ECOSYSTEM
MANAGEMENT PROGRAM BULLETIN

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A publication of the University of Hawai'i at Mānoa Pacific Cooperative Studies Unit,
in cooperation with the U.S. Army Garrison Hawai'i, Directorate of Public Works, Environmental Division

OANRP staff set out for a day's work in the Kahanahāiki management unit, along the northern rim of Mākua.

FROM THE EDITORS

PREVENTING EXTINCTIONS in the endangered species capital of the world is a daunting job. The daily grind of conservation work includes a long list of to-dos. As the tally of endangered species grows, the to-do list follows suit.

Facing new challenges in the field on a daily basis, we can't help but wonder how we can improve our approach, and how we can improve the lives of the endangered species themselves.

As opportunities for further research present themselves, the Oʻahu Army Natural Resources Program has welcomed collaboration with researchers locally and from around the world. A question that is raised in the forest can often be put to the test in a laboratory setting.

By seeking experts to explore research questions in mycology, ecology and plant pathogens, we've learned there's a lot more to managing species than meets the eye. Research results are incorporated into future management decisions and may lead to new approaches back in the field, cutting down our list of to-dos in the long term.

Kimberly Welch & Celeste Hanley,
Editors

ON THE COVER **Endangered kāhuli (*Achatinella mustelina*) congregate on olomea (*Perrottetia sandwicensis*) below Ka'ala. Jaime Tanino, a rare invertebrate conservation technician with OANRP, captured this shot while monitoring the health of the snails, which are endemic to the Wai'anae mountains. The snails featured on the cover are smaller than they appear, with the average adult ranging 18-20 mm in size.**

CONTRIBUTORS

RICHARD O'RORKE

Dr. Richard O'Rorke explores food webs and the use of molecular tools to understand ecological processes in Eukaryotes in Anthony Amend's fungal ecology lab.

Richard is a researcher in the Department of Botany at the University of Hawai'i at Mānoa.

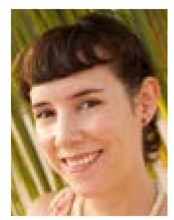
"Rapid advances in DNA sequencing technology have enabled us to investigate ecological mechanisms that would never have been possible to understand before."

JEREMY HAYWARD

Dr. Jeremy Hayward specializes in the evolutionary ecology and invasion biology of mycorrhizal fungi and their plant hosts. He has investigated these topics in island systems in Argentina, the Pacific and the Caribbean.

Jeremy is a postdoctoral researcher in the Department of Botany at the University of Hawai'i at Mānoa.

NICOLE HYNSON



Dr. Nicole Hynson's research focuses on the ecology, ecophysiology and evolution of mycorrhizal plants and fungi.

Nicole is an assistant professor in the Department of Botany at the University of Hawai'i at Mānoa.

KAPUA KAWELO

Kapua Kawelo is one of the original members of the USAG-HI natural resource team. With over 20 years of endangered species work under her belt, the University of California, Davis graduate will do whatever it takes to protect O'ahu's rarest plants from harmful pathogens and other introduced threats.

Kapua is a biologist with the USAG-HI DPW Environmental Division, Natural Resources Program.

"Partnering with researchers is critical to the success of the Army's natural resources protection projects."

JAIME RADUENZEL

Jaime Raduenzel sheds light on the little known internment camp located at what is now Schofield Barracks East Range, O'ahu. Raduenzel has also worked and learned about cultural resources at the Field Museum in Chicago and here on O'ahu at Waimea Valley.

Jaime is a contracted cultural resources specialist with U.S. Army Garrison-Hawai'i's O'ahu Cultural Resources Program.

"We have so much more knowledge to gain by looking further into archives from WWII in Hawai'i."

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OANRP	O'ahu Army Natural Resources Program
USAG-HI	U.S. Army Garrison, Hawai'i

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THE ECOSYSTEM MANAGEMENT PROGRAM BULLETIN (EMP)

The EMP highlights the U.S. Army's Garrison Hawai'i's innovative approaches to natural and cultural resource management in support of the U.S. Army's training mission in Hawai'i. 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, Pōhakuloa Training Area (PTA) Army Natural Resources Program, and PTA Army Cultural Resources Program. Mahalo to all staff who contributed to this issue.

All photos in this issue are by O'ahu Army Natural Resources Program staff, unless otherwise noted.

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DNA Analysis Reveals the Diet of an Endangered Tree Snail

BY RICHARD O'RORKE

OANRP is responsible for establishing six protected sites for the endangered kāhuli tree snail, *Achatinella mustelina*, in the Wai'anae mountains. This conservation work offsets any potential impacts to *A. mustelina* from training exercises on Schofield Barracks and Mākua Military Reservation. A 2003 stabilization plan for *A. mustelina* identified remaining important sites for conservation. Additionally, the plan required representation of these sites ex situ, or off site, through captive propagation.

Currently, a small number of wild tree snails are collected and maintained in a laboratory at the University of Hawai'i at Mānoa. Kāhuli are tricky to maintain under lab conditions, as very little is known about what to feed them to maximize their survival. While we know that kāhuli graze microscopic fungi off of leaf surfaces, we don't know much about the diversity of fungi present on those leaf surfaces. We also wonder if this food source can be developed and provided to snails in a lab setting. Researchers at University of Hawai'i at Mānoa are helping OANRP investigate these questions.

Achatinella mustelina **is a federally listed endangered tree snail endemic to the Wai'anae mountain range of O'ahu. At the beginning of the 20th century, Henry Pilsbry reported that the snail eats fungi from the surfaces of the plants it lives on. Peering at the snails' feces under a microscope, he was the first to observe the partially digested remains of fungal hyphae inside.**

A HUNDRED YEARS SINCE, scientists have discovered little more about the diet of these critically endangered animals. This is concerning because understanding the snails' diet could be crucial to successfully rescuing them by relocating them to either predator-free enclosures or into captive breeding programs. For example, it is important to know if the diet of snails varies across locations or between host plant, and whether the fungi in their new habitat match that which they eat in their natural environment.

Like Pilsbry we use the feces of the snails to infer their diet, but instead of using a microscope, we detect the remnant traces

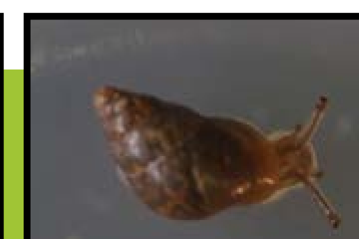
ABOVE (FROM LEFT) **Richard O'Rorke, Casey Jones, Gerry Cobian and Leah Tooman, researchers from the Amend fungal ecology lab at the University of Hawai'i at Mānoa, work together to analyze specimens for the tree snail diet project.** INSET **Research staff collected fresh snail fecal samples, such as this specimen from Pu'u Hāpapa in the Wai'anae mountain range, in order to determine which fungi are part of the kāhuli diet.**
PHOTOS BY AMEND FUNGAL ECOLOGY LAB

Lab tests will reveal the diet of the endangered kāhuli (*Achatinella mustelina*), shown tucked under the leaf of a native lama tree (*Diospyros sandwicensis*) in Kahanahāiki.

of digested DNA from their food to take a forensic-styled approach to discover what they eat. To perform this DNA approach we take advantage of the dramatic improvements in DNA sequencing technologies to generate millions of DNA sequences, each of which can be used like a product bar code in a supermarket to identify fungal species. This technological improvement, along with rapid increases in computing power, mean that we can address a question like how diet varies across the animal's range. This is a simple question to answer with a large animal, where you can simply observe what the animal's food is when they are eating, but it is almost impossible to answer with an animal that eats cryptic and microscopic food.

Vincent Costello, a rare snail conservation specialist with OANRP, helped us in the field by identifying trees that had snails in them at night at four field sites in the Wai'anae range: Hāpapa, Palikea, Kahanahāiki and Pahole. In the morning, we returned to these trees to see if the snails had deposited any fresh fecal material. This was a bit of a lottery, but we managed to get 142 fresh snail feces, which is quite an

Auriculella diaphana **graze on various fungi in the lab.**



Auriculella diaphana **"chews" its meal on a petri dish in the lab.**

The Anthony Amend Fungal Ecology Lab at the University of Hawai'i at Mānoa recorded feeding trials of native tree snails (*Auriculella diaphana*) over 24 hours to determine if they had food preferences. Click the images to the left to view the compressed footage and get a close-up view of snails dining in the lab.

impressive number of samples when dealing with a small and endangered animal! We also collected a leaf samples from each tree from which fecal matter was collected, so that we could get an idea of what microbes were on the menu and whether the snails were fussy eaters. This meant that we had a total of 284 samples, from which we extracted DNA when we got back to the lab. We then sequenced DNA in from each sample, getting about 10,000 bacterial DNA sequences per sample, and for fungus we documented almost 20,000 DNA reads per sample. What we discovered is that the location of the snails affects diet composition more than does the identity of the host plants on which the snails are found (although host plants were also an important factor).

Based on these results and the kāhuli snails' diverse diet, we have started cultivating new strains of fungi in the lab. We are currently running feeding trials in the lab to determine snail preferences and can use this information to make recommendations for future feeding regimes for the lab snails.

Another reassuring discovery that we made is that the species of *Cladosporium* fungus that is fed to snails at the Hawaiian Tree Snail Conservation Lab at the University of Hawaiʻi at Mānoa, where OANRP funds captive breeding of kāhuli, is relatively abundant in the wild. The aim of the facility is to safeguard the genetic stocks of these imperiled animals by keeping a set of them in a captive enclosure that mimics wild conditions. There was concern that *Cladosporium* that is fed to the snails might no longer be the one that was isolated twenty-five years ago when the facility began, and might not even occur in the wild. Our genetic approach was able to address this concern .

THE LOCATION OF THE SNAILS AFFECTS DIET COMPOSITION MORE THAN THE IDENTITY OF THE HOST PLANTS ON WHICH THE SNAILS ARE FOUND.

These results have lead us to ask further questions, such as whether snails change the composition of the microbes on the trees on which they occur. It would make sense if they do, because they are exerting grazing pressure on the microbial communities and because there is recent evidence that animals change the microbiota of environments simply by moving into those environments. We are currently working on comparing the microbial composition on leaves that have snails to those that don't. We look forward to seeing the applications of this genetic work to management of kāhuli in the field.

INSET **A juvenile *Achatinella mustelina*.**
RIGHT (FROM RIGHT) **Vincent Costello, rare snail conservation specialist with OANRP, along with Anthony Amend and Susan Alford of the Fungal Ecology Lab at the University of Hawaiʻi, visit Puʻu Hāpapa to bag some fresh snail feces for conservation research.**

Symbiotic Soil Fungi
in Plant Restoration

BY JEREMY HAYWARD
AND NICOLE HYNSON

Mycorrhizal fungi may play a larger role in the ecology of a Hawaiian forest than we know. PHOTO BY HYNSON LAB

FROM PREVIOUS PAGE
The fruit body—a coralloid mushroom—of an unnamed *Clavulina* sp., an ectomycorrhizal fungus associated with the endemic pāpala kēpau (*Pisonia sandwicensis*). 1

Magnified 1,000 times under a microscope, the roots of pāpala kēpau (*Pisonia sandwicensis*) are enveloped in a thick sheath of fungal tissue. 2

Pāpala kēpau (*Pisonia* spp.) are common trees found within native Hawaiian dry and mesic forests. 3

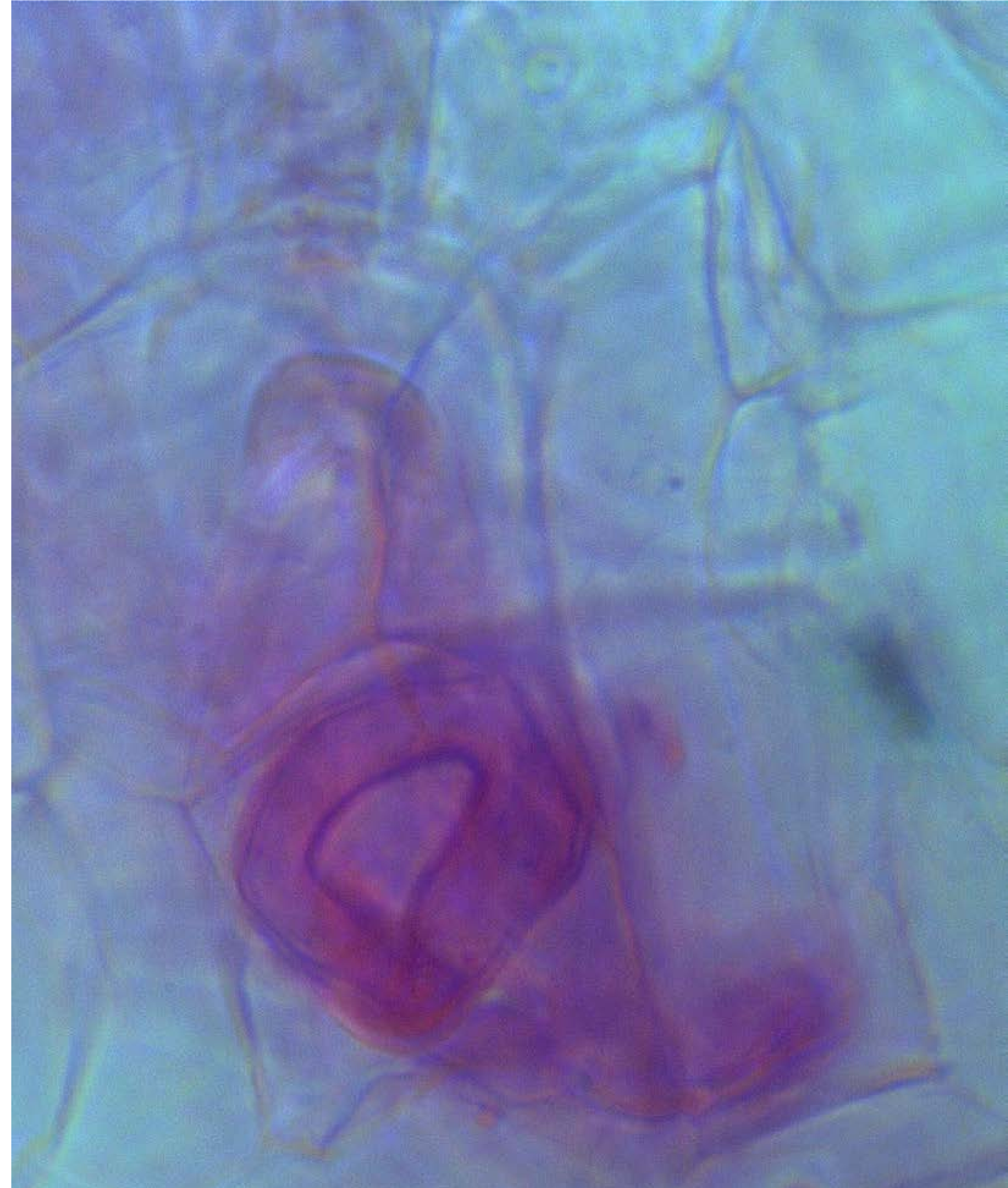
IMAGES 1 AND 2 BY HYNSON LAB

MOST PLANTS ARE SURPRISINGLY BAD AT FEEDING THEMSELVES.

To grow, all plants need three principal nutrients: carbon, nitrogen, and phosphorus. They also need water and a slew of minor nutrients, from magnesium to iron and copper. Of these many nutrients, most land plants excel at harvesting only one: carbon, which they gather through photosynthesis. The remaining necessary nutrients are often locked up in soils in forms that are inaccessible to plants alone. Nevertheless, we live on a green planet—plants are everywhere, so how do they get access to their life-sustaining nutrients?

Enter mycorrhizal fungi. The mycorrhizal symbiosis between the roots of plants and soil inhabiting fungi is one of the oldest mutualisms on earth. Over 90% of land plant families form obligate interactions with specific mycorrhizal fungi. In exchange for carbon from plant photosynthesis, the fungi supply soil nutrients to their host plants. Mycorrhizal fungi have the chemical arsenal to breakdown complex soil compounds and release nutrients that plants lack. Also, mycorrhizal fungi have microscopic filaments known as hyphae that can efficiently penetrate soil cracks and crevices too small for plant roots to enter, thus increasing the soil exploration capacity of plants. These fungi are therefore able to provide plants with all their basic nutrients, as well as improved access to water. In return, the fungi receive direct access to plant-derived sugars, a scarce commodity in the competitive world of soil microorganisms. Together, plants and mycorrhizal fungi are able to thrive, and Hawaiʻi's plants are no exception.

Mycorrhizal associations can be broken down into a variety of different types, depending on both the identities of the plants and fungi that form partnerships. For example, Hawaiʻi's three native orchids, like orchids everywhere, form specific partnerships with otherwise non-mycorrhizal fungi in the genera *Tulasnella*, *Ceratobasidium* and the order Sebacinales. All of Hawaiʻi's native heather (Ericaceae) (ʻōhelo, *Vaccinium* spp.) form ericoid mycorrhizal associations, which help their host plants access nitrogen locked in acidic soil with infertile growing conditions. Just one native tree, pāpala kēpau *(Pisonia sandwicensis)*, associates with mushroom-forming fungi in a partnership known as ectomycorrhizas. The overwhelming majority of



The hypha of an arbuscular mycorrhizal fungus (stained pink for greater visibility) coils through cells in the root of pāpala kēpau *(Pisonia umbellifera)*. This photograph is imaged at 10 times magnification. HYNSON LAB

ECOSYSTEM DISTURBANCES—LIKE FIRE, FOREST REMOVAL OR PLANT INVASIONS—MAY THREATEN NATIVE PLANTS' ACCESS TO THE VITAL NETWORKS OF MICROSCOPIC MYCORRHIZAL THREADS THROUGHOUT SOILS.

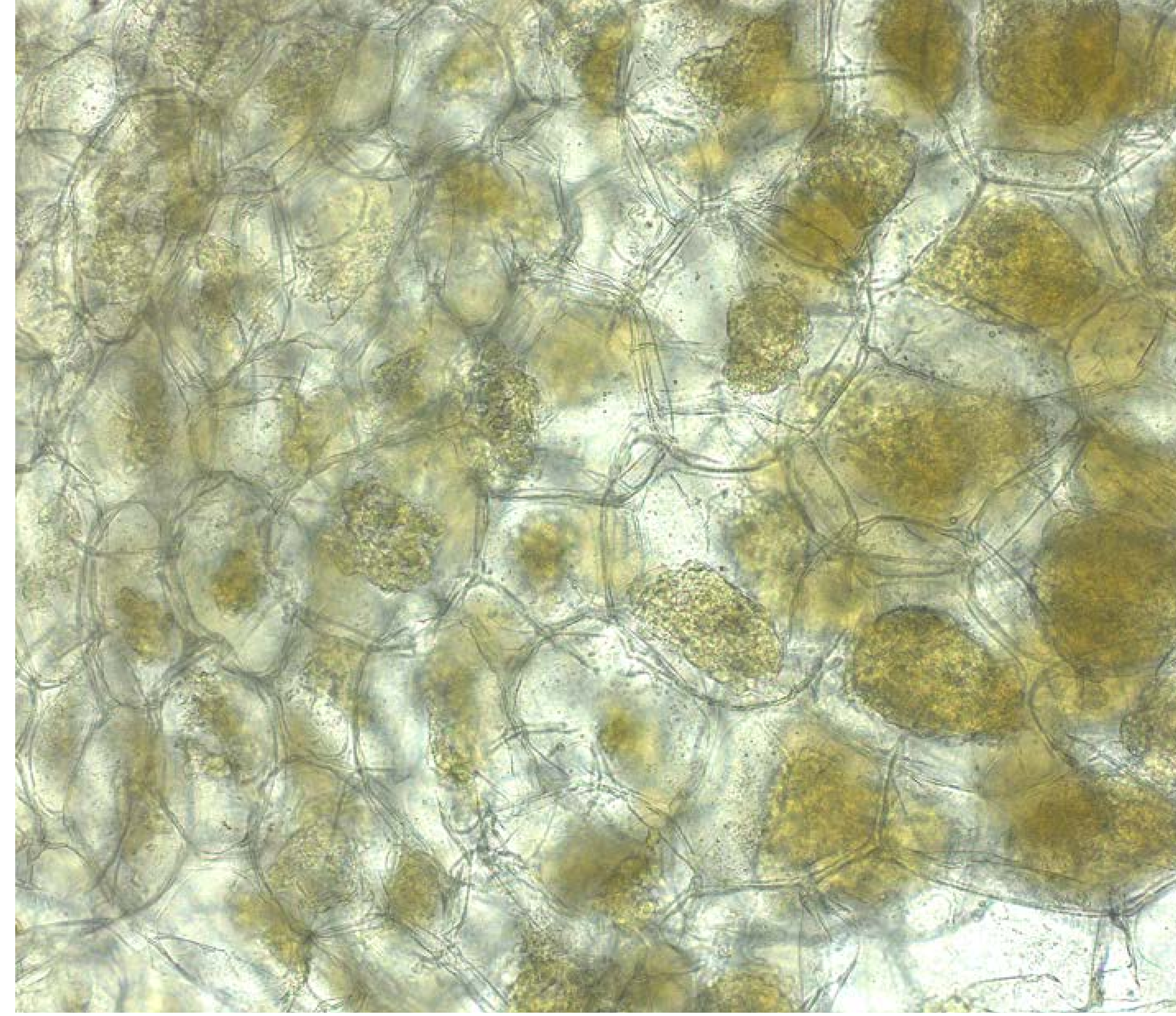
Hawaiian plants, though—some 80-90%—associate with a group of inconspicuous soil-dwelling fungi known as the arbuscular mycorrhizal fungi. These fungi are omnipresent in most ecosystems worldwide but are never obvious: they don't form any structures visible to the naked eye, and they spend their entire lives underground. Despite their cryptic habits, these fungi are common throughout Hawai'i's forests and grasslands and play a vital role in supporting these ecosystems.

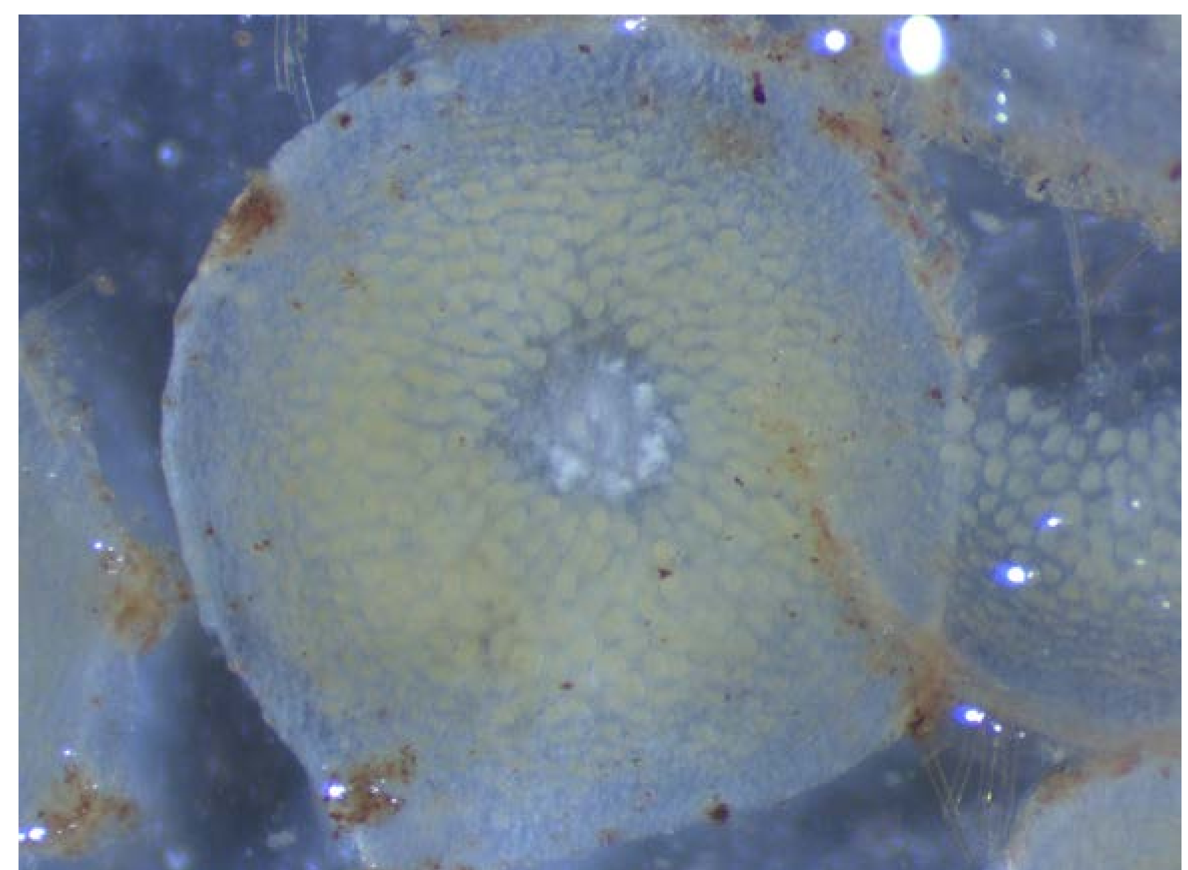
While most plants require mycorrhizal partners to survive in the wild, very few fungal species have adopted the mycorrhizal lifestyle. Many of those that do form mycorrhizas are somewhat picky partners: certain fungal species may form partnerships with only a few plant species. In undisturbed ecosystems, this is rarely a problem for either partner: mycorrhizal fungi form networks of microscopic threads throughout soils underneath intact forests or grasslands, allowing seedlings to easily find potential partners. But when ecosystems are disturbed—by fire, by forest removal, or by plant invasions—things can get more complicated. Just how complicated, though, is something we don't yet know. The Hynson lab at the University of Hawai'i at Mānoa, in collaboration with OANRP, is investigating Hawaiian mycorrhizal communities and their implications for restoring native ecosystems.

Do invasive plants damage communities of native mycorrhizal fungi? It's possible. Invasive plants need mycorrhizal fungi too. All of O'ahu's worst invasive plants (including guava, christmasberry, octopus tree and many more) cannot survive for long without their fungal partners. But if plants and fungi are choosy about their partners, a sea of guava aboveground may conceal a community of fungi below ground that isn't capable of supporting much native plant life. Right now, though, it's hard to say whether this is a real problem: not enough is known about Hawaiian mycorrhizal fungi.

Because they're invisible to the naked eye, and difficult to identify even with a powerful microscope, mycorrhizal fungi are challenging to study. Until 2014, in fact, no Hawaiian ectomycorrhizal fungi had been identified, and the vast majority of the far more common arbuscular mycorrhizal fungi are still unknown. One of the ways the Hynson lab is working to understand the role mycorrhizal fungi play in restoration is by identifying the mycorrhizal fungi of native forests, as well as the ones that specialize on invasive aliens. But identifying these fungi requires more than just a field guide. The Hynson lab is pioneering the application of a new DNA-based technology called Illumina DNA sequencing to identify the mycorrhizal fungi of Hawai'i.

The Hynson lab has taken soil samples from native forests and highly invaded forests throughout lands where OANRP manages endangered plants. To identify the fungi in these soils, they extract all the DNA from all the microorganisms present in the soil. From this pool of soil microorganism DNA, using molecular techniques they then select just the DNA from arbuscular mycorrhizal fungi. The lab can even specify what portion of the arbuscular mycorrhizal fungal genome they want to select: they focus on a region that is highly variable between species, but doesn't vary much between individuals of a single species. This region acts like a fingerprint, but a fingerprint for an entire fungal species. Illumina DNA sequencing then allows them to read these species' fingerprints from every arbuscular mycorrhizal fungus in the soils, simultaneously, providing literally millions of individual





One mycorrhizal fungus plays a major internal role in the root system of the endemic Hawaiian orchid, *Anoectochilus sandvicensis*. LEFT **The cells within *Anoectochilus sandvicensis* roots contain opaque spheres, called pelotons, which are made up of its mycorrhizal fungus.** ABOVE **Higher magnification under a compound light microscope reveals the details of the fungal pelotons within the cells of *Anoectochilus sandvicensis* roots.**
HYNSON LAB

Research on native mycorrhizal fungi may help improve success rates of outplantings such as these endangered hāhā (*Cyanea superba* subsp. *superba*), planted by OANRP staff in Mākaha.

fingerprints. This advanced technology allows the lab to identify all the mycorrhizal fungi that are present in invaded forests and compare them to native forests, in addition to other fungi from around the world.

Identifying fungi in this way is an intensive process, and the Hynson lab hasn't finished sequencing yet. But all indications so far suggest that they will be able to successfully identify the mycorrhizal fungal species that associate with native Hawaiian forests, and whether or not they are unique to these habitats. The next steps will be to cultivate these fungi in the greenhouse to test their potential benefits for native plant restoration.

The lab has yet to determine know how much applying native mycorrhizal fungi will help plant restorations in Hawai'i. But in damaged ecosystems elsewhere in the world, from mine tailings to post-fire grasslands, careful use of mycorrhizal fungi has shown extraordinary promise. By combining advanced molecular technology and ecological knowledge, the Hynson lab hopes to provide a new fungal dimension to OANRP's restoration projects.

Visit the HYNSON LAB WEBSITE to get the latest updates on ecology of plant and fungal communities.

You can also download "New evidence of ectomycorrhizal fungi in the Hawaiian Islands associated with the endemic host Pisonia sandwicensis (Nyctaginaceae)", Jeremy and Nicole's full journal article on the mycorrhizal research on pāpala kēpau.

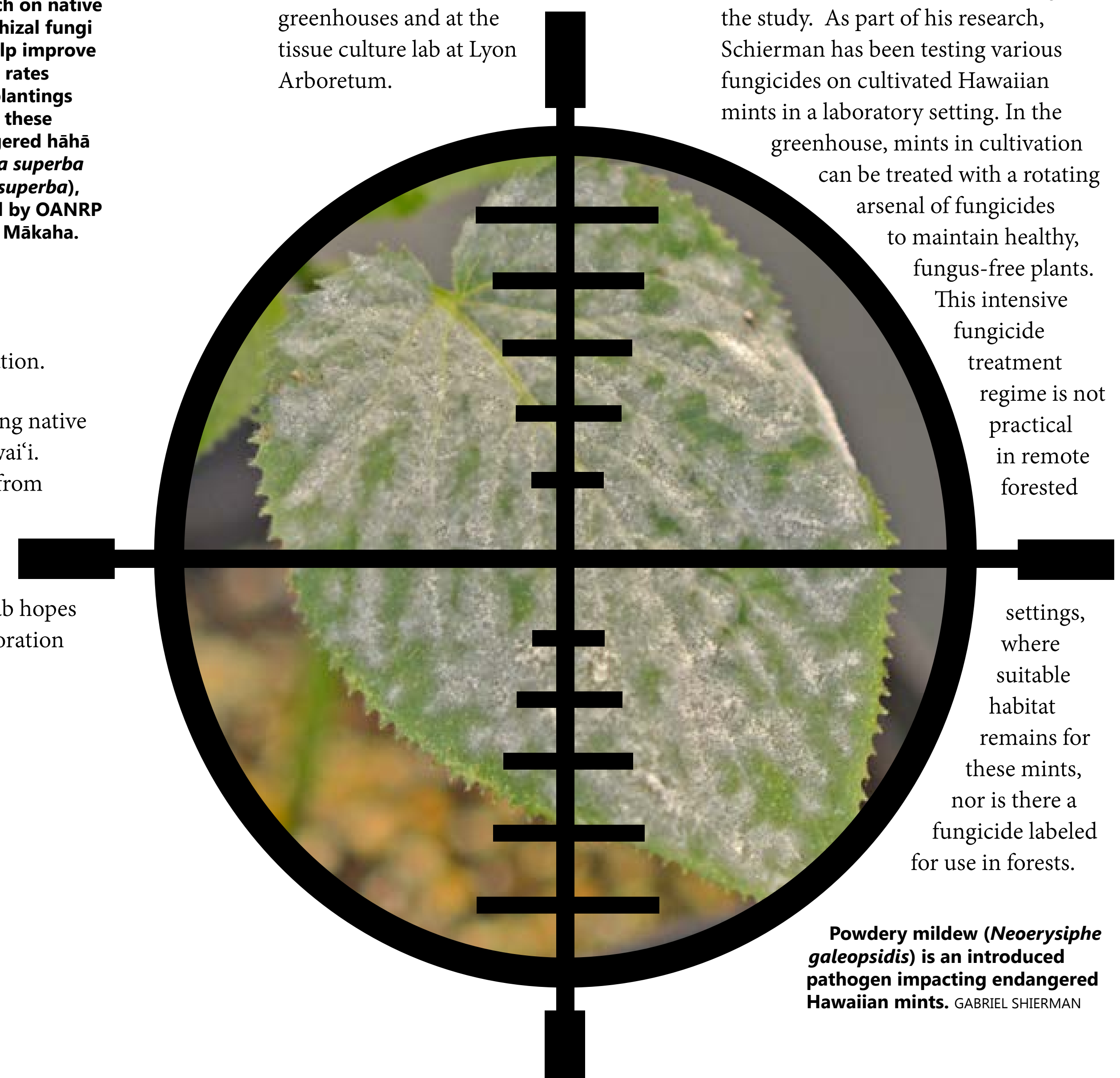
CROSSHAIRS SET ON A POWDERY MILDEW PLAGUING NATIVE MINTS

BY KAPUA KAWELO

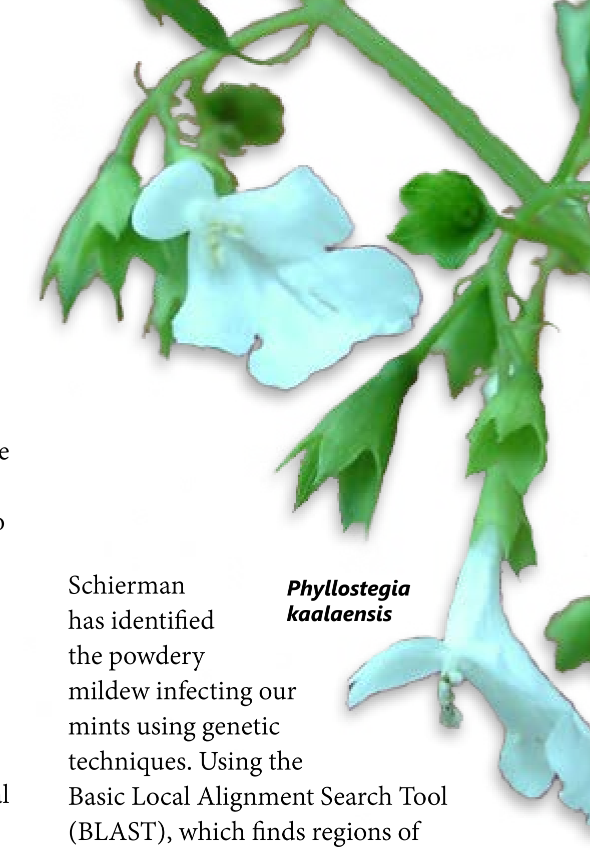
THERE ARE OVER 50 taxa of native Hawaiian mint (Lamiaceae) found across the state of Hawai'i. OANRP works to stabilize four endangered mints, *Phyllostegia kaalaensis*, *P. mollis*, *P. hirsuta* and *Stenogyne kanehoana* in the Wai'anae and Ko'olau Mountains. *P. kaalaensis* and *S. kanehoana* are extinct in the wild; *P. mollis* has one individual remaining; and *P. hirsuta* numbers are down to approximately 50 individuals.

Cuttings from wild individuals of these taxa are maintained in OANRP greenhouses and at the tissue culture lab at Lyon Arboretum. Hawaiian mints are relatively easy to grow at these facilities, but for two of the four taxa, *P. kaalaensis* and *P. mollis*, all attempts to reintroduce these mints into the wild have failed. The reason for this failure is a powdery mildew fungus.

OANRP has provided funding for the research of this pathogen, and Gabriel Schierman, a Master's candidate from Dr. Janice Uchida's lab in the Department of Plant and Environmental Protection Sciences at the University of Hawai'i at Mānoa, is conducting the study. As part of his research, Schierman has been testing various fungicides on cultivated Hawaiian mints in a laboratory setting. In the greenhouse, mints in cultivation can be treated with a rotating arsenal of fungicides to maintain healthy, fungus-free plants. This intensive fungicide treatment regime is not practical in remote forested settings, where suitable habitat remains for these mints, nor is there a fungicide labeled for use in forests.



Powdery mildew (*Neoerysiphe galeopsidis*) is an introduced pathogen impacting endangered Hawaiian mints. GABRIEL SHIERMAN



Phyllostegia kaalaensis

Schierman has identified the powdery mildew infecting our mints using genetic techniques. Using the Basic Local Alignment Search Tool (BLAST), which finds regions of similarity between biological sequences, Schierman was able to assign a name to the pathogen in question: *Neoerysiphe galeopsidis*. He describes it in a report to OANRP:

"A strong band indicated amplification, and the sequence was then 'BLASTed' against the National Center for Biotechnology Information database, which strongly matched (98%) *Neoerysiphe galeopsidis*. This powdery mildew is recorded on [plants]... in the Lamiaceae family."

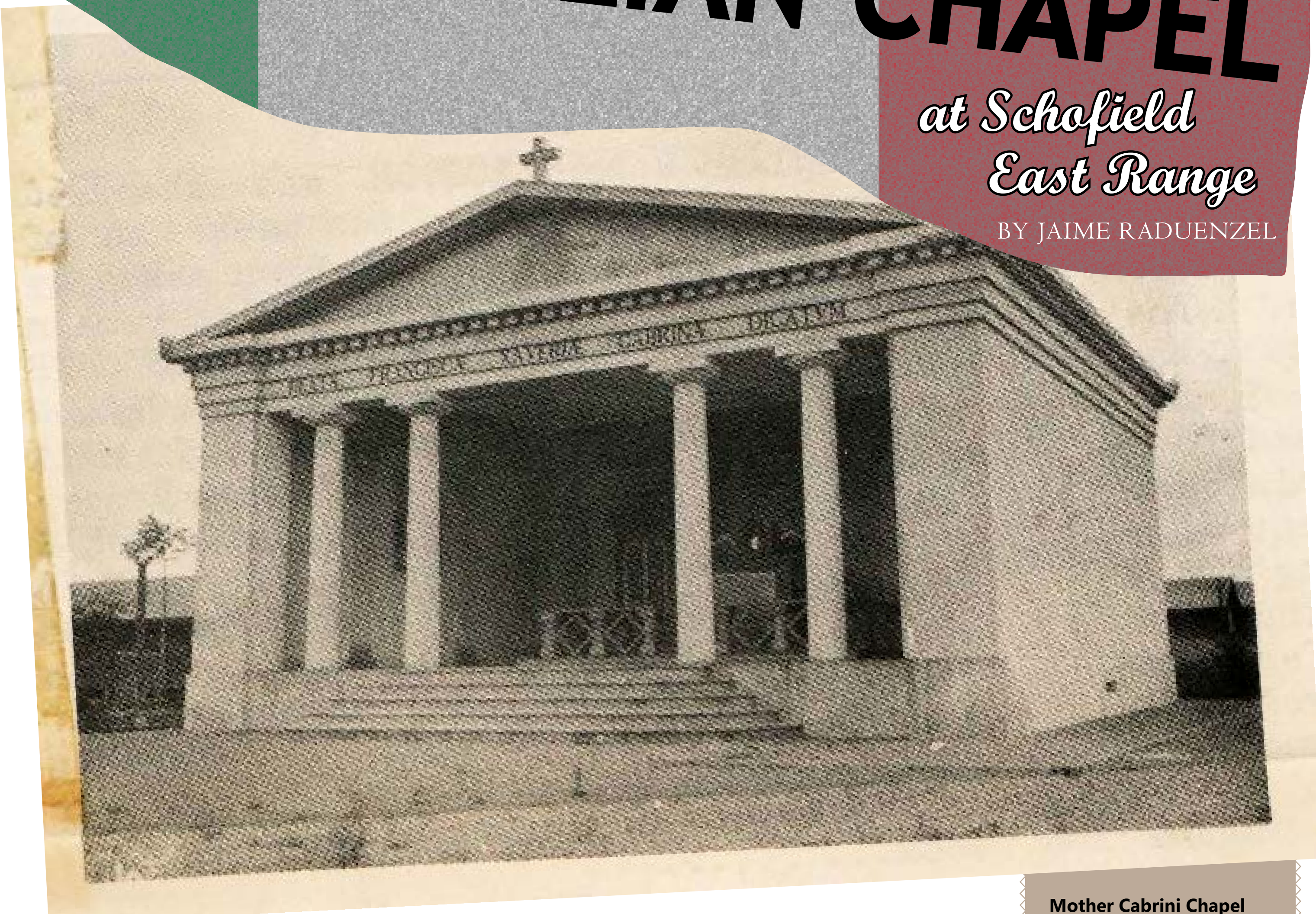
Now that its identity is known, OANRP can put the crosshairs on this pest to overcome reintroduction challenges. There will be more to come on the results of this research as it progresses.

We know that *N. galeopsidis* is a known pest of plants in the mint family, and it is likely that this pest arrived on ornamental shipments of mints brought to Hawai'i for landscaping. This risk reinforces the importance of screening and inspections at our ports. We can all play a role in keeping new pathogens from entering our fragile archipelago if we opt to choose native plants in our landscaping designs.

CULTURAL RESOURCES PROGRAM RESEARCHES

WWII POW CAMP & ITALIAN CHAPEL at Schofield East Range

BY JAIME RADUENZEL



Mother Cabrini Chapel
SIGNAL CORP PHOTO, JULY 1946

IN A SHROUDED LOCATION hidden with vegetation, are the ruins of a World War II Prisoner of War (POW) camp at Schofield Barracks' East Range. Remnants of the razed buildings, undated plans of the camp, deeply buried archival records and newspaper articles from more than 20 years ago are the only sources of information about this camp and the thousands of Italian men imprisoned here. The O'ahu Army Cultural Resources Program (OACRP) has been busy researching the POW camp and a chapel built by its Italian prisoners.

Between July and September 1944, the U.S. War Department transferred 5,000 Italian POWs from the continental U.S. to Hawai'i to provide much needed manpower to support the war efforts. They were the largest ethnic group of POWs to arrive in Hawai'i. Many of the Italian POWs were imprisoned at the Schofield East Range Camp, which was also known as "Compound 1." Smaller numbers of Italian prisoners were held at Sand Island, Fort Hase in Kāne'ohe, Kalihi and Honouliuli. At least 13 POW compounds operated in Hawai'i during World War II. The precise location of some camps remains unknown.

The Schofield East Range Camp was located on the outskirts of Wahiawā, opposite Kawamura Gate at Wheeler Army Airfield, near the current location of the DPW Natural Resources Facility at East Range. Double barbed wire fences, guard towers and flood lights were added to an existing battalion camp known as "Troop Area HH" to create the POW camp. The location was chosen in part because the reservoir adjoining the site would provide some natural protection against the escape of prisoners. A work order from the War Manpower Commission notes that the East Range site is closest to the Main Post, and troops can be marched or transported to work areas on the Post. Four other POW camps were authorized on O'ahu on the same date as the East Range camp.

Some prisoners at the East Range compound worked the post laundry, which was inside the fenced and guarded camp. Two undated plans from the OACRP's Map and Plan Collection (archive of Army engineering plans and historic maps gathered from around the installation) titled "Laundry and Prisoners Camp" depict the location of the laundry in the northwest corner of the camp. The camp had a capacity of 3,000 men. The exact number of POWs at the Schofield East Range Camp fluctuated, but at least 2,390 Italians were in custody there in February 1946, around the time Italian prisoners were being repatriated.

WHO WERE THESE ITALIAN PRISONERS, AND WHY WERE THEY SHIPPED TO HAWAI'I?

The Italian prisoners were captured by the British in North Africa in 1943 and shipped to the continental U.S. Most of the prisoners passed through more than one mainland camp before transfer to Hawai'i.

The status of Italian soldiers changed when Italy surrendered and declared war on Germany in October 1943. Italy's new

HAWAI'I'S PLANTATION VILLAGE

POW ARCHAEOLOGY

The field of POW archaeology has been growing. The Department of Defense (DOD) completed a nationwide inventory of former WWII POW camps on current DOD installations in 2007. The study, however, did not include Hawai'i. The discovery and research of the Honouliuli POW and Internee Camp turned attention to WWII prisoner compounds in Hawai'i, particularly the internment of Japanese Americans. The former camp at Honouliuli (ABOVE) **was listed on the National Register of Historic Places in 2012. President Obama recently designated the site as a national monument, permanently protecting it under management by the National Park Service. Researchers at Honouliuli published *Breaking the Silence, Lessons of Democracy and Social Justice from the WWII Honouliuli Internment and POW Camp*. The book was a valuable tool for OACRP staff and pointed to several archival sources to research the East Range camp.**

BACKGROUND **Italian fascists hold a funeral at Compound 2 in Kalihi, another camp where many Italian POWs were held during the war.**

Schofield Barracks' East Range ITALIAN POW CAMP

Sean Newsome, Cultural Resources Technician with OACRP, found fluted columns from the chapel in July 2014.

leader stated that all POWs should help the Allied cause. The U.S. Government established Italian Service Units (ISU) in March 1944 to maximize this new source of labor. Men who joined the ISU were reassigned to war-related industries. In exchange, they earned the status of "collaborators," received a portion of their monthly pay in cash, were given better food and had the opportunity to participate in off-post social activities under escort. Nearly 35,000 of approximately 50,000 Italian POWs in the U.S. signed up to join ISU. The Italians sent to Schofield's East Range were pro-fascists who refused to recognize the new Italian government and declined joining the ISU. Some of them considered the move to Hawai'i to be punishment for declining to join ISU.

Mario Benelli, a former POW, explained, "We were young and wanted to stay loyal to Italy, but we didn't know what was happening back in our own country."

PHOTOS AND IMAGE WITH PLAN OVERLAY BY OACRP

OACRP staff cleared and flagged this latrine foundation, one of many found in August 2014.

OACRP staff discovered a portion of a fountain, likely built by Italian POWs and possibly associated with the chapel.

The creation of ISU caused most Italian POWs, whether they joined or not, to be moved to new camps. Men were transferred and consolidated based on where ISU could provide the most help to the Army. The War Department considered forming ISU in Hawai'i until a policy was adopted to employ ISU only in operations against Germany. Following the policy, only non-cooperative Italian fascists were sent to Hawai'i.

WORK OUTSIDE AND INSIDE THE EAST RANGE COMPOUND

As the war continued, a gross manpower shortage resulted from the deployment of men and the increased production needed to support the war effort. The demand for workers in Honolulu was eight times the number of job applicants. Service facilities such as transportation, construction, repair shops, laundries, restaurants and hospitals were especially in dire need of help. The Schofield East Range Laundry operated two 8-hour shifts due to the inability to hire sufficient civilian labor to run 24 hours a day. Records at the Tropic Lightning Museum indicate plans to assign 1,400 Italian POWs to the Schofield East Range Laundry upon their arrival in Hawai'i. They worked alongside civilians and communicated in broken English and hand signals.

Italian prisoners also worked outside the camp in construction, agriculture, landscaping and reforestation. Work outside the camp provided an opportunity to gather materials for their own construction project inside the East Range compound. The Italians were building their own chapel. According to one former POW, men snuck pieces of concrete and stone into their pockets before returning to camp. They also stockpiled excess construction materials until they finally had sufficient supply to complete the chapel. Once complete, the chapel was dedicated to Blessed Mother Francis Xavier Cabrini, an Italian-born nun who was the first U.S. citizen to be canonized as a Saint.

The Romanesque chapel had fluted columns and was described as gleaming white amid the drab prisoner barracks and green pineapple fields.

A visitor named Larry Ponza recalled, "The chapel was a very beautiful and imposing structure, with a beautiful altar and decorated with two large magnificent oil paintings of Mother Cabrini, painted by the prisoners themselves. The chapel had a full basement for vestments and religious articles … Sunday morning mass at the Mother Cabrini Chapel was celebrated every week until the camp was shut down and the prisoners were returned to Italy."

THE FATE OF MOTHER CABRINI CHAPEL

Much of what OACRP learned about Mother Cabrini Chapel came from multiple newspaper articles about a visit in 1993 by eight prisoners of the East Range POW camp. The former prisoners visited O'ahu from Italy to "take a sentimental journey to relive old memories." Their primary interest was to see the Mother Cabrini Chapel and the "grown men cried like babies" when they heard it had been destroyed. Many intended participants decided not to make the trip.

Renato Astori, who designed and supervised the construction of the chapel, heard the news of the chapel's destruction and responded that he thought there was more. He said he had placed an Italian flag in a secret space between two walls in the basement of the chapel. "That flag is still there," Astori commented. The flag was not the only treasure tucked away in the basement. A note signed by the chapel's five primary builders was placed in one of the pillars.

It's unknown exactly why the chapel was abandoned and destroyed. OACRP staff contacted the Catholic Diocese of Honolulu and inquired about Mother Cabrini Chapel. The editor of the Hawai'i Catholic Herald, a newspaper of the Diocese of Honolulu, responded almost immediately and provided three issues about the chapel's public dedication July 7, 1946. The chapel was opened to the public as a permanent place of worship and described as a treasured shrine among the Catholic people of O'ahu. The public opening coincided with the canonization of Maria Francesca Cabrini by Pope Pius XII in Rome. The Bishop of Honolulu gave the sermon, and two brigadier generals, including the commander of Schofield Barracks, attended the mass. A reception was held on the chapel's grounds followed by a lunch at the Schofield Officer's Club. The ceremonies were also broadcast by radio station KGU. Mother Cabrini Chapel was clearly of interest to the military and religious community in 1946.

Anthony Casciano and Torie Robinson, cultural resource technicians with OACRP, map an unknown structure at the Italian POW compound at Schofield Barracks' East Range. PHOTO BY OACRP

OACRP FIELD WORK AND FINDINGS

The OACRP team was determined to find the original location of Mother Cabrini Chapel. Accounts of the chapel's specific location and its demolition varied. A search for aerial photos from 1944 and the following years eventually led to answers.

OACRP archaeologist Sean Newsome discovered remnants of Mother Cabrini Chapel, including three fluted columns, during a quick reconnaissance survey. The find was enough to justify surveying and mapping the remains of the camp. Did the presence of the ruins mean the demolished chapel could still be found? Could the basement still be intact?

In 1945, Italian POWs contributed 8,996 man-days of work to reforestation and planted 42,406 trees on O'ahu.

None of the original buildings at the East Range camp still stand, but many signs of its existence remain visible. OACRP archaeologists used basic equipment, such as GPS units, tape measurers and digital cameras to record the site. Former structures and infrastructure were identified by comparing GPS points with construction plans archived in the OACRP Map and Plan Collection. Archaeologists found 31 features and identified the foundations of a mess hall, five latrines and a guard tower. Features associated with water and plumbing appear to be intact. Pathways and roads can still be seen in portions of the camp. Further investigation would likely lead to the discovery of artifacts associated with the prisoners, their guards and daily life.

Hopes that the pillars might be at or near the original location of the chapel were dashed when OACRP staff gathered aerial photos of the camp's location from 1948 and 1951. In the 1948 photo, the chapel is intact. By 1951, the chapel appears to be a pile of rubble. OACRP staff layered (georeferenced) the construction plans, the 1951 aerial and a 2010 aerial from Google Earth showing the H-2 off ramp. When the 1951 aerial is layered with the 2010 aerial, the pile of rubble is very nearly under the H-2 off ramp. The OACRP concluded that the chapel was razed sometime between 1948 and 1951 and the highway was built on top of the site in 1976. The pillars and associated features were pushed or hauled to their current location.

WHAT NEXT?

While researching the little-known story of Italian POWs at Schofield East Range, OACRP staff found that there is much more information to gather from various archives. The former POW compound has excellent potential for public education and establishing partnerships. By sharing knowledge with the public and working with community and researchers, we can learn more about Hawai'i's role in WWII, the lives of prisoners, issues of nationalism, human relations and the impact of war.

RIGHT **A 1948 aerial photo of the POW camp remnants shows Mother Cabrini chapel intact (circled in red). Three years later, it appeared to be a pile of rubble.** BELOW **Today, the camp stretches across the area below H-2. The location where the chapel would have stood today is circled in red (Google Earth aerial, 2010).**
IMAGE AND PHOTO BY OACRP

Root into your community

HO'OA'A

VOLUNTEER OPPORTUNITIES

JULY

SATURDAY 7/25
Ka'ala

THURSDAY 7/30
Kahanahāiki

AUGUST

THURSDAY 8/5
West Makaleha

THURSDAY 8/13
West Makaleha

THURSDAY 8/20
Puali'i

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OANRP offers volunteer service trips in the forest to help protect endangered plants, animals and habitats.

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ORGANIZE A TRIP

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

ABOUT THE U.S. ARMY GARRISON–HAWAI'I

U.S. Army Garrison-Hawai'i (USAG-HI) is responsible for the day-to-day operations of Army installations and training areas in Hawai'i. The USAG-HI 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.

ABOUT THE USAG-HI DIRECTORATE OF PUBLIC WORKS ENVIRONMENTAL DIVISION

The DPW Environmental Division Office at USAG-HI is comprised of two branches: the Compliance Branch and the Conservation Branch, who 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.

ABOUT THE O'AHU ARMY NATURAL RESOURCES PROGRAM

The O'ahu Army Natural Resources Program is an award-winning Army program dedicated to natural resources protection and conservation. The program supports the Army's training mission by protecting the biological resources found on O'ahu Army installations and training areas. To minimize the impacts of military training on some of O'ahu's rarest plants and animals and their habitat, the U.S. Army Garrison-Hawai'i partners with the University of Hawai'i at Manoa Pacific Cooperative Studies Unit (PCSU) to protect more than 80 threatened and endangered species. PCSU employs over 60 staff through the Research Corporation of the University of Hawai'i to accomplish natural resource work for the Army throughout the island of O'ahu.

ABOUT THE O'AHU ARMY CULTURAL RESOURCES PROGRAM

The U.S. Army's O'ahu Cultural Resources Program is charged with identifying and managing cultural resources on Hawai'i's Army installations and training areas. The program consists of a dedicated team of government and contracted archaeologists and cultural resources professionals. Together they manage and protect more than 1,000 archaeological sites on O'ahu, as well as more than 800 historic buildings and structures within two National Historic Landmark Districts and five Historic Districts.