangered species and countless cultural and archaeological resources.

A number of these unique resources can be found on U.S. Army installations and training areas. From plants and birds, to snails, bats and insects, the Army's natural resource programs on O'ahu and Hawai'i Island manage more than 120 threatened and endangered species. Likewise, the Army's cultural resource programs in Hawai'i manage more than 3,000 significant cultural resources, including historic sites, structures, buildings and artifacts.

The Ecosystem Management Program Bulletin is designed to educate the public and the military community about the unique resources on Army-managed lands and the Army's efforts to conserve them. Our hope is to encourage a collective conservation ethic, foster innovation and inspire and expand opportunities for collaboration and partnership with academia, industry and beyond.

The Army's core mission is to train our Soldiers so they are ready when called, and this mission is directly tied to the environmental stewardship of the resources in our care. Protecting the environment means sustaining the mission and securing the future.

U.S. ARMY GARRISON HAWAI'I

Daniel Misigoy
Colonel, U.S. Army Commanding

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Director of Public Works

Published for the U.S. Army Garrison Hawai'i
by the Office of the Vice President for Research and Innovation

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Phil Taylor's passion for bird conservation started at a young age. For the past 15 years, he has worked with the Army Natural Resources Program on O'ahu, helping protect the endangered O'ahu 'elepaio. When he is not in the field, Phil enjoys sharing his love for birds and the sport of tennis with his daughter.

Phil is a rare vertebrate conservation specialist with the University of Hawai'i, Office of the Vice President for Research and Innovation, working for the U.S. Army Natural Resources Program on O'ahu.

"Be passionate about what you do. Passion is a contagion that even a mask can not stop ."

PAMELA SULLIVAN

Pamela Sullivan has worked as an ecological consultant in Illinois and natural resource manager in Hawai'i for a combined total of 13 years, focusing on ecological restoration, endangered species conservation, and invasive species management to address impacts to natural resources.

Pamela is an invasive plants program manager with Colorado State University, Center for Environmental Management of Military Lands, working for the U.S. Army Natural Resources Program at PTA.

"Early detection and rapid response (EDRR) are the most cost-effective and efficient solutions to address the growing threat of invasive species."

CLAY TRAUERNICHT

Dr. Clay Trauernicht's research examines fire risk and ecosystem integrity in response to changes in land use and climate and is the lead for the Pacific Fire Exchange, a collaborative project making fire science useable by managers and the public. When not working, he is probably playing in the garden or the ocean with is wife and two daughters.

Clay is an extension specialist in ecosystems and fire in the Department of Natural Resources and Environmental Management at the University of Hawai'i at Mānoa.

"Conservation is as much about people as it is about plants, animals, and ecosystems. We are an integral part of these life support systems whether land or sea and our work must therefore seek to improve both social and ecological conditions such that we all can thrive."

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Endangered 'Elepaio Claim New Territory in the Wai'anaes

BY PHIL TAYLOR

Foraging among the trees in deep gulches of the Ko'olau and Wai'anae Mountain ranges is a small forest bird endemic to the island of O'ahu—*Chasiempis ibidis*, or the O'ahu 'elepaio. This active and energetic flycatcher feeds exclusively on insects that it gleans from the leaves and bark of plants and trees, sometimes performing acrobatic flight displays to catch its prey in midair.

As referenced in the excerpt from the oli—or chant—featured on the left, 'elepaio foraging behavior was closely observed by Hawaiian canoe makers as they searched the forest for quality koa trees to use for their craft. If the bird pecked at the tree, the wood was considered poor quality. If it simply landed and sang, the wood was considered sound.

To this day, 'elepaio are still regarded as guardian spirits by the Hawaiian canoe makers, in spite of the fact that koa trees large enough for traditional voyaging canoes are now rare in the islands. Until recently, the fate of the O'ahu 'elepaio looked very grim as well.

On April 18, 2000, the O'ahu 'elepaio was added to the U.S. Federal Endangered Species list. While once described as the most common native land bird on the island, in the year 2000 an estimated 1,500 O'ahu 'elepaio remained, occupying less than four percent of their original range. Thirteen years later, in 2013, the O'ahu 'elepaio had an estimated population of 1,261 birds.

'Elepaio are found on O'ahu, Kaua'i, and Hawai'i Island and they are biologically classified into three distinct species. While fairly common on Kaua'i and the island of

Ka'apeha ke koa o Hale'au'au
Lele le'ale'a nā hoa kālai wa'a

The koa of Hale'au'au are large and impressive
Friends of canoe carvers flitting about[1]

[1]H'ilei Kawelo, Kapua Kawelo and Kaia Kong. Kilo Ka Mēhamehame (2019).

ABOVE **An adult O'ahu 'elepaio incubates eggs in a camouflaged nest made of mosses, lichens and other various plant materials, along with spider webs to hold the tightly packed nest together.** PRECEDING PAGE **Phil Taylor, rare vertebrate conservation specialist with the Army Natural Resources Program, O'ahu, collects biometric data such as tail and wing measurements. When combined with data from other 'elepaio in the area, the biometrics create a detailed picture regarding the conservation status of this species.**

For such a small bird (average weight 0.4 ounces and total body length of 5.9 inches) 'elepaio are extremely long-lived with the oldest confirmed to have survived to the age of 23 on O'ahu.

Hawai'i, the O'ahu species is the only 'elepaio listed as federally endangered. The fragmented O'ahu populations that remain have been in decline over the past century due to shrinking habitat, nest predation by the non-native black rat, and mosquito-borne diseases such as avian poxvirus and avian malaria. Those that do survive form monogamous pairs that aggressively defend territories from neighboring 'elepaio. Within these territories, between the months of December and June, an 'elepaio pair builds a camouflaged cup-shaped nest in the fork of a tree branch and lays up to three eggs. One or two young typically survive and adults will have as many as two successful nests per season.

MANAGING THREATS TO THE O'AHU 'ELEPAIO

The O'ahu 'elepaio also inhabits portions of the island used by the Army for active training. To mitigate any potential negative impact from training, the Army Natural Resources Program on O'ahu (ANRPO) has been providing rodent control for almost two decades to help reduce the impact of nest predation by rodents during the 'elepaio breeding season. The goal is to increase 'elepaio nesting success and stop population declines in ANRPO management units.

Before rodent control was implemented, surveys were conducted between 2004-2010 in the Wai'anae Mountains to locate areas that sustained breeding pairs of 'elepaio. Data collected from these surveys provided a population estimate for the species. Initial surveys were conducted at over 30 locations and results indicated there were at least 300 O'ahu 'elepaio surviving in the Wai'anae mountain range during this time period. To protect these 'elepaio from rats, ANRPO staff deployed a combination of rodenticide stations and snap traps baited with peanut butter in areas with the largest and most accessible 'elepaio populations.

Over the years, ANRPO's rodent control methods have evolved to become more effective at eliminating threats of predation. Snap traps have been replaced with CO_2 powered self-resetting A-24 Goodnature© kill traps. Fences were also built to preserve the forested habitat by preventing constant damage from wild pigs. At Schofield Barracks, in the large Lihue fence where hunting is prohibited, rodenticide was dropped by helicopter. With these advances and consistent use of a variety of rodent control methods, O'ahu 'elepaio nesting success increased and the once small populations grew to expand into previously unoccupied areas of the management units.

UPDATED CENSUS YIELDS ENCOURAGING DATA

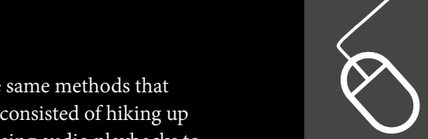
With the increase in 'elepaio occurring within ANRPO managed areas, staff wondered what was happening beyond managed forest, outside of zones with consistent rodent control. The decision was made to re-visit the areas surveyed in 2004-2010 to see if the population was increasing and to provide an updated population estimate for the species across the Wai'anae range.

> **'Elepaio have gigantic eyes. In fact, the only thing bigger than 'elepaio's eyes is his huge curiosity.**
>
> Vince Mahoney.
> 'Elepaio and Pūnāwai:
> A Waipao Adventure
> (2016).

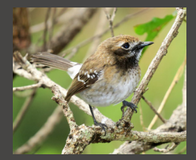
Surveys began in 2020 using the same methods that were used a decade earlier. This consisted of hiking up and down steep drainages and using audio playbacks to lure the birds in so that they could be visually identified. O'ahu 'elepaio are extremely territorial and responsive to playbacks of their songs or calls that have been recorded near their geographic region. When a recording is played through a small Bluetooth speaker, 'elepaio often fly in to investigate a possible 'elepaio intruder. The birds can then be observed and information on age, sex, and any interactions or behaviors gets recorded. A GPS point is also taken where the birds are first detected.

Today, the latest surveys are more than halfway completed and have been extremely encouraging. While earlier surveys from 2004-2010 detected 300 O'ahu 'elepaio in the Wai'anae Mountains, current surveys indicate that the population has more than doubled in size. Of the 32 areas previously surveyed, 22 have been re-surveyed, resulting in the detection of 631 O'ahu 'elepaio already. This is reassuring considering the population suffered such drastic declines in the past. As suspected, the greatest expansion of O'ahu 'elepaio occurred in areas adjacent to those with extensive and long-term rodent control. This suggests the birds in these managed areas are thriving, responding well to reduced predation from rats, and serving as a population source for birds to disperse to new regions.

These latest surveys are still ongoing and will continue into 2023. Once all areas of the original survey are completed ANRPO plans to survey even more areas in the Wai'anae mountains that have yet to be thoroughly searched. ANRPO hopes that these more complete and detailed surveys will provide updated information about the distribution and abundance of O'ahu 'elepaio, across the Wai'anae range, to provide a more accurate and current snapshot of this species, which both ANRPO and other land managers can use to guide future management efforts.



Click the image below to hear a playback of an O'ahu 'elepaio recorded in the southern Wai'anae mountain range.



CONTROLLING FUELS PROTECTS ENDANGERED PLANTS at PŌHAKULOA TRAINING AREA

BY PAMELA SULLIVAN

"...IT'S CRITICAL TO PROTECT SENSITIVE ECOSYSTEMS HARBORING THREATENED AND ENDANGERED SPECIES LOCATED IN GRASS-INVADED, FIRE PRONE AREAS FROM WILDLAND FIRE."

A mature *Isodendrion hosakae*, an endangered species managed by the natural resource staff at Pōhakuloa Training Area (PTA). PRECEDING PAGE **Wildland fire protection at PTA includes bare-mineral soil firebreak roads that are embeded within 60-foot-wide fuel breaks, along with weed control buffer zones (bright green patches of vegetation in background) that are designed to protect threatened and endangered species unique to Hawai'i Island.**

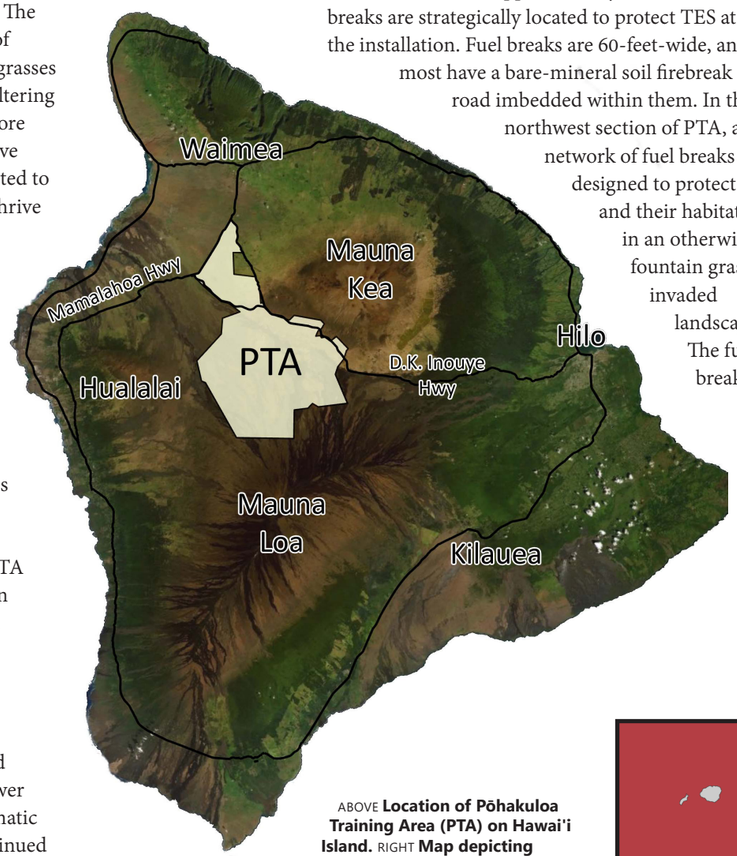
Wildland fires in Hawai'i present serious risks to people, homes, communities, infrastructure, and also to valuable natural resources—particularly rare native species. Like other areas in the nation, the incidence of wildfires in Hawai'i has increased severalfold over the last century, especially in the last decades. Experts predict wildland fires will become more frequent and larger due to global climate change.

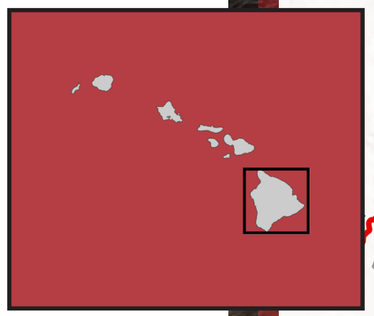
Most conservation professionals agree that Hawaiian ecosystems are not adapted to fire as most native plant species do not exhibit specific fire adaptations. Due to a combination of poorly adapted native species and the introduction of highly invasive pyrophytic species over the past century or more, wildfire has altered and degraded native Hawaiian ecosystems. The invasion and establishment of nonnative, drought tolerant grasses can change the fire regime, altering the ecosystem to promote more frequent fires. These nonnative grasses are much better adapted to fire than native species and thrive in fire disturbed ecosystems, exacerbating what is termed the grass-fire cycle.

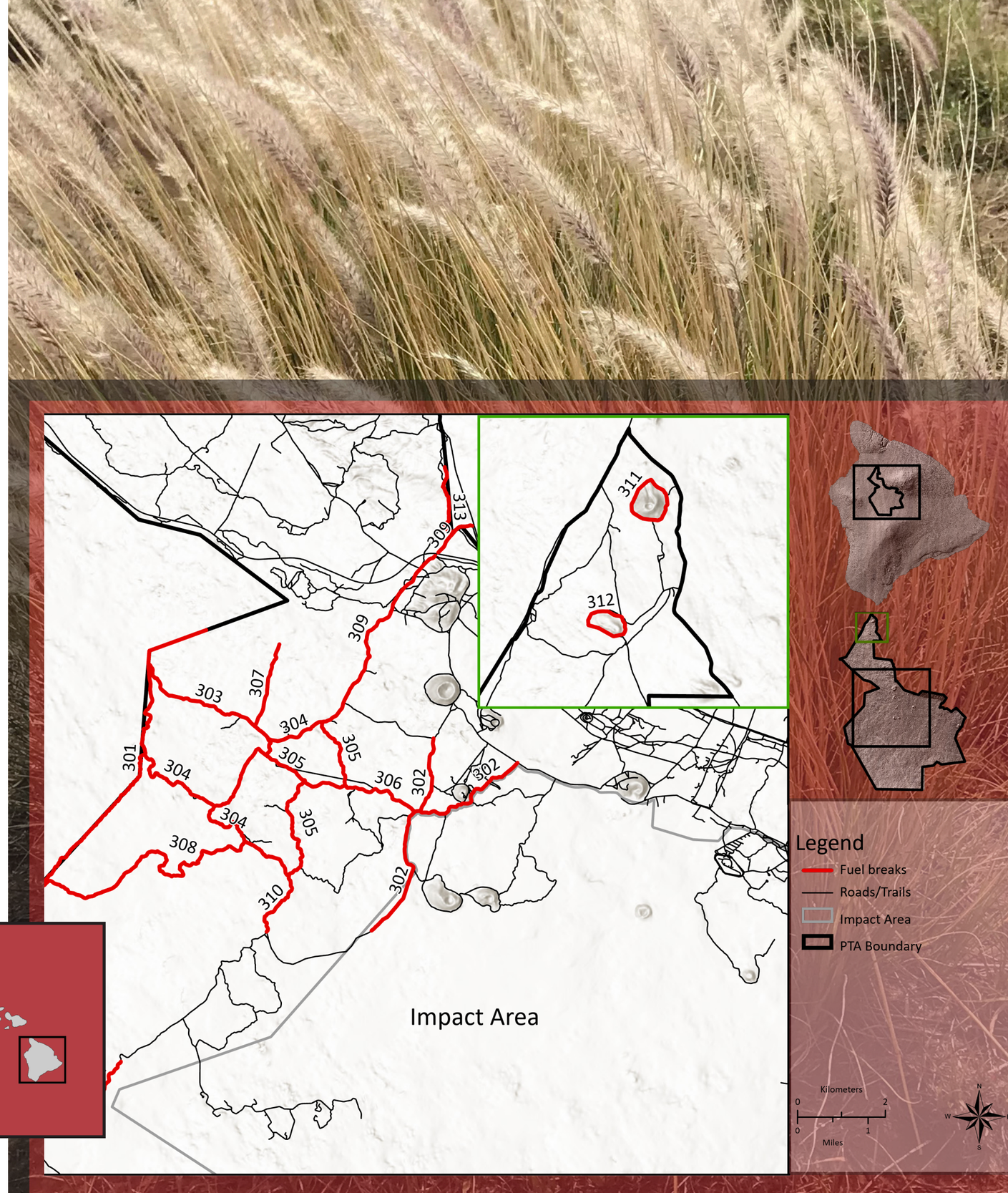
This issue is evident at the U.S. Army's Pōhakuloa Training Area (PTA) on Hawai'i Island, where invasive grasses occur in some areas with documented threatened and endangered species (TES). PTA is located in the saddle region between Mauna Kea, Mauna Loa, and Hualālai volcanoes with the elevation ranging from 2,460 feet to 8,694 feet. The habitat is dryland forest at upper elevations and former pastureland at the lower elevations. The most problematic fuels issue at PTA is the continued invasion and expansion across the installation of fountain grass (*Cenchrus setaceus*), a highly invasive nonnative, drought tolerant grass. Given the dry, windy conditions at PTA conducive to fire spread and the increasing fuel loads of fountain grass, wildfires pose a significant risk to most of the 26 TES, including 20 plants and six animals, present on the installation. Thus, it's critical to protect sensitive ecosystems harboring TES located in grass-invaded, fire prone areas from wildland fire.

FUEL BREAKS, INVASIVE WEED CONTROL, & FUEL MONITORING CORRIDORS: A THREE-PRONGED DEFENSE AGAINST WILDFIRES

To that end, the PTA Natural Resources Program (NRP) implements conservation measures to avoid and minimize potential effects to TES from ongoing military training activities. These measures include implementing and maintaining fuel breaks and firebreaks to mitigate the threat from wildland fires and military training-related fires to TES and native habitat. Approximately 40 miles of fuel breaks are strategically located to protect TES at the installation. Fuel breaks are 60-feet-wide, and most have a bare-mineral soil firebreak road imbedded within them. In the northwest section of PTA, a network of fuel breaks is designed to protect TES and their habitats in an otherwise fountain grass-invaded landscape. The fuel break







ABOVE **Location of Pōhakuloa Training Area (PTA) on Hawai'i Island.** RIGHT **Map depicting nearly 40 miles of fuel breaks at PTA and the location of Hawaii Island within the island chain.** RIGHT BACKGROUND **Fountain grass (*Cenchrus setaceus*), an invasive and flammable grass introduced to the Hawaiian islands in the early 1900s and widespread at PTA.**

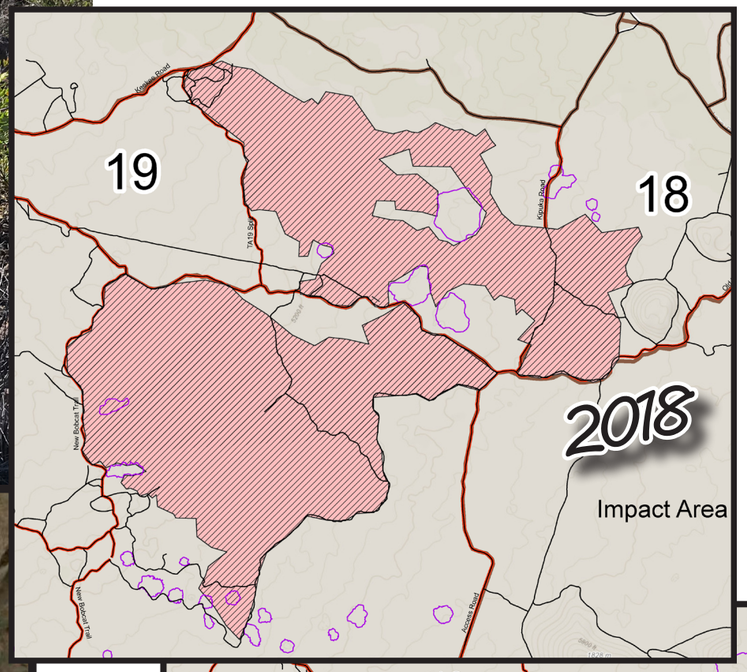
network divides the area into discreet "cells" so there are several lines of defense during a wildfire event. The expectation is that one wildland fire event will not impact the entire distribution of a single species if they occur in more than one cell, although some TES plants are so rare they do only occur in one cell. The old adage "don't put all your eggs in one basket" applies here.

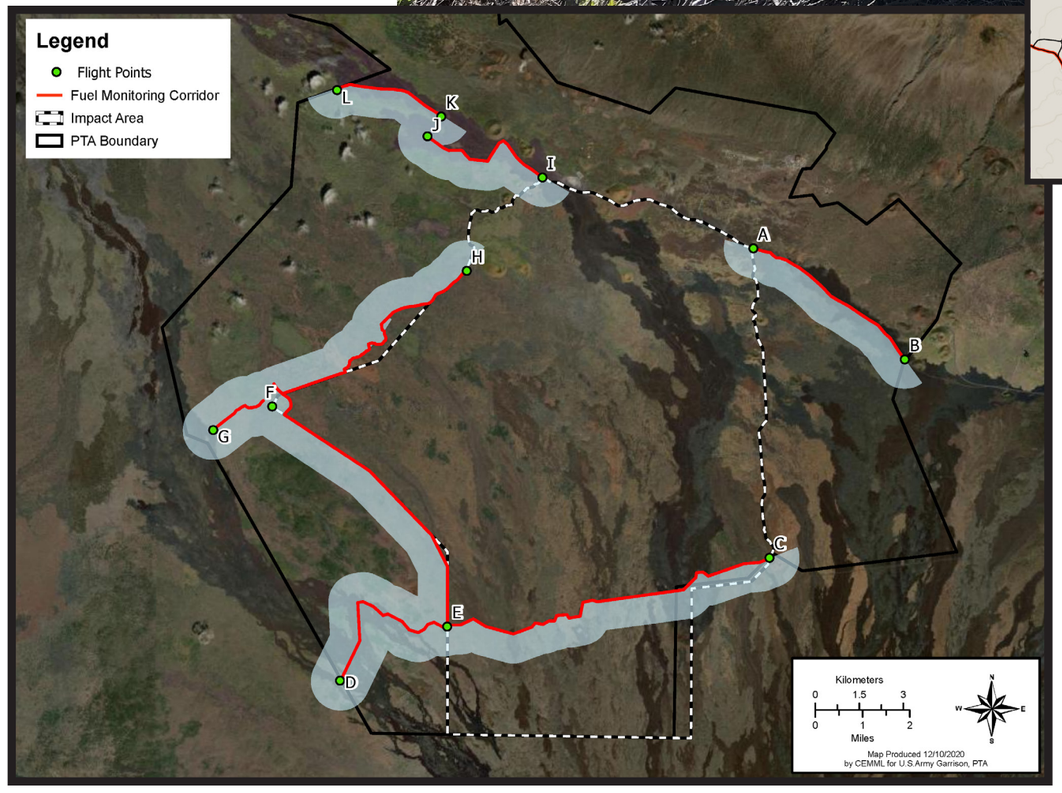
Invasive plant control around TES plant populations is another important conservation measure as it reduces competition for resources by the TES, but it also augments fuel breaks in fire-prone habitats because a primary weed target is fountain grass. Invasive plants are controlled in a series of weed control buffers (WCBs), defined as areas that have had some form of invasive plant control implemented, and are maintained at less than 20% weed cover. Currently, the WCBs at PTA cover approximately 270 acres, cumulatively. The NRP controls weeds within these buffers by hand clearing, cutting, and herbicide application.

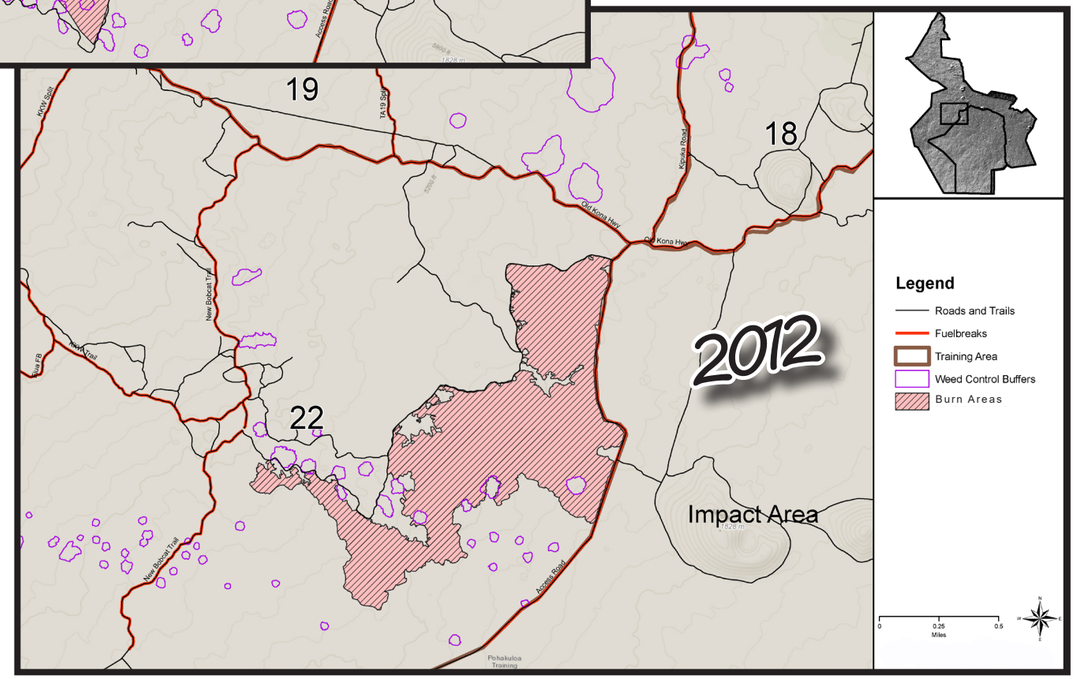
Unique to PTA, where newer lava landscapes exist, there is a third level of protection from the spread of wildland fire termed fuel monitoring corridors (FMCs). These are designated belts of land at least 330 feet wide in which fuels are monitored to ensure separation of contiguous fuels from either side of the corridor. Essentially, the corridors are barren or sparsely vegetated natural barriers absent of contiguous fine fuels such that fire is not likely to spread (i.e., burn across from one side to the other). There are five FMCs at PTA totaling 35 miles that the NRP monitors every five years via helicopter and imagery.

Fuels management within the fuel break network on the western side of PTA, combined with WCBs and FMCs, can reduce fire spread, large fire probability, and ignition probability, thereby reducing or preventing impacts to TES. In fact, post-fire assessments of two wildfire events at PTA in 2012 and 2018 in the Kīpuka Kālawamana Endangered Plant Habitat, which has high fuel loads, indicate that pre-suppression of fuels in strategic locations reduced wildfire impacts to TES plants. This area has one of the highest concentrations of TES plants on the west side of PTA. The area also burned twice before in the 1990s, but there was little to no fuels control at the time. Much of the NRP's management occurs in this area now, including a network of fuel breaks, WCBs, and FMCs to the northeast and southeast. In November 2012, a 465-acre fire burned part of this area. In July 2018, another fire burned 1,446 acres just north of the 2012 fire footprint.

Results of assessments for both fires show that several WCBs around individuals of TES plants, where invasive grasses were removed, were effective in preventing fire from impacting the TES plants, while fuel breaks were effective as a resource for firefighters







TOP LEFT **Caine Lunsford, a field technician with the U.S. Army's Natural Resource Program, hand clears within a weed control buffer for the endangered *Lipochaeta venosa* at Pōhakuloa Training Area (PTA).** LEFT AND BOTTOM RIGHT **Maps showing the extent of fires in the Kīpuka Kālawamauna Endangered Plant Habitat at PTA; burn areas included 1,446 acres in 2018 and 465 acres in 2012.** BOTTOM LEFT **This map highlights the five fuel monnitoring corridors (FMCs) totaling 35 miles at the installation.**

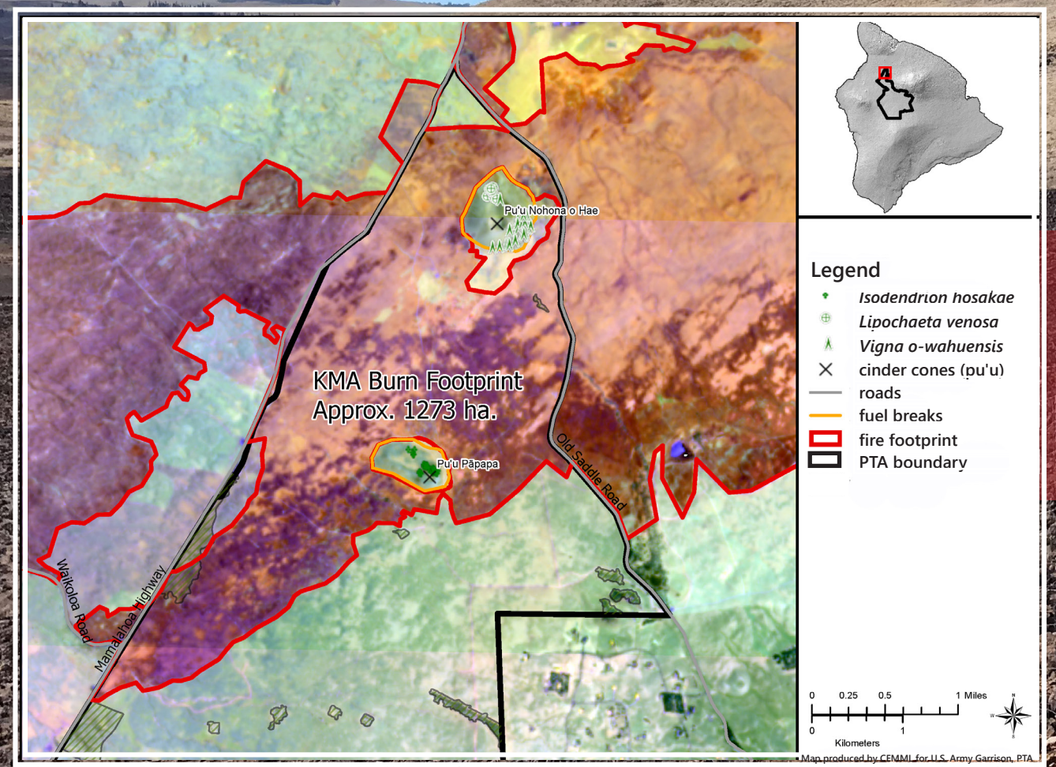
A weed control buffer for the endangered *Tetramolopium arenarium* plant at Pōhakuloa Training Area.

in preventing fires from spreading into other TES habitat. In one 30-acre site where the only known location of the endangered *Tetramolopium arenarium* plant occurs, the WCB likely prevented the extinction of that species as the 2018 fire burned right up to and around the WCB edge before stopping. As expected, the fire also stopped at the edge of the FMC to the northeast.

More recently, in the summer of 2021, one of the largest fires recorded in Hawai'i occurred on the slopes of Mauna Kea and spread into the Ke'āmuku Maneuver Area (KMA) unit of PTA. The KMA is former ranchland and thus a degraded grass-invaded landscape. The fire scorched more than 42,000 acres of mostly grassland above Waimea and largely on the Parker Ranch. It caused severe damage to Parker Ranch land, residents' homes, and other infrastructure and was devastating to the surrounding community. The fire ignited on Mānā Road on the slopes of Mauna Kea and spread through Parker Ranch, crossing Old Saddle Road and into the north end of the KMA where two pu'u (Pu'u Nohona o Hae and Pu'u Pāpapa) are among the last refugia for three critically endangered plant species (*Lipochaeta venosa*, *Vigna o-wahuensis*, and *Isodendrion hosakae*).

The fire underscored the challenges in controlling and containing a large wildland fire in grass-invaded, dryland habitats. Although the fire was significantly large overall, only a portion (1,273 hectares or 3,146 acres) of the KMA was impacted. WCBs around some of the TES plants have helped to restore the native habitat and reduce competition from invasive weeds. The fuel breaks encircling the two pu'u, created to protect the TES plants from fire, served as effective assets for firefighters to conduct operations. The fire burned around and between the two pu'u, engulfing most of the grassy fuels surrounding them. The fuel breaks provided firefighters a stronghold to defend both pu'u, which remained intact, preventing fire impacts to the TES plants.

Fuel breaks at PTA are not intended to stop a wildland fire in its tracks. They are designed to provide firefighters an asset to conduct firefighting operations. However, combining fuel breaks, WCBs, and FMCs in strategic locations increases firefighters' success in preventing fires from spreading into other areas and reduces the chances of impacts to TES and their habitats. Effective communication between NRP staff and firefighters about where priority resources like TES occur is key so firefighters can focus their efforts on protecting TES from wildfire impacts. The PTA NRP will continue to implement and maintain fuel breaks and WCBs in fire-prone areas and monitor for fuels encroachment into FMCs, as they anticipate an increased threat from wildland fires due to climate change and expansion of invasive grasses across the landscape. These cases underscore the importance and value in removing and controlling fire fuels like invasive grasses in TES habitat to ensure the Army remains in compliance with its regulatory obligations of promoting the continued existence of TES and sustaining military training at PTA.



ENDANGERED PLANTS BENEFIT FROM STRATEGIC FUEL BREAKS AT PTA

A map showing 2021fires that affected Ke'āmuku Maneuver Area (KMA). The map highlights how fuel breaks maintained by natural resource staff at Pōhakuloa Training Area kept flames from engulfing Pu'u Nohona o Hae (pictured here) and Pu'u Pāpapa, important refugia for the endangered *Lipochaeta venosa* (LEFT) *Isodendrion hosakae* (RIGHT) and *Vigna o-wahuensis* (FAR RIGHT).

RESOURCE MANAGERS & RESEARCHERS PARTNER TO PROMOTE NATIVE SPECIES CONSERVATION

BY CLAY TRAUERNICHT

The move by Army Natural Resources Program on O'ahu (ANRPO) to the University of Hawai'i at Mānoa (UHM) Office of The Vice President for Research and Innovation (OVPRI) brings a new model for academic partnerships to promote native species conservation. First, the program is now supported by a full-time Extension faculty position in the UH Department of Natural Resources and Environmental Management. Extension faculty differ from traditional professorships in that they are mandated to bridge research with applied questions and needs of on-the-ground practitioners and ensure that knowledge is shared across a wide range of potential end-users. In this case, the new faculty position will not only support ANRPO with their research questions and information needs but also work to identify and share the lessons learned and best practices among conservation and restoration programs across the state. The position began officially in July 2021 and will facilitate program data analysis, help raise external funds to address additional research questions, and engage more UHM faculty and students on projects that support the program.

Second, the new funding model under OVRPI has explicitly designated funding for two graduate research projects per year that support the needs of ANRPO. These funds create graduate assistantships for students and summer salary for faculty at UH who put forth proposals addressing problems articulated by ANRPO leadership and staff. Many of these research questions lie unanswered simply because the program has had little capacity to secure external awards for program or Hawai'i specific questions, or to recruit student and faculty researchers whose interests align with program needs or directly contribute to management decisions. Recently, ANRPO has funded five projects with UHM faculty and students tackling conservation questions ranging across several different species and technological applications. These projects will fill critical information gaps, enhance the program's ability to make science-based decisions, and increase the effectiveness of management actions.

Rather than provide a second-hand account of these projects, the program asked the research teams to describe their work in their own words, featured on the following pages.

Mapping Weed Species Using Helicopter and AI-Based Ultra-High Spatial Resolution Imagery

Yoko Uyehara and Dr. Qhi Chen

Our research examines whether the synergy of Artificial Intelligence (AI) and ultra-high spatial resolution remote sensing can automate the detection of native and invasive tree species. The methodology is based on the latest deep learning models and is calibrated using visual interpretation from centimeter-level aerial photographs. The detection of native lapalapa trees (*Cheirodendron* spp.) within a patchwork of native forest canopy pictured on the preceding pages, provides a good example of how this blending of AI and aerial imagery can be utilized. We expect the method will significantly increase the cost-effectiveness of vegetation monitoring and help identify target tree species that cannot be easily reached using conventional field observations.

PRECEDING PAGE **A high resolution aerial imagery taken from a helicopter and reproduced using artificial intelligence-based remote sensing to detect native lapalapa (*Cheirodendron* spp.)trees.**
BACKGROUND **Helicopters are important tools used by the Army Natural Resources Program to accomplish a vairety of managment objectives, including invasive weed surveys (shown here) and transportation of staff, native plants and supplies into remote locations.**

Monitoring the Phenology of *Chromolaena odorata* to Inform Management of an Incipient and Highly Invasive Species in Hawai'i

Samantha Shizuru and Dr. Creighton Litton

In 2011, *Chromolaena odorata*, also known as devil weed, was first detected in Kahuku Training Area (KTA) on the Island of O'ahu, and has since been the top incipient priority for the Army Natural Resources Program on O'ahu (ANRPO). The project seeks to investigate how a phenology monitoring program for *C. odorata* can help to better inform the use of integrated weed management to successfully manage this problematic invasive species in Hawai'i. Establishing a phenology monitoring program for *C. odorata* at KTA will allow ANRPO to gain a better understanding of the correlation between phenophases of *C. odorata* and climate variables. This will allow ANRPO to more readily predict when specific phenophases will occur and could then be used to inform the timing and integration of other weed control methods such as biocontrol and more traditional chemical and mechanical control.

LEFT **Graduate assistantship recipient, Samantha Shizuru, monitors invasive devil weed (*Chromolaena odorata*) at Kahuku Training Area on O'ahu.** BACKGROUND **Flowers and leaves of a mature devil weed plant.**

Understanding Low Seed Viability and Overcoming Self-Incompatibility in the Endangered Species *Dubautia herbstobatae*

Sunyoung Park and Dr. Anna Sugiyama

Our research will focus on the mechanisms of self-incompatibility and other factors resulting in low seed viability in the endangered species *Dubautia herbstobatae* (Asteraceae) via hand-pollination and microscopy. Ideally, we will identify less related populations to avoid self-incompatibility, but considering the small remnant populations of *D. herbstobatae* left in the wild and difficulty in obtaining new founders, this may not be possible. If inter-population crosses are not very successful, we will employ different techniques to overcome self-incompatibility.

INSET **An endangered *Dubautia herbstobatae* blooms atop a rocky outcropping in the Wai'anae mountain range on O'ahu.** BACKGROUND **An eyebrow brush is used to collect pollen granules from endangered Hawaiian plants to support hand-pollination efforts.**

Symbiotic Germination of Rare Endemic Hawaiian Orchids—*Anoectochilus sandvicensis*, *Liparis hawaiensis*—As Means to Promote Reintroduction Success

Thomas Chapin and Dr. Nicole Hynson

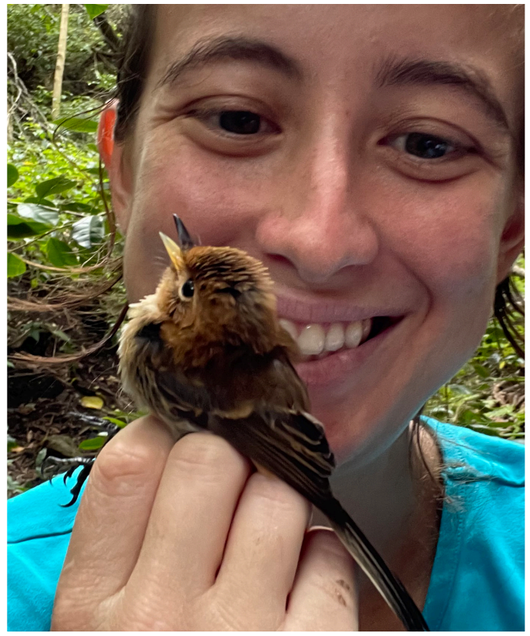
Orchids engage in complex symbioses and are quite dependent on orchid mycorrhizal fungi (OMF) for germination and growth. We are culturing the native mycorrhizal fungi that native Hawaiian orchids (*Anoectochilus sandvicensis* and *Liparis hawaiensis*) are reliant on and hope to use these cultures to support germination in the lab. While orchid seeds can be germinated without fungi, these asymbiotic-germinated seedlings often have a hard time adjusting when they are outplanted. The goal is to generate a viable collection of OMF, develop effective protocols for seed germination, and help illuminate this orchid-fungal symbiosis.

These diminutive and rare Hawaiian plants, the jewel orchid (*Anoectochilus sandvicensis*) (LEFT) and 'awapuhiakanaloa (*Liparis hawaiensis*) (INSET) represent two of just three orchid species that are native to the Hawaiian islands. BACKGROUND A typical wet forest habitat that supports native Hawaiian orchids.

Investigating Predictors of O'ahu 'elepaio Nesting Success Between Rodent Controlled and Uncontrolled Areas

Nikki Preston and Dr. Melissa Price

We are interested in evaluating factors influencing 'elepaio (*Chasiempis ibidis*) nesting success, to identify a set of management actions that will optimize population growth and expansion. In this project we will be identifying which factors influence 'elepaio nesting success by comparing nesting outcomes and nest-site characteristics between areas with rodent control and areas without, through a field study. Additionally, 10 years of existing data collected by Army Natural Resources Program, O'ahu will be evaluated to determine trends in trapping efforts, nesting success, and number of established 'elepaio territories.



INSET **Graduate assistantship recipient, Nikki Preston, collects data on an 'elepaio at one of the many nest sites she is monitoring during her field study on O'ahu.**
BACKGROUND **An adult O'ahu 'elepaio returns to the nest and displays the upturned tail behavior that is characteristic of this species.**

Root into your community

HO'OA'A

The U.S. Army Garrison Hawai'i natural resources program staff leads monthly volunteer service trips to protect rare and endangered plants and animals on Army-managed lands. Each educational trip incorporates hiking and a hands-on opportunity to care for Hawai'i's natural resources through invasive weed control in native habitat and occasional planting activities.

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Contact OUTREACH@OANRP.COM or (808) 656-7741 to be added to the volunteer database.

ORGANIZE A TRIP

Contact OUTREACH@OANRP.COM to organize a service opportunity for your class, hālau or group.

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The U.S. Army Garrison Hawai'i is responsible for the day-to-day operations of Army installations and training areas in Hawai'i. The U.S. Army Garrison Hawai'i team provides facility management and quality Soldier and military family services for more than 95,000 Soldiers, retirees, civilians and families across 22 military installations and training areas on O'ahu and Hawai'i Island. These installations include O'ahu-based Schofield Barracks, Wheeler Army Airfield, Fort Shafter, Tripler Army Medical Center, and the Island of Hawai'i-based Pōhakuloa Training Area.

The Directorate of Public Works Environmental Division Office at the U.S. Army Garrison Hawai'i is comprised of two branches: the Compliance Branch and the Conservation Branch, which are dedicated to providing guidance, support and liaison services to those who live, work and train on the installation, while also protecting the environment. The Conservation Branch includes the Army's natural and cultural resource programs, which protect endangered species and cultural resources, respectively, on O'ahu and Hawai'i Island. To learn more about the Army's environmental stewardship mission, visit HTTPS://HOME.ARMY.MIL/HAWAII/INDEX.PHP/GARRISON/DPW/

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The Office of the Vice President for Research and Innovation (OVPRI) provides leadership, coordination and support of research and innovation efforts throughout the 10-campus University of Hawai'i System, including oversight of extramural funding, compliance, export controls, technology transfer and commercialization, and the Applied Research Laboratory at UH – one of only 13 U.S. Department of Defense University Affiliated Research Centers (UARC). Through a cooperative agreement, OVPRI supports the U.S. Army Garrison Hawai'i Natural Resources Program on O'ahu. For more about OVPRI, please visit: WWW.HAWAII.EDU/RESEARCH/