ECOSYSTEM

MANAGEMENT PROGRAM BULLETIN

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in cooperation with the U.S. Army Garrison Hawai'i, Directorate of Public Works, Environmental Division

Hālapepe (*Chrysodracon hālapepe*) is host to *Drosophila obatai*.

FROM THE EDITORS

When you think about iconic Hawaiian fauna, does a fruit fly come to mind? What about a beetle? A spider? Arthropods are the largest group of animals on planet earth, yet they often seem to be the least mentioned. These minute members of the animal kingdom play major roles in ecological communities. With over 94% of Hawai'i's 6,000+ arthropods found nowhere else in the world, we are only beginning to appreciate their significance in our unique island ecosystems. In fact, entirely new insect species are still being discovered.

Some of these discoveries are discouraging, like the invasive coconut rhinoceros beetle (*Oryctes rhinoceros*) and little fire ant (*Wasmannia auropunctata*), recently detected on O'ahu for the first time. Natural resource managers are forced to contend with the challenges these new pests present—on top of the ones they're already facing. Other finds, however, are signs of hope, such as observing *Drosophila neogrimshawi* for the first time since 1972—and in the Wai'anae mountains since 1916!

Small creatures are celebrated in this issue. Arthropod enthusiasts, we know your mouths are already watering. The rest of you may be a bit apprehensive. Wherever you fall, we're sure that you'll appreciate the incredible amount of effort put forth by conservation professionals who have dedicated their lives to studying these fascinating critters. Maintaining an avid curiosity, they bring unparalleled expertise to the table and are slowly closing the gap between the micro- and macro-world, expanding and enhancing our current body of knowledge. We can only look forward to what they'll find next.

Kimberly Welch & Celeste Hanley,
Editors

ON THE COVER ***Drosophila neogrimshawi*, notable for its beautiful wing pattern, was recently seen by OANRP entomology specialist Karl Magnacca. It has not been observed in the Wai'anae mountains since 1916. At Ka'ala, *D. neogrimshawi* lives on the very steep slopes and gulches below the summit bog where there are stands of *Clermontia* sp., its host plant.**

CONTRIBUTORS

KARL MAGNACCA

"Insects are the biggest part of what makes Hawai'i unique in the world. Preserving them keeps Hawai'i from becoming like everywhere else."

Dr. Karl Magnacca has been studying the evolution, ecology, and systematics of native Hawaiian insects for 20 years, working with the U.S. Geological Survey, National Park Service, and the University of Hawai'i–Hilo. He has described 64 new species, about 1% of the endemic insect fauna. His gallery of over 7,000 photos of Hawaiian plants and insects can be found on Flickr at HTTPS://WWW.FLICKR.COM/PHOTOS/53189052@N08/SETS.

Karl is an entomology specialist with the Pacific Cooperative Studies Unit working for the O'ahu Army Natural Resources Program.

PAUL KRUSHELNYCKY

"Partnering researchers with land managers is key to advancing Hawaiian insect conservation."

Dr. Paul Krushelnycky has been conducting conservation research in Hawai'i for over 20 years, working with U.S. Geological Survey, U.S. Department of Agriculture and currently the University of Hawai'i. Most of his career has focused on native and invasive insect ecology, but other interests include insect-plant interactions and plant ecology.

Paul is an assistant researcher with the College of Tropical Agriculture and Human Resources at the University of Hawai'i at Mānoa.

STEPHANIE JOE

"We have to engage people, bring them in and make them part of the solution for little fire ant and coconut rhinoceros beetle. With pests like these, you can't nickel and dime a response; you have to commit money and resources over the long term."

Stephanie Joe has been working with insect pests since 1995 when she joined the Haleakalā National Park Argentine ant field crew. She has been with OANRP since 2006 after getting a Master's degree in Botany. She is always interested in any insects you might find. If you have questions about an insect pest, you can email her at SJOE@HAWAII.ED

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

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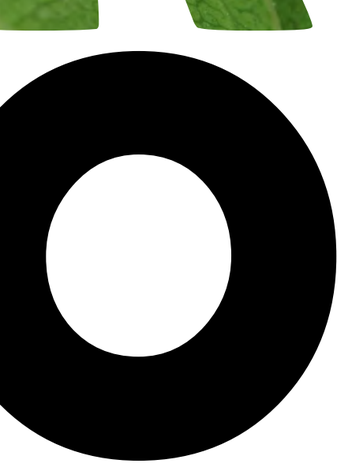
THE ECOSYSTEM MANAGEMENT PROGRAM BULLETIN (EMP)

The EMP highlights the U.S. Army's Garrison Hawai'i's innovative approaches to natural and cultural resource management. 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. Special thanks to OANRP entomology specialist Karl Magnacca for providing the majority of photos in this issue.

DROSOPHILA



BY KARL MAGNACCA

Far back in the deep gulches of the Waiʻanae range, some of the rarest animals in Hawaiʻi survive in pockets of native forest. The picture-winged pomace flies, *Drosophila*, live quietly in the shaded valleys, almost always unseen—only by tempting them out with fermented bananas and mushrooms can they be observed and counted. They are the product of 25 million years of evolution in the Hawaiian Islands, and hopefully the progenitors of millions more.

Conservation of insects has been late in coming to Hawaiʻi, and long overdue. With over 6,000 endemic species, including hundreds that are still undescribed, our native insect diversity dwarfs that of better known groups. Preserved remains from caves show insects have suffered the same kind of mass extinction and range contraction as forest birds. *Drosophila* is the largest Hawaiian insect radiation, with an estimated 800-1,000 species—equal to or greater than the total number of endemic flowering plants or land snails—and three other groups have evolved over 300 species each, all from single colonizers. The 120 species in the charismatic picture-wing group of *Drosophila* include some of the largest and most colorful *Drosophila* in the world, dwarfing the laboratory genetics workhorse *D. melanogaster*.

All of the Hawaiian picture-wing flies breed in dead or dying native trees, where the larvae burrow into the mushy bark as it rots to feed on bacteria and yeasts. Though often overlooked, saprophages (consumers of decaying material) like these play an important role in maintaining the balance of microbes and ultimately in the conversion of dead plant matter into organic soil. Each species is particular to only one or two species of host plants—a habit that has contributed to both their astonishing diversity and their current rarity, as many host plants have declined. Since they require a steady supply of mature trees that may die or have large branches broken off by other treefalls, maintaining a healthy forest with adequate numbers of all size classes is essential to their survival.

SOME OF THE SMALLEST LIVING MEMBERS OF OUR ARCHIPELAGO ARE AMONG THE MOST DIVERSE.

ABOVE **Female *Drosophila montgomeryi* insert clusters of eggs under the bark of rotting ōpuhe (*Urera glabra* and *U. kaalae*) branches.** RIGHT **After the larvae hatch, they tunnel through the soft inner bark (cambium), filtering out yeasts and other microorganisms.**

As the diverse moist forests of the Waiʻanae range have contracted from hundreds of years of direct and indirect human impacts, including clearing for agriculture, fire, and the effects of introduced animals such as rats, goats, pigs, and ants, the native insects have retreated with them. Today, most of the native *Drosophila* are restricted to small patches of native-dominated forest in areas that are largely alien vegetation. Despite being one of the smaller islands, Oʻahu has the second-highest number of picture-wing *Drosophila* species with 33 (Maui has the most with 39). Six of the Oʻahu species are federally listed as endangered (along with eight from other islands), and many more are equally rare. Three of the endangered species—*D. montgomeryi*, *D. obatai*, and *D. substenoptera*—live on Schofield Barracks above the live-fire training areas.

Since they are now confined to smaller and smaller sites, the flies are vulnerable to random natural or human-caused disturbances, such as fires, landslides, drought, and flooding. A single event can wipe out even what might be considered a thriving population of flies, particularly if the flies are confined to a small grove of trees in a single gulch. The potential for new invasive species to arrive always lurks in the background as well. The introduction of the western yellow jacket in 1978, a voracious and abundant general predator, has impacted *Drosophila* on Maui and Hawaiʻi island in

***Drosophila kinoole*, one of the picture-wing species, had only been known from a single specimen reared from rotting bark in 1971. It was rediscovered this year in Waiʻanae Kai Forest Reserve.**

In the spring of 2014, multiple boulders from an eroding ridge crashed through one of the best sites for *Drosophila montgomeryi*, smashing several large ōpuhe (*Urera glabra*) trees, its breeding host. While this provides short-term breeding habitat for the flies, the small amount of space available for them means that even natural events like this can put populations at risk of local extinction.

particular. Less conspicuous insects can have just as great an impact—an alien crane fly, still unidentified, that arrived in the late 1990s and feeds in the same decaying bark has dramatically reduced the number of native *Drosophila* breeding in many wet forest trees.

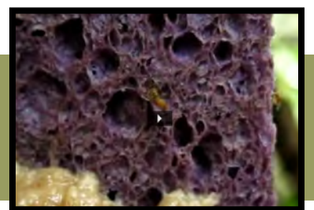
A lack of information is one of our biggest impediments. Until OANRP began managing endangered *Drosophila* two years ago, relatively few surveys or collections had been done since the early 1970s. Secretive creatures, the flies are much harder to monitor than plants or birds, since their numbers may fluctuate wildly through the year and the degree to which they are attracted to baits also varies. However, in a year and a half of intensive surveys with OANRP, we have discovered 11 new populations of the endangered species in our management units and rediscovered seven species that had not been seen in over 40 years. A new species was even found in the Koʻolau range, the first picture-wing *Drosophila* from Oʻahu (and only the sixth statewide) to be newly discovered since 1973.

It is encouraging to find the flies surviving better than expected, but many challenges lie ahead as we move from surveys to active management. Insect conservation in Hawaiʻi has mainly been directed at simply protecting habitat, such as caves or a specific host plant, and efforts elsewhere aimed at organisms such as butterflies and beetles are largely inapplicable to the unique situation of Hawaiʻi. Successful management of our *Drosophila* will require different methods for expanding the area of habitat available, including control of invasive plants,

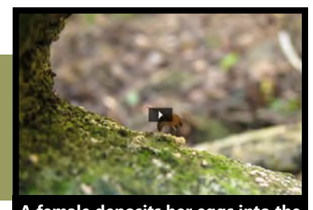
CHECK IT OUT ONLINE

Click the images to the right to watch video clips of *Drosophila montgomeryi* in action.

You can view more *Drosophila* videos and photos on Karl's Flickr photostream, HAWAIIAN BIOTA.



Two males compete for a mate.



A female deposits her eggs into the bark of an ōpuhe (*Urera* sp.).

Drosophila obatai (ABOVE) **breeds in rotting branches of halapepe (*Chrysodracon halapepe*** (BELOW) **and *C. forbesii*** (LEFT)**), the larvae feeding on yeasts in the decaying bark. This tree is slow-growing and long-lived, so it persists in disturbed areas. However, there are few seedlings in areas where pigs occur. In areas where OANRP has excluded pigs by building fences, such as the upper portion of Schofield Barracks West Range and Mākua, seedlings are starting to appear again.**

outplanting both host plants and others that provide a sustainable forest environment, and possibly releasing lab-reared flies at sites where they have been extirpated. As with any conservation program, the goal for restoration areas is to establish self-sustaining ecosystems with reproducing populations of both host plants and flies that will be able to maintain themselves in the long term. By ensuring they survive, we can perpetuate Hawaiʻi's natural history and continue their evolutionary legacy.

Tracking Arthropod Abundance:

A pathway to endangered species recovery

BY PAUL KRUSHELNYCKY

Jessica Hawkins, Natural Resources Management Technician with OANRP, gets ready to use an aspirator, one of the many "bugging" tools that come in handy when surveying arthopod communities in the forest.

A native carnivorous caterpillar, (*Eupithecia orichloris*) feeds on an introduced pomace fly (*Drosophila simulans*) at Palikea. These caterpillars have increased in abundance in rat-trapped areas at both Kahanahāiki and Palikea.

OANRP Senior Natural Rescource Manager Joby Rohrer discovers a fresh catch. Long-term arthropod surveys, combined with large-scale trapping efforts, help managers understand the effects predator suppression may have on native insects and the greater forest ecosystem.

FAMILIAR WITH THE DEMANDS of night work in the forest, staff from OANRP and the University of Hawai'i's College of Tropical Agriculture and Human Resources (CTAHR) perform a routine gear check at the trailhead in the southern Waiʻanae mountains. The team confirms that all the essentials are packed before heading out: sweep nets, beating sheets, aspirators, ethanol, vials and headlamps, as well as dinner and snacks for the night ahead. It's a typical start to the latest 'bugging trip,' a series of collecting efforts aimed at understanding how intensive rodent trapping grids at Palikea and Kahanahāiki may be affecting insect communities in the forest.

Since 2009, researchers from CTAHR have been leading a project that is tracking trends in insect populations over time, from before the rodent trapping began at the two sites, to up to four years afterwards. Insects are not often a focus of conservation monitoring, which makes this collaborative effort a bit unusual. But the relative neglect of insects has more to do with the challenges of studying them, rather than their insignificance. In fact, insects are an integral part of native ecosystems, as important as the plants and birds that typically get most of the attention. Insects and their relatives make up the majority of the native Hawaiian biodiversity and thus deserve protection in their own right. But they also play important ecological roles, so understanding how to keep their populations healthy will also benefit the other members of their biological communities, including threatened and endangered species.

A problem conservationists face is not always knowing what the most important management actions are for conserving native insects, especially when you're talking about large numbers of species that make up insect communities, as opposed to focal species or groups that may have more specific needs and limiting factors. That is what makes projects such as this one so useful. It takes advantage of a particular management action, rodent trapping, conducted over sizable parcels of valuable habitat, to assess what effect suppressing these invasive

mammals may have on a wide range of insects. Rats and mice have long been known to consume insects, and fragments of rare native insects have been found in rat stomach contents taken from lands managed by OANRP. However, it is still unclear how much this predation is impacting insect populations. By sampling insects before and after the rodent trapping was implemented and comparing with trends in adjacent areas where trapping has not been conducted, CTAHR and OANRP hope to gain insight into this question.

***Laupala* cricket (*Laupala* sp.)**

Unfortunately, the question is not an easy one to answer. Because rodents and many insect species are nocturnal, night sampling must be combined with daytime sampling. In addition, staff conduct ground-based pitfall and leaf litter sampling to get a comprehensive picture of the insect community and how rodents may be affecting it. Navigating forest plots and sampling insects at night can be difficult, but it can also be the most interesting and exciting part of the trip. Many of Hawai'i's most charismatic insects only show themselves at night, including predatory *Blackburnia* carabid beetles, large leaf-chewing *Rhynchogonus* weevils, and some of the largest native spiders, such the orb-weaving *Araneus* species and the giant sheet-web weaver *Orsonwelles*. What follows each monitoring event is the truly tough part: months of sorting and identifying thousands of specimens in the lab.

The results of this project are not fully complete, but a picture is emerging. Monitoring at the Palikea site has been most intensive, and after two years of rodent trapping it appears that wide-ranging changes to the insect community have not occurred. For example, changes in total community biomass and diversity have been small. Similarly, shifts in trophic structure—the proportion of predators vs. herbivores vs. detritivores—have taken place, but have been relatively minor in magnitude. Instead, it appears that certain taxonomic groups have responded while many have not. This is perhaps not too surprising, as rodent eradication campaigns in places like New Zealand have also often resulted in recovery of select groups of insects, particularly

Native Orthoptera like this cone-headed katydid (*Banza nitida*) (BACKGROUND) and the *Laupala* cricket (*Laupala* sp.) (INSET) and have shown the most consistent positive response to rodent trapping.

large-bodied species like beetles, grasshoppers and katydids. Comparison of results between the northern (Kahanahāiki) and southern (Palikea) Waiʻanae sites suggests that different groups may respond to rodent trapping at different sites. For example, spiders and caterpillars appear to have rebounded at Kahanahāiki after trapping began, but at Palikea spiders and caterpillars have shown a tendency to decline while true bugs (Hemiptera) have increased in abundance. Such site-specific differences may be related in part to differential responses to rodent trapping by birds. Birds prey on insects as well, and changes in bird abundance are known to have strong impacts on insect communities.

One commonality between the Kahanahāiki and Palikea sites represents the most consistent result measured in the study so far, namely the increase in native crickets and katydids after rodent trapping was implemented. This response was strongest among native *Laupala* crickets, but the large native *Banza* katydids are also showing a tendency towards increase, especially at three years after trapping began. This result matches findings outside Hawaiʻi, including examples of population rebound in New Zealand's giant weta (relatives of crickets and katydids) following rodent eradication. Recovery by Hawaiʻi's singing crickets and katydids is a welcome change to all, with the possible exception of light sleepers!

Insects may provide a critical link between plant restoration and bird recovery efforts.

The project has also yielded other insightful information about insect communities and their potential ecological importance in Oʻahu forests. For example, over 570 taxa have been identified from the two sites, providing valuable data on native and introduced insect biodiversity in the Waiʻanae mountains. In addition, sampling at Palikea has revealed that native insect diversity and abundance increases strongly as forest plots support a higher cover of native plants. As a result, insects regarded as prey by endangered Oʻahu ʻelepaio (*Chasiempis ibidis*) birds are estimated to be two to four times more abundant in plots dominated by native plants as compared to plots dominated by alien plants. Insects may therefore provide a critical link between plant restoration efforts and bird recovery efforts. Weeding and outplanting should increase native insect diversity and abundance, which should in turn benefit native forest birds and provide other ecosystem services. By including insects in the equation, OANRP is employing a more holistic approach to ecosystem management and endangered species recovery.

Another component of the arthropod surveys involves curating numerous insect specimens from Palikea and Kahanahāiki. PAUL KRUSHELNYCKY

Biosecurity Strategies on Schofield

BY STEPHANIE JOE

Within the last year, two new insect pests, the coconut rhinoceros beetle (*Oryctes rhinoceros*) (CRB) and the little fire ant (*Wasmannia auropunctata*) (LFA) have arrived and spread on Oʻahu. Both are major pests that can hurt our native ecosystems, agriculture and affect our households. Thanks to the cooperation between the OANRP and Patrick Ching, an agronomist with DPW, Schofield Barracks remains free of these incipient pests. With continued vigilance and help from the community, it will stay that way.

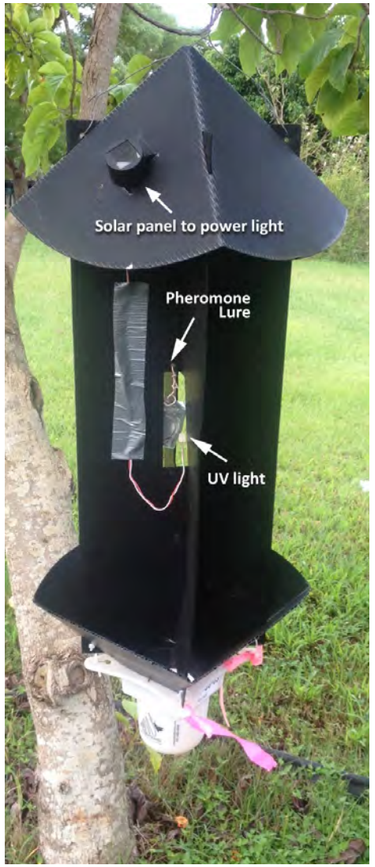
CRB is a chunky black beetle, about two inches long that arrived from Guam. In addition to the impacts it has on coconut palms, CRB also threatens other palms like the endangered loulu (*Pritchardia kaalae*) and crops like banana, kalo, sugarcane and pineapple.

LFA is a miniscule orange ant (just 0.06 inches long!) whose stings can cause blindness in cats and dogs. LFA came to Oʻahu on infested potting material from Hawaiʻi Island.

Identifying Pathways of Possible Invasion

The first step in preventing introduction at Schofield was to identify pathways whereby CRB and LFA may be accidentally brought onto Schofield. The CRB infestation originates at Joint Base Pearl Harbor–Hickam (JBPH) where adult beetles live off the sap of coconut trees and lay their eggs in mulch piles. Thus, CRB can be transported by landscapers moving mulch or dead palm material after tree trimming from one

LEFT **Coconut rhinoceros beetles (*Oryctes rhinoceros*) were first found breeding at Mamala Bay Golf Course, Joint Base Pearl Harbor-Hickam in a large compost pile. The accumulated compost is about 200 yards long and up to four feet deep where the ground slopes down to a stream, making the search for CRB a lengthy process.** ABOVE **CRB also burrow inside the fronds of coconut palms (*Cocos nucifera*), like the two adults pictured above.** INSET **Although other introduced beetles may look similar to CRB, only the CRB is solid black in color. This CRB is trapped in a plastic mesh that was placed over the compost pile to catch emerging adults and reduce the number escaping from the pile.**



place to another. While it is possible for adults to disperse without human aid, the insects are bulky and poor fliers, making moving mulch one of the primary risks for accidentally transporting this pest elsewhere. After compiling a list of plant suppliers and landscapers servicing Schofield and JBPH, the team found only one overlap and contacted the company. They warned about the risk of moving CRB onto Schofield. Fortunately, the company explained that they do not move plant material between bases and that the trucks are cleaned and power-sprayed after each job. The team thoroughly checked the company's vehicles and confirmed this was the case.

In September a few weeks later, a handful of CRB were found at Fort Shafter. The team suspects that these CRB have flown to Fort Shafter from JBPH and are not yet breeding onsite. Since then, the team has instructed landscapers working at the installation to remove and treat their mulch piles.

Preventing Invasion on a Smaller Scale

Like CRB, LFA hitchhikes on plant material, however these tiny ants are much more difficult to detect being only about the size of a pinhead. Sizeable LFA infestations have been found in Mililani and Waimānalo and are moving around the island on potted plants and planting mix. To tackle this challenge, the team obtained a list of nurseries supplying the post exchange garden shop and surveyed them for LFA. They also surveyed new housing construction on Lyman Road in Schofield where extensive landscaping is taking place. So far, LFA has not been found at any suppliers or on post.

Keeping Pests Off Post in the Long Term

To ensure CRB and LFA do not reach Schofield, the team continues surveys. LFA surveys are conducted twice a year in high risk areas such as garden shops and new landscaping. The team monitors for CRB using traps that employ a pheromone and light attractant to draw in any beetles that happen to be within the vicinity of a trap. With continued vigilance by both professionals and members of the community, we can prevent these incipient pests from becoming a permanent problem.

ABOVE **The small size of the little fire ant (*Wasmannia auropunctata*), shown here under a microscope, makes it more challenging to detect.** LEFT **Nearly 2,000 CRB traps are deployed throughout O'ahu to detect any beetles that may have traveled beyond the original infestation at JBPH. Attracted by light and pheromone lures, beetles hit the cardboard flange and fall into the white bucket at the bottom of the trap, where there isn't enough space for them to fly out.**

GET involved


ELI SARNAT

LFA *Wasmannia auropunctata*

Survey for LFA

1. Put a small amount of peanut butter in a vial or on a chopstick.
2. Leave the baited vial or chopstick in a shady, grassy spot during mild (not rainy) weather.
3. After one hour retrieve any ants coming to the bait by closing the vial or putting the chopstick into a ziplock.
4. Think you might have LFA? Contact the Hawai'i Deptartment of Agriculture pest hotline at (808) 643-PEST (7378).

The State of Hawai'i Departments of Agriculture and Land & Natural Resources have released an instructional video for homeowners, who are encouraged to test for LFA in their yards and around their homes. Click the image to the right to view a three-minute video providing step-by-step instructions on the simple procedure for testing for LFA.

How to Test for Little Fire Ant

Stay up to date with CRB, LFA and other pests online at
HTTP://DLNR.HAWAII.GOV/HISC/INFO

CRB *Oryctes rhinoceros*


O'AHU INVASIVE SPECIES COMMITTEE

Rake out your mulch pile so it is no more than a few inches deep. The beetles need a deep, moist substrate for their eggs, so as long as the compost is thin and dry, you won't have to worry about them nesting in your yard.

HAVE YOU SPOTTED LFA OR CRB?

Contact the Hawai'i Department of Agriculture pest hotline:

(808) 643-PEST

Volunteer Efforts Help Protect Endangered Plants on Public Land

BY KIMBERLY WELCH

In spite of the damp weather forecast, ten O'ahu residents gave up their Saturday on September 27 to help control invasive weeds in Kahanahāiki, the northern ahupua'a (traditional Hawaiian land division) of Mākua Military Reservation. The native forest of Kahanahāiki is home to several endangered species, including the hāhā (*Cyanea superba* subsp. *superba*), a plant that nearly went extinct in 1995. Fortunately, before the last five *C. superba* died off, staff were able to collect fruit from these plants and later grow new *C. superba* from the seed in the OANRP nurseries. Today, hundreds of *C. superba* have been returned to the Kahanahāiki forest, and staff and volunteers work hard to stabilize this fragile species by improving habitat and removing threats.

The task for Saturday's group was to control the invasive downy wood fern (*Cyclosorus dentatus*), an aggressive weed that has begun to blanket the slopes around the endangered *C. superba*. The weeding took place on the 21st Annual National Public Lands Day, the largest single-day volunteer effort for public lands in the U.S. OANRP was selected as a recipient of a National Public Lands Day, Department of Defense Legacy Award for the seventh year in a row.

Catherine Upton helps to control the invasive *Cyclosorus dentatus* fern to improve habitat for the endangered *Cyanea superba* subsp. *superba* (INSET) **in Kahanahāiki.**

Like most days in the conservation field, the day began with a hike. Staff and volunteers traversed along a rugged, hot, mountain ridge trail for thirty minutes, transporting heavy packs filled with weeding tools before dropping down into the shady gulch habitat of the *C. superba*. The temperature difference and scenery change from ridge to valley was dramatic. The blazing sun from above filtered out through a multitude of tree layers, including a canopy of sixty-foot-tall koa and kukui trees, shorter statured māmaki (a native nettle), giant tree ferns (hapu'u), and the stunningly beautiful *C. superba* in full bloom.

"When you descend into the gulch and suddenly see the fifteen-foot-tall endangered *Cyanea superba*," said Roy Kikuta, a regular volunteer with OANRP, "it just takes your breath away. "

As Kikuta and many other volunteers took time to photograph the ivory blooms of the plant, the group's collective gasp could be heard with the sudden appearance of our state insect, the Kamehameha butterfly (*Vanessa tameamea*). Camera lenses quickly shifted focus to capture images of this beautiful red and black insect as it hovered around māmaki trees (the primary host plant for the Kamehameha butterfly) in the area.

"This area is wonderful! " exclaimed volunteer Kelly Perry. "The native plants, the *Cyanea*, the native butterfly—it feels like an ecosystem. These days, few people get to see native Hawaiian animals and plants interacting, and we are seeing Kamehameha butterflies landing on māmaki right before our eyes!"

Once the excitement over the butterflies died down, OANRP staff spent time orienting the volunteers to a few target weed species in the area. Hand saws and pruners were handed out and weeding goals were outlined for the day. Controlling the invasive downy wood fern proved to be the most challenging of tasks. Volunteers were shown how to clip each frond from the plant's long rhizome (horizontal stem) and how to then apply small drops of herbicide to each cut along the rhizome. The work was tedious and required a lot of focused attention. Look away for a second. and the stem that was just cut becomes invisible, lost in the leaf litter of the forest. Untreated stems (without herbicide) grow back, cancelling out the weeding efforts. Volunteers were undaunted by the challenge and worked steadily across the sloping terrain, clearing approximately 250 square meters of dense weeds.

"It was gratifying to see the amount of area we covered," commented Perry. "Even though the weeding was very detailed, we were really able to accomplish a lot because we had so many people working together."

Check out the last page of the bulletin for information on how to get involved as a volunteer with OANRP!

IN THE FIELD

KARL MAGNACCA

Dr. Magnacca applies fermented banana and mushroom mixtures to sponges in order to attract *Drosophila* species, waiting an hour before checking to see which flies are attracted to them. The flies come and go, some of them staying for hours. Others may only be on the baits for a short time, so it's necessary to keep checking throughout the day.

Root into your community

HO'OA'A

VOLUNTEER OPPORTUNITIES

JANUARY

FRIDAY 1/23
Kahanahāiki

FEBRUARY

THURSDAY 2/5
Palikea

SATURDAY 2/7
Palikea

TUESDAY 2/24
Kalua'ā

BECOME A VOLUNTEER

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

JOIN THE VOLUNTEER LISTSERV

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

COMPLETE YOUR VOLUNTEER APPLICATION

Download the form online at HTTP://MANOA.HAWAII.EDU/HPICESU/DPW/OTHER/VOLUNTEER.PDF.

SIGN UP ONLINE FOR COMMUNITY VOLUNTEER TRIPS

Visit WWW.OANRP.IVOLUNTEER.COM to sign up. Sign ups are on a first come, first served basis, and volunteer trips fill up quickly! If a trip that interests you is full, we encourage you to add your name to the waitlist so that we may contact you in the event that a spot opens up.

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.