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the bulletin

of the National Tropical Botanical Garden

contents

ON THE COVER

Senior horticulture specialist Randy Umetsu places protective netting on a loulu palm *(Pritchardia)* in Limahuli Garden as a proactive measure to prevent a potential attack by coconut rhinoceros beetles (CRB). Read how NTBG is safeguarding its large and diverse collection of loulu, Hawai'i's only native palm genus, on page 6. Photo by Erica Taniguchi

The Bulletin is a publication for supporters of the National Tropical Botanical Garden, a not-for-profit institution dedicated to tropical plant conservation, scientific research, and education.

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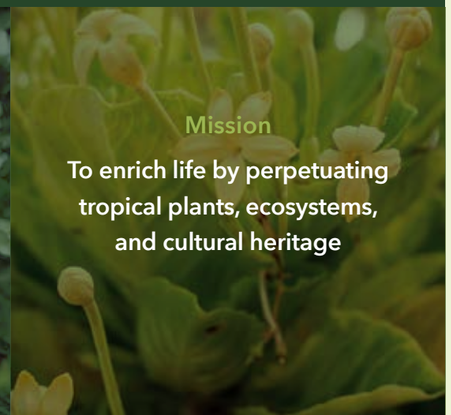
We are the National Tropical Botanical Garden

We work across five botanical gardens and throughout the tropics to grow a brighter tomorrow for plants and all they sustain. We do so through a biocultural approach, where Indigenous knowledge, community priorities, and scientific research guide our path forward. Together, we will restore flourishing relationships between plants, people, and places.



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Message from Tami Rollins, Interim CEO

As we bid farewell to winter, I'm feeling hopeful even as I gaze at the ground. Just beneath my feet and covered in dirt, the earth is peppered with seeds — some small and round, others flat or hooked, still others look like dust.

As we welcome spring, I ponder our future and the potential inherent in seeds. From seeds come a new generation of plant life and all they offer — not just trees and shrubs, but the flowers, fruits, and fiber that fill our lives with beauty, nourish our bodies, and bind us to culture, livelihood, and each other. Spring is the season of seeds, the beginning of new life and hope.

Following our 60th anniversary last year, NTBG continues to fulfill its mission of enriching life by perpetuating tropical plants, ecosystems, and cultural heritage. As we move forward, we embrace a renewed commitment to growth — not just the growth of plants, but growth in our awareness and practice of biocultural values. This includes uplifting Indigenous knowledge systems and placing communities at the heart of conservation. By doing so, we can help restore flourishing relationships between plants, people, and places — guided by Indigenous science and stewardship practices that have sustained tropical environments for millenia.

Inspired by a Hawaiian planting oli (chant) composed by Dr. Taupōuri Tangarō, we embark on a five-year journey guided by the life cycle of plants. These planting oli are recited with deep reverence, calling upon the elements and moving through the phases of plant growth to support the realization of an abundant future for the plants and all they sustain.

Over the next five years, we will explore the five stages of plant growth, dedicating each year to a different phase. This year, we begin with the seed — hua. Seeds symbolize possibility, resilience, and the power to create something greater. In the years that follow, we will journey through kupu (sprouts), lau (leaves), lālā (branches), and pua (flowers), recognizing the interdependence and strength that these stages represent. As we move through these phases of the oli, we are in turn asking to grow deeper in our collective understanding of biocultural values and practices. We're so excited to go on this journey with you. You'll find Oli Hoʻoulu (chant for growth) on page 31.

In this issue of The Bulletin, you'll find stories of seeds, as told by Dr. Dustin Wolkis, our scientific curator of seed conservation and in an interview with Melanie Mark-Shadbolt, a Māori seed keeper. This issue examines the lengths to which NTBG is going to safeguard our loulu (*Pritchardia*) collection, Hawaii's only native palm species which bear seeds that are vulnerable to the destructive coconut rhinoceros beetle (CRB). We also profile Hawaii's state tree, the kukui or candlenut tree, another treasured source of seeds. On page 22, you can read about how NTBG is playing an important role in *Hawai'i's Year of our Community Forests* through our work with breadfruit and our expanding Grow Aloha plant adoption program.

To be sure, there are challenges ahead and obstacles to overcome, but as an organization comprised of hundreds of deeply committed individuals and as ʻohana (family), NTBG believes in possibility and the power of people to care for and build relationships with plants. And just like the native seeds in our seedbank or conservation and horticulture center, we see the potential for life, growth, and a better tomorrow.

Thank you for joining us on this journey.

Tami Rollins
Interim CEO

A special **thank you** to our new Fellows and Members!

Become an NTBG Fellow and join a special group of tropical plant enthusiasts

The Council of Fellows was established in 1985 as NTBG's leadership membership group to advance NTBG's core programs in tropical plant conservation, research, and education. This exceptional group of philanthropists has been instrumental in helping NTBG to become one of the most important tropical botanical gardens in the world. Annual membership dues begin at the $1,500 level and continue up to the $20,000 Chairman's Circle level. In addition to enjoying general membership benefits, Fellows are invited to NTBG's bi-annual Board of Trustees meetings and also have the opportunity to participate in specially arranged travel programs, which include visits to private and public gardens and explorations of botanical hotspots around the world.

Become a Member of NTBG and support tropical plant conservation

Your membership dues directly support tropical plant conservation and research, provide the resources to protect and cultivate our living collections, and educate the public about the importance of tropical plants at NTBG's five gardens and preserves. Membership levels range from $90 to $500 with a level to fit everyone from individuals to families. **Contact: members@ntbg.org**

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KUKUI TREES ON THE CLIFFS OF KAUA'I. PHOTO BY KEN WOOD

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Protecting

Hawai‘i’s Only Native Palm from a New Threat

NTBG is preserving Hawai‘i’s botanical and cultural heritage through its loulu palm collection

BY JON LETMAN, BULLETIN EDITOR

Close your eyes and think of the Hawaiian Islands. What do you see? Perhaps a coconut palm swaying in the breeze? Coconut palms in Hawai‘i are so common, they almost go unnoticed, even as their towering arched figures evoke images of tropical paradise—pacific, serene, and abundant. Given their ubiquity, many are surprised to learn that *Cocos nucifera* or niu in Hawaiian may, in fact, not be native at all.

It is the *Pritchardia*, loulu in Hawaiian, that is Hawai‘i’s only native palm genus. Currently, there are at least 23 species of loulu endemic to Hawai‘i, with four additional species known from other Pacific Islands[1].

Hawai‘i is the epicenter of loulu diversity and it is fitting that NTBG houses the largest and most diverse collection with 22 of the 23 endemic species. Loulu are found at all four NTBG Hawai‘i gardens, but they are most numerous in McBryde Garden—more than 700 trees.

Dr. Seana Walsh, conservation scientist and curator of living collections, explains that NTBG prioritizes the collection and conservation of rare loulu species including *Pritchardia flynnii*, a Kaua‘i single island endemic with an estimated 400 trees left in the wild. The loulu collection is not only an invaluable resource for research, it serves as a living seed bank for a genus whose seeds are not ideal for dried or frozen storage. It’s also a source for genetic material to be shared with other botanical institutions.

[1] *P. thurstonii, P. pacifica, P. mitiaroana, P. tahuatana,* native to Fiji, Tonga, the Cook Islands, and French Polynesia

A KUPU INTERN MEASURES *PRITCHARDIA PERLMANII* LEAVES IN THE UPPER LIMAHULI PRESERVE. PHOTO BY SUSAN FAWCETT

NTBG's loulu conservation dates back to at least the late 1980s when longtime NTBG botanists Steve Perlman and Ken Wood explored far and wide across some of Hawai'i's most remote and inaccessible habitat including steep valleys and high sea cliffs where they used an innovative webbing-line method that synched around loulu trunks to climb and collect seeds. *Pritchardia* conservation gained momentum with the establishment of the Hawai'i Plant Conservation Center at NTBG in 1989.

NTBG staff and partners have successfully collected and are growing two extremely rare loulu species endemic to east Maui—*P. woodii* and *P. arecina*. Rare loulu species have long grown in and around Limahuli Garden and Preserve as well as Kahanu Garden and Preserve, contributing greatly to the genetic diversity, health, and vigor of the overall collection.

PHOTO BY SUSAN FAWCETT

INVALUABLE RESEARCH ASSETS

NTBG's loulu collection also provides research material for scientists and students like University of Hawai'i masters student Makoa Elgin who is studying hybridization patterns and breeding systems. The collection is also the focus of Dr. Susan Fawcett, an NTBG postdoctoral researcher and botanist at the University of California, Berkeley and Jepson Herbaria. Susan spent much of 2024 on Kaua'i modeling the origin and evolution of twelve Hawaiian species including loulu.

Armed with Pritchardia pollen records, Susan is investigating the dominant role of loulu in Hawai'i's ancient coastal forests. "It's hard to overstate what an important role ecologically loulu had in the history of Hawai'i," she says, pointing to the loulu's sturdy fronds and trunk which are used for construction and thatching material, for dye, flower lei, spears, mats, fans, and pahu (drums).

Loulu have also been used for altars or small heiau dedicated to specific deities and to make honorific floral decoration called ho'oulumāhiehie, a practice that continues today. The sweet inner flesh of seeds can be eaten like young coconuts. Research indicates that it was the loulu, not the coconut palm, that was most common in pre-Western contact Hawaiian homesteads.

Susan says she first became interested in studying loulu after encountering what she calls "NTBG's spectacular collection." As a scientist, this diversity allows her to familiarize herself with hundreds of palms as distinct individuals, closely examining them for subtle variations in height, length of petioles and inflorescence, fruit and flower size, color, appearance, growth habits and more. Because each tree is tagged with data, she can study loulu in a way not possible elsewhere, gaining a better understanding of the adaptive advantages of evolving on a remote island or the role of fruit size in seed dispersal.

The loulu at NTBG provide the tools needed to make taxonomic assessments (determining if species should be lumped together or split apart), which, Susan notes, has serious implications for conservation policies and environmental law.

"There's no way that I'd be able to do this if I was working only with herbarium specimens," Susan says. "I don't think I would have been able to get to know these plants in the way that I can when I walk among them." As one example, she points to a photo of a loulu species *P. glabrata* which includes 89 individuals she can easily examine in the garden.

RETHATCHING WITH LOULU FRONDS IN MCBRYDE GARDEN. PHOTO BY JON LETMAN

PHOTO BY ERICA TANIGUCHI

Because loulu have thick, large fronds, they are difficult to collect as dried herbarium vouchers and optimum long-term seed storage conditions are not well known, (read more on pg. 12) growing collected seeds into plants is our best option until more is known. This makes NTBG's living collection akin to a library, a classroom, and a living seed bank. It is the collection that also allows for the perpetuation of cultural knowledge and illustrates why the seeds need to be collected, protected, and grown for outplanting in restoration sites where some species are down to single-digit populations.[2]

Today, few people ever see loulu growing in the wild but they can be found in Hawai'i's forests, albeit in habitat that has been degraded by rats, pigs, and feral ungulates which disrupt the understory and alter forest composition. In lower elevations and along the coast, humans have developed areas once populated by loulu.

When the first humans settled the Hawaiian Islands, they most likely encountered forests and groves of loulu. But with humans came *Rattus exulans*—the Pacific rat, a ravenous pest that can rapidly and dramatically alter ecosystems. Rats quickly developed a fondness for loulu seeds, leading to greatly reduced wild regeneration.

NEW PEST IN TOWN

Rats, pigs, and other animals have fed on native Hawaiian plants for centuries, but there's a new pest in town, one that threatens Hawai'i's most cherished plants including the common coconut palm and the loulu.

Named for its favorite food, the coconut rhinoceros beetle[3] (CRB) is native to East Asia, but began moving through the Pacific in the 1940s, spread by human activity, on vessels and vehicles, and inside organic material like mulch and potting soil.

In 2007, CRB was detected in Guam, and in the Northern Mariana Islands a decade later. CRB was found in Hawai'i at the end of 2013 and has since invaded Vanuatu and the Marshall Islands where it has proven to be fatal to trees causing major cultural and economic impacts.

In 2023, CRB was discovered on Hawai'i Island and Maui[4], but no further spread has been detected in almost a year or more. After CRB was found near Kaua'i's airport in May 2023, NTBG took quick action to hang and monitor a pheromone-baited trap designed for early CRB detection. In January 2024, the first coconut rhinoceros beetle was found in a trap at NTBG headquarters on Kaua'i and by early March it had spread into the Lāwa'i Valley.

PHOTO BY CRB RESPONSE

[2] For example, *Pritchardia viscosa*
[3] *Oryctes rhinoceros* (Scarabaeidae)
[4] As of early April 2025, CRB has not been detected on Moloka'i or Lāna'i

LOULU IS ON THE MENU

Dr. Mike Melzer, principal investigator with the University of Hawai‘i’s College of Tropical Agriculture and Human Resilience’s Coconut Rhinoceros Beetle Response program, describes CRB as one of the most impactful invasive insects in the Pacific, warning that Kaua‘i today is where O‘ahu was at roughly five years ago.

Mike says that although CRB have a limited flight range and are generally “lazy” insects content to spend their days in a mulch pile eating and breeding, they pose a major threat to coconut, loulu, and other palms with a diameter greater than six inches. He notes that if coconut or loulu are unavailable, CRB have been known to eat hāpu‘u tree ferns, hala (*Pandanus*), kalo (taro), mai‘a (bananas), and other crops. Even if loulu is not the coconut rhinoceros beetle’s preferred food, Melzer says, “loulu is certainly on the menu for CRB, unfortunately.”

When the beetles burrow into the center of a palm, they feast on the sap, destroy the central meristem, leaving the tree weak and vulnerable to infection or killing it outright.

These voracious feeders and stealthy hitchhikers can expand their territory through the movement of potted plants, green waste, compost, and mulch where eggs and larvae thrive and so, Mike says, early detection and response is vital. That means setting and monitoring traps, carefully managing potential breeding sites, and watching for signs of beetle damage.

Mike says that on O‘ahu the threat to coconut palms has garnered the most attention, but loulu also face great risk. He calls this an *“all hands on deck moment.”*

As CRB Response encourages greater awareness and scientists look for innovative ways to combat this threat, Mike says, “the more people we have doing treatments, the better,” adding that O‘ahu’s greatest success in fighting CRB has been at the landscape-scale level where full—not patchwork—treatment has been possible.

LOOK CLOSELY, ACT FAST

Recognizing the grave threat to its living collections, NTBG staff have had no choice but to quickly familiarize themselves with CRB early detection and rapid response. From the first trap that was set until the present moment, NTBG horticulture and ground staff have had a crash course in monitoring for CRB damage, shredding mulch and compost management, and taking precautions to avoid spreading any material that could serve as a breeding site.

Ever since the first CRB detection at NTBG headquarters in 2024, McBryde Garden foreperson Leslie Matsumoto and horticulture technician Laura Mansor have spent countless hours checking traps, inspecting trees and painstakingly wrapping netting as a protective barrier around the crowns of priority loulu species. Additionally, they have been bagging flower buds with nets and, when the loulu seeds reach the size of olives or small plums, they switch to mesh wire cages to protect the seeds from rats.

PHOTOS BY JON LETMAN (TOP), ERICA TANIGUCHI (MIDDLE, BOTTOM)

Defending these valuable seeds from beetles and rats, ensures more seeds are available for propagating palms that can be managed ex situ (in the garden), outplanted in the wild, and shared with conservation partners.

Over the last year, NTBG has sent more than 600 loulu seeds representing six species to institutions including Lyon Arboretum, Singapore Botanic Gardens, San Diego Zoo, and the Montgomery Botanical Center, as well as NTBG’s own Kampong in Miami and Kahanu Garden on Maui.

FIGHTING BEETLES WITH DOGS AND DRONES

In the months since CRB reached the Lāwa‘i Valley, McBryde Garden has welcomed Conservation Dogs of Hawai‘i, an environmental nonprofit that visits suspected or infested sites with canine sleuths trained to detect CRB. Over several visits, the dogs have not detected CRB larvae, but the search benefits both the dogs and the collections.

Meanwhile, some of the garden’s coconut palms (but not the more sensitive and rare loulu) have been treated with an injected systemic insecticide which has proven effective but moves slowly through the palm.

Last December, NTBG partnered with the Aloha ‘Āina Drone Company which visited McBryde Garden with a drone equipped with a spray nozzle that safely and surgically applied a contact insecticide to the crowns of over 90% of the targeted palms on NTBG’s south shore properties. The difference between treating loulu by hand using a lift boom and spraying with a drone was tremendous. The drone was able to reach the crown of even the tallest palms, in hard-to-reach areas under dense canopy and along steep cliffs, reaching dozens of palms in minutes rather than days. In less than a week, the drone treated nearly 650 loulu palms.

HAWAIIAN PALMS ARE HAWAIIAN HERITAGE

Why is protecting NTBG’s loulu collection so urgent? “The vast majority of the diversity of *Pritchardia* is in Hawai‘i,” explains Seana Walsh. “They are our only native palm genus so getting more native loulu on the landscape and in horticulture should happen.”

Tobias Koehler, director of South Shore gardens, points to the cultural importance of loulu. He says that while much of the CRB conversation has understandably been focused on the better-known coconut palm, loulu are a unique life form, without which Hawai‘i is incomplete. “We’re here to sound the alarm that loulu are special and irreplaceable,” says Tobias. “We need others to join us to rally to the cause of preservation of this Hawaiian palm.”

PHOTO BY ZACHARY PEZZILLO

While the battle against the beetles continues, Leslie is cautiously hopeful that CRB can be contained. With a dozen traps on NTBG’s south shore properties, Garden staff are catching between one and up to eight beetles a week and while there has been damage observed, to date, no palms have been killed by CRB in the Lāwa‘i Valley.

CRB has been found on the north shore of Kaua‘i, but as of February 2025, it has not been detected at Limahuli Garden or Kahanu Garden on Maui. Staff at both gardens continue to take preventative measures (quarantining and wrapping) to protect these sites as they are both home to rare and single-island endemic loulu, many from wild collected sources.

If CRB gets out of control on Kaua‘i, that could severely impede or prevent NTBG’s horticulture center in the Lāwa‘i Valley from sending plants to Maui or Limahuli. Kahanu Garden and Preserve director Dr. Mike Opgenorth says the potential disruption underscores the need to build capacity at each garden rather than being dependent on centralized operations.

Meanwhile, NTBG has taken every preventative measure recommended, from careful monitoring and management, safeguarding plants from rats and beetles, and an aggressive effort to promote the study, conservation, and expansion of collections of loulu, Hawai‘i’s one and only native palm.

READ AND SHARE ONLINE

DR. DUSTIN WOLKIS (L) AND JENA OSMANI HOLD LOULU SEEDS TO BE TRANSFERRED TO THE NURSERY FOR PROPAGATION. PHOTO BY JON LETMAN

Exploring NTBG's Multi-Strategy Approach to

SAVING HAWAIIAN SEEDS

BY DR. DUSTIN WOLKIS, SCIENTIFIC CURATOR OF SEED CONSERVATION

One of NTBG's core activities is to address the current biodiversity crisis by perpetuating tropical plants and ecosystems. Around 90 percent of Hawai'i's plants are endemic, meaning they're found nowhere outside of Hawai'i. Nearly 270 native Hawaiian plant species are represented by fewer than 50 individuals in the wild and nearly half of all species federally listed as Threatened and Endangered are native Hawaiian plants.

Fortunately, NTBG has an active seed banking program with the staff and facilities to allow for ex situ seed conservation at our Botanical Research Center on Kaua'i. Ex situ conservation refers to work happening "off site", as opposed to in a plant's natural wild environment (i.e. in situ). Typically, seed banking involves drying, sealing, and storing seeds at low temperatures.

In general, the longevity of a seed increases with lower moisture content and colder temperatures. That said, the seeds of different species respond differently to conditions meant to extend their longevity. A seed's physiological response to drying and cooling is called "storage behavior." Seeds of "orthodox" species can be dried and frozen for decades or centuries and retain a high degree of viability. In contrast, seeds with "recalcitrant" behavior do not tolerate drying or freezing and require different conservation methods.

Still other seeds, categorized as "intermediate," are short-lived. Some intermediate seeds may tolerate drying but lose viability more rapidly than expected when frozen.

All seeds at NTBG are dried to a species-specific level of humidity, hermetically sealed in an aluminum foil pouch, then stored at a species-specific temperature. Each accession (collection) is filed alphabetically by family, genus, and species, then by its unique number. Our state-of-the-art database helps us keep track of each of more than 18 million seeds.

Drawing on over 30 years of data gathered by NTBG and our colleagues in the Hawai'i Seed Bank Partnership, we have observed different patterns of longevity for different species stored at varying conditions. Based on these observations and current knowledge we continually update best seed conservation strategies. In this way Hawai'i can serve as a model for seed conservation in other tropical, subtropical, and island systems.

JENA OSMANI SWABS POLLEN TO CHECK FOR GERMINATION. PHOTO BY JON LETMAN

Below are five examples of native Hawaiian species (or groups of closely related species) that illustrate various seed storage requirements that we are addressing at NTBG.

ʻŌHIʻA (*METROSIDEROS* SPP.)

ʻŌhiʻa, ʻōhiʻa lehua, or lehua is the Hawaiian name for native *Metrosideros* spp., members of the Myrtaceae (myrtle family) which includes eucalyptus and guava. The five species and 13 varieties of ʻōhiʻa are some of the most dominant and ecologically important trees in Hawaiʻi's rainforests and occur on most islands. ʻŌhiʻa are among the first plants to colonize new lava flows and provide food and cover for native forest birds. Considered to be among Hawaiʻi's most bioculturally important trees, ʻōhiʻa is intimately intertwined with Hawaiian culture.

Recently, a newly identified fungal pathogen began killing ʻōhiʻa trees in Hawaiʻi. The disease is commonly known as Rapid ʻŌhiʻa Death (ROD) and has, over the last decade, killed more than one million trees across Hawaiʻi. Fortunately, ʻōhiʻa seeds are small and easy to collect, germinate readily, and can be dried and frozen. Working with our partners across Hawaiʻi, we are collecting, storing, and exchanging seeds. When a seed collection grows large enough, the seeds are divided and stored at conventional as well as ultra-cold (minus 80°C/minus 112°F) temperatures to better understand the effects of temperature on seed longevity.

LOULU (*PRITCHARDIA* SPP.)

Loulu (also known as hāwane or wāhane, which are also the names for the seeds of these species), Hawaiʻi's only native fan palm, is currently represented by at least 23 endemic species found on Hawaiʻi's main high islands except Kahoʻolawe. It also grows on Nihoa, a one sq. km island with high basalt cliffs roughly 150 miles northwest of Niʻihau. Pollen records show that loulu were abundant across the islands but are now rare. Today, loulu, like other palms in Hawaiʻi, are threatened by a pest called the coconut rhinoceros beetle (CRB) [Read more on page 6]. Loulu seeds are some of the biggest in the Hawaiian flora, take around 400 days to mature, and have a storage behavior not yet fully understood.

In one loulu species, *Pritchardia remota*, seeds were found to tolerate an intermediate level of desiccation (i.e. neither orthodox nor recalcitrant), yet there have been anecdotal reports of some loulu seeds germinating after 20 years in conventional storage. At NTBG, we have stored loulu seeds in a variety of ways, and finding optimal storage conditions is a focus of future research.

KOKIʻOʻULA (*HIBISCUS CLAYI*)

The endangered *Hibiscus clayi* or kokiʻoʻula is a red-flowering native Hibiscus species endemic to Kauaʻi. Like many species in the Malvaceae (mallow family), kokiʻoʻula have seed coats that are impermeable to water. These seeds can be kept frozen and in dry storage but, with a few exceptions, they require hand pollination.

Hibiscus clayi seeds are brownish-black, shaped like a mix between an egg and a kidney bean, almost half a centimeter long, and have a few soft, star-shaped and simple hairs on their surface. The seeds produce mature fruit in just 40 days.

ALANI (*MELICOPE* SPP.)

Alani refers to the majority of 54 species of native Hawaiian *Melicope* (in the Rutaceae or citrus family) which occur across all the Hawaiian islands except for Kahoʻolawe and Niʻihau, and include the iconic mokihana *(Melicope anisata)*, a shrub endemic to Kauaʻi beloved for its anise-scented fruits which are woven into lei. A second melicope species *(M. clusiifolia)* grows alongside mokihana and bears similar fruit but those unfortunate enough to mistake the two plants are ridiculed at having collected what is derisively referred to as "kūkae moa" (chicken feces).

Alani seeds are on the larger side (around half a centimeter long) and are glossy black and oval-shaped. They are exceedingly difficult to germinate and the best means of storing the seed remains a mystery. However, we continue to actively explore new methods which we hope will allow us to preserve and protect alani species, some of which are abundant, while others are extinct.

HAWAIIAN LOBELIADS

The largest example of adaptive radiation[1] in the Hawaiian flora are the lobeliads and their relatives, members of Campanulaceae (bellflower family). Currently, 161 species and subspecies make up six genera, five of which are endemic to Hawaiʻi. One species, ʻālula or pua ʻala *(Brighamia insignis)* was last seen growing wild on Kauaʻi in 2012. Although recent drone surveys have confirmed that the species is extinct in the wild, decades of successful collection and cultivation efforts have made ālula a powerful symbol of plant conservation.

STORING SEEDS AT MINUS 80°C. PHOTO BY JON LETMAN

[1] The diversification of a group of plants or animals into new forms to fill varying ecological niches

CYANEA FISSA

METROSIDEROS POLYMORPHA VAR. *POLYMORPHA*

BRIGHAMIA INSIGNIS

DELISSEA KAUAIENSIS

SEEDS OF HAU KUAHIWI *(HIBISCADELPHUS)*, A GENUS OF EIGHT SPECIES ENDEMIC TO HAWAI'I. COVERED IN WHAT LOOKS LIKE SOFT, WOOLY HAIRS, THESE ARE THE SEEDS OF *HIBISCADELPHUS STELLATUS* WHICH WAS DISCOVERED ON MAUI BY BOTANISTS WITH THE PLANT EXTINCTION PREVENTION PROGRAM AND NTBG IN 2012. ALL SEED PHOTOS (PG 16-17) COURTESY OF THE UNIVERSITY OF HAWAI'I'S HAROLD L. LYON ARBORETUM SEED CONSERVATION LAB.

HIBISCUS CLAYI

PRITCHARDIA NAPALIENSIS

DUSTIN WOLKIS COLLECTING PLANT MATERIAL FOR EDUCATIONAL OUTREACH. PHOTO BY JENA OSMANI

Hawaiian lobeliads also include ʻōhā wai, the various species of *Clermontia*; hāhā (another name for *Clermontia*), and the majority of *Cyanea*, and *Delissea* species; lobelia species such as pānaunau *(Lobelia yuccoides)*; and koliʻi, the majority of *Trematolobelia* species. Hawaiian lobeliads also represent the family with the largest number of endangered Hawaiian plants and extinctions. Seed conservation is critical for this family.

Hawaiian lobeliad seeds range in size from 0.5 mm to almost 1.5 mm long, may be wrinkled or ridged across their widths, and can be white or blackish brown depending on the species.

These seeds generally tolerate drying but their viability declines faster when frozen rather than if stored at moderately cool temperatures (above 5°C/41°F). We dry these seeds and store them at an ultra cold minus 80°C and, when possible, keep a portion of the same accession at multiple temperatures.

Through NTBG's efforts to monitor seed longevity, we can maximize viability for future use of seeds in a variety of conservation and restoration efforts, while improving our ability to understand seed conservation biology.

Going forward, NTBG continues to collect, study, and save seeds of some of the world's most endangered plants. We are also making progress in our ability to store pollen, fern spores, and are beginning to store bryophyte (mosses, hornworts, and liverworts) spores as well. As we enhance our storage methods and improve our ability to save seeds, we are making a positive contribution to safeguarding one of the most unique floras on Earth.

READ AND SHARE ONLINE

National Tropical Botanical Garden
The Garden Club of America

SCHOLARSHIPS

The National Tropical Botanical Garden and The Garden Club of America are collaborating to offer two scholarships related to tropical botany. The Garden Club of America Fellowship in Tropical Botany will award $5,500 to PhD students. A second scholarship, The Loy McCandless Marks Scholarship (an International Scholarship in Tropical Horticulture or Landscape Architecture), will award $5,000 to graduate or undergraduate students.

The deadline for both scholarships is January 15, 2026. Learn more at: https://www.gcamerica.org/scholarships

THE GARDEN CLUB of AMERICA

SEEDS GATHERED IN MCBRYDE GARDEN

wish list

Make a difference today! Your purchased Wish List item will directly meet immediate program needs. Donate online at ntbg.org/support/donate or call Chelsey Aki at (808) 332-7324 Ext. 209. Mahalo for your support!

BREADFRUIT INSTITUTE
Chainsaw - $275
(2) Pole pruner - $800

KAHANU GARDEN
(3) Electric hand pruners - $1,200
Tires for Kubota mower - $500

LIMAHULI GARDEN
Desks & chairs for Multipurpose/Cultural building - $500
Shelves, racks, & storage containers for Multipurpose/ Cultural building - $500

ALLERTON/MCBRYDE/NURSERY
Garden Tiller - $650
Batteries for power tools - $300
Washing machine for the Nursery - $800

SCIENCE AND LIVING COLLECTIONS
Herbarium supplies - $500
Clear Labels - $1,000

SOUTH SHORE GARDEN
Computer monitors for check in - $420

THE KAMPONG
Laser color printer - $1,000
Shelves for shade house - $1,000

VOLUNTEER PROGRAM
Garden sickles - $200
Gardening gloves - $200

To see the complete Wish List, please visit: https://ntbg.org/support/wishlist/

plant people

EXPLORING PEOPLE'S RELATIONSHIPS WITH PLANTS

PHOTOS BY TRINA MARK

MELANIE MARK-SHADBOLT

In Māori culture, *taonga* refers to that which is highly-prized or treasured. Taonga could be a body of water, a mountain, a bird, or a seed. Caring for Aotearoa (New Zealand)'s taonga is central to the work of Te Tira Whakamātaki, an independent Māori nonprofit organization dedicated to the protection of the environment.

The organization's name translates as "the watchful ones," a reference to their stewardship of Aotearoa's treasured places, plants and biodiversity. Their work includes predator control, pest eradication, and *whare taonga* (seed banking). Since its formation in 2017, Te Tira Whakamātaki has distributed more than a dozen kits called "seed drums" across New Zealand, teaching communities how to build, manage, and maintain them.

Te Tira Whakamātaki's cofounder and CEO, Melanie Mark-Shadbolt, explains that for Māori people, it is essential to preserve seeds in a way that respects sacred land, follows proper protocols, and is socially, ethically, and legally sound.

Melanie spoke with *The Bulletin* from her home in Rangiora, a small community near the coast on the South Island about the importance of seed banking in Aotearoa and her own relationship with plants.

How did your organization start banking seeds?

We have a really strong biosecurity background and a lot of our work has been about keeping harmful things out of Aotearoa. In 2014, colleagues from Hawai'i and other places told us we needed to keep an eye on myrtle rust (the fungal disease *Austropuccinia psidii*) which is detrimental to forests and devastating for cultural practices. We started looking at how myrtle rust could impact New Zealand, and we knew pretty much straight away — especially from NTBG's work — that seed banking was going to be core to protecting our trees from myrtle rust. After years of investing in projects and holding traditional meetings around the country asking communities how they might respond to myrtle rust, we decided to establish this network in 2017.

Te Tira Whakamātaki ramped up very quickly because myrtle rust was on our shores a month after our launch and seed banking was one of our areas of interest. In the early days our work was almost entirely based on seeds.

In what ways are seeds important in Māori culture?

We have a Māori proverb that says *E kore au e ngaro, he kākano i ruia mai i Rangiātea* ("I shall never be lost. I am a seed sown from Rangiātea[1]), Rangiātea being where we come from. Who we are as a people is connected to our journey across the Pacific. Seed collection and distribution tells the story of where our ancestors have traveled across the world. They kept us company in our travels, provided for us, and so they're like family to us, probably like they are with Kānaka maoli (Native Hawaiians).

How did you get involved with distributing seed drum kits?

We reached out to our colleagues and friends at the Millennium Seed Bank during the myrtle rust incursion and they were really helpful. They told us about their seed drums that are distributed in emergencies. They sent a couple to New Zealand and we realized that with a seed drum kit, our communities could have everything they needed to keep the seeds at home where they could manage them, love them, care for them, and monitor them. I think since 2018 we've distributed maybe 15 kits that we've funded and built. We've also helped communities build their own and run courses to train people to use them.

[1] Rangiātea is a place in Hawaiki and point of final dispersal of some migration canoes

Our dream for the seed drums is to ensure that every *marae*, that's a traditional meeting house in a community village, could have one. Every community weaving group could also have one if they wanted, as could every *tohunga* (expert priests, healers, navigators, etc.), wetland restoration project, or anyone who wants a kit for their piece of land.

In 2018 you visited NTBG's seed bank and laboratory on Kaua'i. How did that visit influence your work?

That has informed our thinking and design hugely and was probably one of the best visits we've had. Coming to see your seed bank with Dustin Wolkis[2] and talking about community involvement, especially to those in the language revitalization space, was really eye opening for us.

One factor we hadn't considered until we visited NTBG was how involved communities can become in terms of donating things like insect collections, books, and things the community brings because they see you as a safe set of hands with which to leave their taonga — their treasures. That greatly informed us because we liked the community feel.

[2] NTBG's Scientific Curator of Seed Conservation

Let's talk about plants that are important in Māori culture.

Probably one of the most well-known plants is mānuka *(Leptospermum scoparium)* because New Zealand is known for our mānuka honey. It was once considered a scrub plant and now people are desperate to keep mānuka everywhere because the honey is so sought after. It has beautiful pink or white flowers. For Māori it's a really important medicine plant. It's a good example of a plant that is significant to both Māori and non-Māori from an economic and, for us, from a cultural perspective.

What about a plant that's not as well known?

I've been trying to grow the akeake bush *(Dodonaea viscosa)* which has long, thin leaves. It was traditionally used to treat a variety of conditions, but wasn't really popular outside of Māori circles until nurseries picked it up. There's lots of focus on plants here in Aotearoa, especially traditional medicine plants. But we also have a really diverse range of fungi and a huge variety of ferns and they are much harder to collect. It's something we're just starting to think about, how we might collect and store those. We have a black tree fern called mamaku *(Cyathea medullaris)*, which I personally really love. Our ferns are really diverse and unique, with huge medicinal and cultural importance.

What is one tree closely identified with Aotearoa?

Our pōhutukawa tree is the equivalent of Hawai'i's 'ōhi'a trees (*Metrosideros* sp.). You rarely see them inland, but you see it everywhere on our shorelines. We have some really significant pōhutukawa, including a tree that the stories say is the mother of all pōhutukawa trees across the Pacific. It sits right out on the shoreline in the very farthest reaches of New Zealand's east coast and sends its seeds across the Pacific so for us it's connected to your trees, it's a sibling.

For some of my tribes, pōhutukawa and other trees were used to suspend our corpses before the bones were interred. That's our traditional practice. Those trees are where we farewell our departed. They are not just pretty. They are very much part of our lives in everything we do from building houses and creating clothing, to healing our people, and also farewelling our deceased at the end and protecting them.

This interview was edited for length and clarity.

IT TAKES A FOREST:

The Power of Community Forests in Biocultural Restoration

BY DAVID BRYANT, DIRECTOR OF COMMUNICATIONS

PLANT PROPAGATION WORKSHOP AT THE KAMPONG. PHOTO BY KATRINA MORRIS
OPPOSITE PAGE: HARVESTING BREADFRUIT. PHOTO BY ANUHEA PEREZ

What if we viewed our homes, neighborhoods, and communities as fertile ground for biocultural renewal? Imagine urban spaces transformed into flourishing community forests—places where ecological health meets human well-being, where abundance flows between people and plants.

In Hawaiian culture, the Wao Kānaka—the realm of people—teaches us that the spaces we inhabit are intertwined with ʻāina (the land). This relationship is reciprocal: as we care for the land, it nurtures and sustains us in return. Cultivating community forests honors this vital bond. In proclaiming 2025 as the Year of Our Community Forests, Hawaiʻi Governor Josh Green celebrates this connection, highlighting the critical role of trees and green spaces in the Wao Kānaka, "where we live, learn, and play."

At the National Tropical Botanical Garden, this vision comes to life through community forestry initiatives that blend ecological restoration with cultural renewal.

WHAT IS A COMMUNITY FOREST?

A community forest can take many forms, but at its core, it is a shared landscape where people engage with plants for mutual benefit. These spaces are as diverse as the communities they serve, ranging from food forests with multi-layered edible canopies to urban parks and preserved native ecosystems. Unlike many large-scale agricultural systems, community forests are inseparable from the needs, values, and cultures of their caretakers. By fostering localized, sustainable food systems, community forests offer meaningful pathways toward food sovereignty, empowering communities to grow, share, and sustain resources on their own terms.

BREADFRUIT PHOTOS BY NEAL UNO (L), NOEL DICKINSON (R)

As we build greater biocultural understanding at NTBG, we reflect on the ways our network is engaging with community forestry to nurture flourishing relationships between people, plants, and places. These examples illustrate how tailored, place-based approaches can address local needs, inspire stewardship, and demonstrate the vital role of community forestry in fostering both ecological and cultural resilience.

BREADFRUIT — THE QUINTESSENTIAL COMMUNITY FOREST TREE

About a decade ago, NTBG's Breadfruit Institute launched the Plant a Tree of Life—Grow ʻUlu campaign, distributing over 10,000 breadfruit trees across Hawaiʻi. This initiative aimed to raise awareness, increase access to breadfruit (ʻulu in Hawaiian), and revive its use as a staple crop deeply rooted in Hawaiian culture. By placing trees in the hands of individuals, schools, and organizations, the program nurtured not just food security but also a profound connection between communities and this resilient, climate-adaptive crop.

Research by Breadfruit Institute coordinator Noel Dickinson has shed light on the program's lasting impact. Growers reported cultivating not only abundant food but also a sense of pride and community through stewardship of this culturally significant tree. Breadfruit's low maintenance, adaptability, and generous yields have fueled local food networks, reducing reliance on imported produce and bolstering food security. As Noel's master's thesis highlights: "Breadfruit appears to be a key component of a food safety net, supplementing store-bought produce and supporting food security during socio-economic shocks." Her findings reveal how Kauaʻi's growers are embracing breadfruit cultivation as a pathway to resilience, often sharing harvests within community networks.

An important insight from the study is the limited availability of Hawaiian ʻulu varieties. While most distributed trees were non-Hawaiian varieties, growers expressed a strong desire to perpetuate Hawaiian culture by cultivating traditional plants. Increasing access to heritage ʻulu trees presents a vital opportunity for biocultural conservation.

The success of the distribution program underscores the importance of accessible planting initiatives that prioritize culturally significant species and offer long-term education. Despite challenges like pests and variable yields, the overwhelmingly positive outcomes demonstrate breadfruit's potential as a cornerstone of food forests and sustainable agriculture in Hawaiʻi and beyond.

The Breadfruit Institute builds on this vision through the Regenerative Organic Breadfruit Agroforestry (ROBA) demonstration in Lāwaʻi Valley's McBryde Garden. Since August 2017, this two-acre agroforest has showcased the power of small-scale, sustainable food systems, producing more than 50,000 pounds of produce for staff and local food banks. ROBA stands as a living model of how agroforestry principles can foster food security, promote ecological health, and support biocultural connections. By empowering individuals to grow breadfruit within thriving agroforests, the Breadfruit Institute is working to inspire a future where regenerative food systems flourish once again in our communities.

GROW ALOHA: EXPANDING ROOTS STATEWIDE

In March of 2024, NTBG built on the legacy of plant adoption programs like Tree of Life-Grow ʻUlu and with the Molokaʻi Land Trust launched Grow Aloha, a monthly giveaway series designed to deepen relationships between Hawaiʻi residents and Hawaiian plants. The program places our community at the heart of biocultural restoration efforts, offering native plants and heritage crops that are ecologically vital and culturally significant. "How to grow" videos and a Grow Aloha podcast episode (available on Spotify) for each plant inspires horticultural success and stronger connections with these cherished plants. So far, over 2,000 plants have been adopted representing 40 species and 60 zip codes across Hawaiʻi.

This year, Grow Aloha has gone statewide as part of Hawaiʻi's Year of Our Community Forests campaign. Bishop Museum, Maui Nui Botanical Gardens, and Amy Greenwell Ethnobotanical Garden have joined Grow Aloha, offering adoption locations on nearly every major island. By expanding the program, we are encouraging more people to build up their relationship with Hawaiian plants and support the biocultural restoration of our built environment.

KAMPONG'S LIVING LABORATORY OF FOOD FORESTS

At The Kampong, our Miami garden, community forestry thrives in delicious and innovative ways, continuing a legacy of tropical crop exploration., Once home to Dr. David Fairchild, a plant explorer for the United States Department of Agriculture, The Kampong has long been a hub for introducing tropical crops to American diets. Fairchild brought cultivars of mango, avocado, dates, oranges, and many more to the U.S., naming his home "The Kampong," inspired by traditional Malaysian villages he encountered during his expeditions. These kampongs often feature rich food forests, where layers of edible, medicinal, and utilitarian plants grow together, sustaining daily life and cultivating a generational connection with the land.

Today, The Kampong's Food Forest exhibit brings this concept to life in South Florida, integrating ecological principles with community needs. This living system produces fresh, nutritious crops using a multi-layered approach combining a canopy of edible fruit trees with a vibrant undergrowth of perennial herbs, greens, and vegetables. Harvests are donated to the local food pantries and the community.

PHOTO BY JON LETMAN (TOP), NEAL UNO (CENTER), KATRINA MORRIS (BOTTOM)

This initiative demonstrates how any space—regardless of size—can contribute to a community forest. As Nina Jungman, operations manager at The Kampong explains, "A food forest copies the structure and function of a natural forest, but everything from the ground up is edible. It's not about the size but the intention—layered systems that serve people and our shared ecosystems." Drawing inspiration from local food forests, which are celebrated for their utility and resilience, The Kampong envisions expanding into container gardening and creating accessible designs for urban spaces, hoping to inspire visitors to create food forests even in the smallest areas.

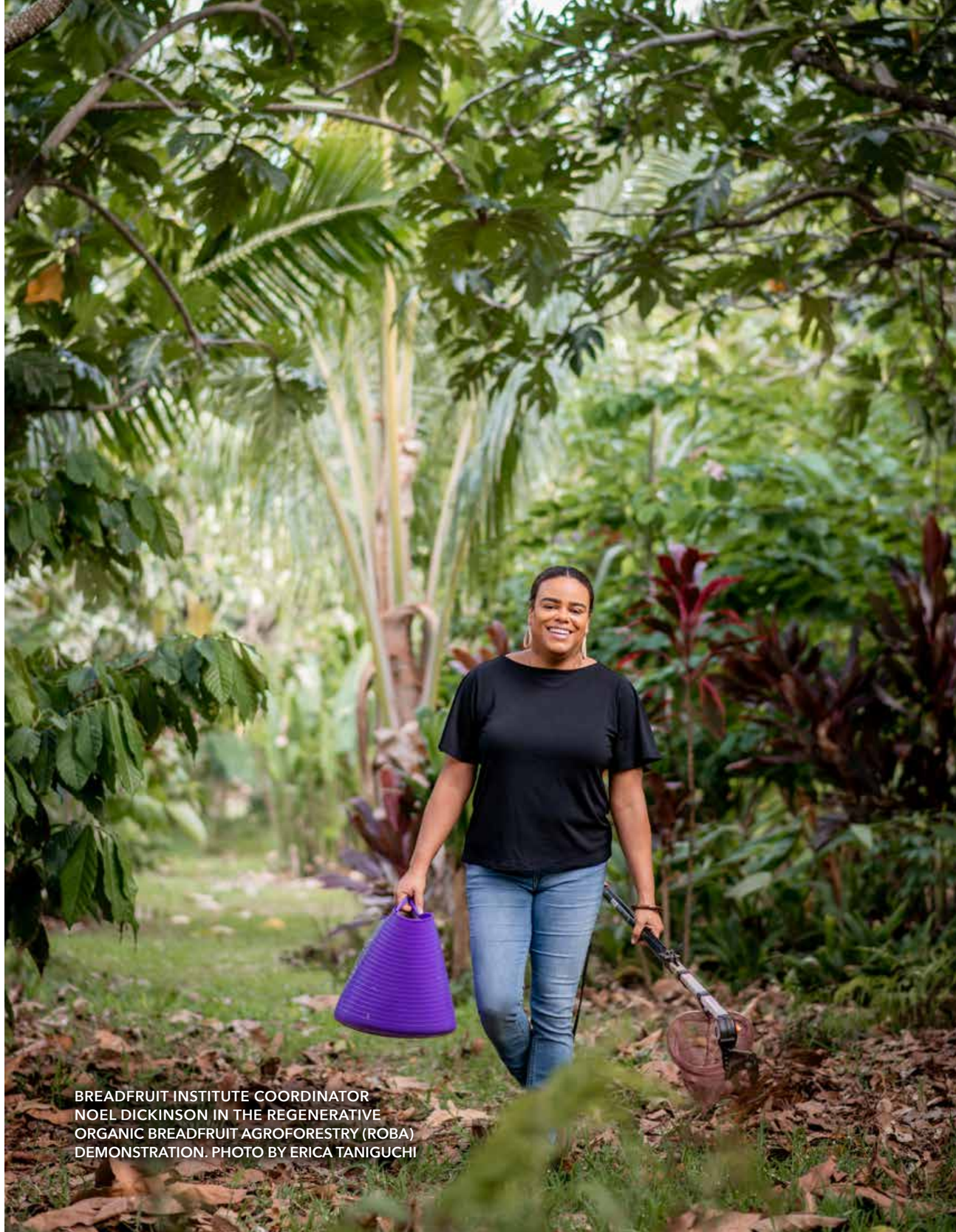
The Kampong's Food Forest serves as a place where urban communities can connect with plants. As Nina puts it, "You may say you don't care about plants, but I'm 100% certain you care about what you eat." The Kampong is introducing students to the power of edible landscapes through K-12 education programs, while collaborations with the International Center for Tropical Botany at The Kampong explore culturally significant crops such as Haitian basket vine. By reconnecting people to the origins of their food, The Kampong continues its commitment to plant exploration and education, proving that caring for plants means caring for ecosystems, communities, and our shared future.

PRESERVING CULTURAL CONNECTIONS AT LIMAHULI AND KAHANU

NTBG's Limahuli and Kahanu preserves offer compelling examples of how conservation and cultural perpetuation support one another. These profound places safeguard Hawaiian biodiversity and culture. By engaging community members in restoration efforts—offering access to ancestral places and plants—these preserves help sustain the inextricable connections between people, plants, and ʻāina.

At Limahuli, biocultural conservation initiatives focus on the bonds woven between people and plants, including species like olonā, the strongest plant fiber in the world, and pāpala, used in famed fire-brand ceremonies. Spanning over 1,000 acres, the Limahuli Preserve is stewarded as an ahupuaʻa—a traditional Hawaiian land division extending from ridge to reef. The ahupuaʻa land management practice and perspective is carried out in the footprint of our team's Hawaiian ancestors, and reflects the health of the watershed.

KUPU INTERNS WORKING IN THE KAHANU PRESERVE. PHOTO BY JOCELYN HUEU



BREADFRUIT INSTITUTE COORDINATOR NOEL DICKINSON IN THE REGENERATIVE ORGANIC BREADFRUIT AGROFORESTRY (ROBA) DEMONSTRATION. PHOTO BY ERICA TANIGUCHI

THE REGENERATIVE ORGANIC BREADFRUIT AGROFORESTRY (ROBA) DEMONSTRATION IS A MODEL OF LOCAL FOOD SECURITY. PHOTO BY NEAL UNO

Kahanu Preserve, home to one of Hawai'i's few remaining coastal hala forests, is both a refuge for native plants and a space for perpetuating traditional practices. Biocultural restoration efforts in the preserve enhance the forest's ecological role while fostering cultural connections, demonstrating how community forestry can integrate cultural traditions with ecological resilience. In 2024, our teams completed comprehensive botanical surveys, enabling staff and partners to better understand the preserve's biodiversity, prioritize areas in need of attention, and document the rich natural resources along the coastline. Through the iNaturalist platform, NTBG is sharing findings from these surveys, inviting the broader community to virtually explore this vibrant ecosystem.

THE FUTURE OF COMMUNITY FORESTS

As Hawai'i celebrates the *Year of Our Community Forests*, NTBG envisions a future where these spaces are more abundant, accessible, and inclusive. From expanding edible canopies in urban neighborhoods to restoring native ecosystems in our preserves, the underlying ethos of community forestry offers a path toward resilience and renewal. It invites all of us to reimagine our relationship with plants—not just as resources to be used but as partners in creating a thriving, sustainable world.

READ AND SHARE ONLINE

red listed

The International Union for Conservation of Nature (IUCN) publishes the online resource, The IUCN Red List of Threatened Species, ranking taxa (species, subspecies, or varieties) in one of nine categories from 'Not Evaluated' to 'Extinct'. The Red List is an invaluable tool for not only scientists, educators and policy makers, but for anyone seeking a better understanding of the conservation status of plants and animals around the world.

In recent years, conservation agencies, institutions, and organizations including NTBG have increased efforts to assess the nearly 1,400 native plant taxa in Hawai'i. To date, over half have been assessed, reviewed, and published on the Red List, adding to the more than 73,500 plant taxa published through the latest update of the Red List worldwide. In 2021, NTBG scientists completed assessments of all Kaua'i single-island endemic vascular plants (currently at least 256 species) and even more recently, collaborated with conservation partners to complete assessments for all of Hawai'i's native trees.

NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENDANGERED	EXTINCT IN THE WILD	EXTINCT
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PHOTO BY DON DRAKE

Species: Hāhā or 'ōhā wai (*Clermontia fauriei)* Campanulaceae

IUCN RED LIST CATEGORY: ENDANGERED (EN)

Clermontia, a genus endemic to Hawai'i comprised of 32 taxa, is one of six genera that make up the endemic Hawaiian lobeliads. *Clermontia fauriei* is the only species of this genus that occurs on Kaua'i. It was also known from O'ahu but has not been observed in many years. In the wild, *C. fauriei* grows terrestrially or epiphytically as a shrub or tree reaching two to seven meters in height. It has beautiful greenish or purplish flowers that are highly recurved, with the end of the flower tip sometimes nearly touching the flower base. The ripe, orange fruits resemble small pumpkins. The total population is estimated to be around 35,000 individuals among 12 subpopulations, all of which occur on Kaua'i. Threats include pigs, goats, and rats, as well as a decline or complete loss of native pollinators.

Working with scientists from the University of Hawai'i at Mānoa, NTBG researchers helped conduct floral visitor observations of *C. fauriei* in the wild in 2023 and 2024, in the same area observations had been conducted 20 years prior. Unfortunately, we found a drastic decline in native bird visitation over this time span, coinciding with documented precipitous declines in native forest birds. We recorded no floral visits in 2024. This lack of visitation and pollination severely limits the species' ability to reproduce. Although self-pollination appears to provide reproductive assurance, it will likely lead to inbreeding overtime, which could eventually result in population declines and species extinction on Kaua'i as well. Ex situ conservation for this species is challenging because seeds do not last very long in storage.

—Dr. Seana Walsh, Conservation Scientist and Curator of Living Collections

garden sprouts

News from around the Garden

PHOTO BY NINA JUNGMAN

THE KAMPONG PROVIDES A 'PLACCE' FOR CLIMATE CHANGE EDUCATION

The Kampong has been selected to be part of the Plants and Climate Change Education (PLACCE) cohort, an initiative of the United States Botanic Garden and the American Public Gardens Association. Funding and collaboration in this peer learning group will enable The Kampong to engage K-12 students and teachers through Miami-Dade County public school field trips, providing experiential learning opportunities focused on the effects of salt intrusion and heat on plants and people.

The Kampong will use four demonstration plots for plant-focused climate change education consistent with state education standards in multiple subjects. One plot will be located in The Kampong's mangrove preserve, which hosts all of Florida's native mangrove species. Unlike most urban trees, mangroves are uniquely adapted to thrive in salty or brackish waters and are vital for coastal protection. At a higher elevation (about 15 ft), a comparison plot will help students understand the effects of saltwater intrusion.

Other plots will be in The Kampong food forest where students can study how rising temperatures can affect agricultural ecosystems and access to food. Food forests are a time-tested system for producing food from the understory to the canopy while replenishing soil nutrients, saving water, and supporting wildlife. There are thousands of edible plant species in the world, but today most food comes from just a handful of crops. Studying and supporting greater crop diversity can increase food security in the face of a changing climate.

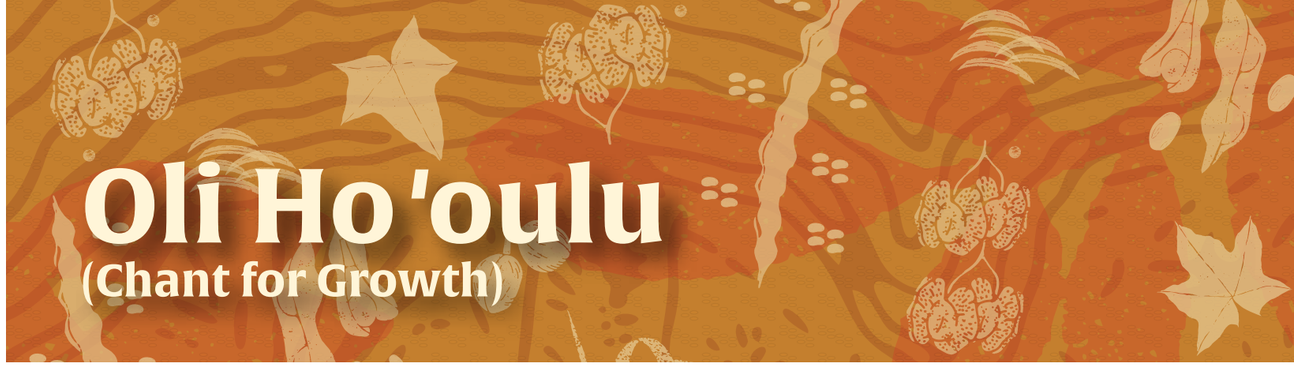
PHOTO BY BEN NYBERG

MAMBA FINDS ANOTHER RARE POPULATION

Wahine noho kula *(Isodendrion pyrifolium)* is a Critically Endangered Hawaiian endemic species in the violet family that was once known throughout the Hawaiian Islands, including Niʻihau, Molokaʻi, and Lānaʻi. Collected for botanical research in 1870, Wahine noho kula (lit. woman dwelling on the plain) vanished suddenly and was presumed extinct for over a century. In 1991, it was rediscovered when four individual plants were found growing on land slated for residential development on Hawaiʻi Island.

In 2015, surveys conducted in the Waiʻanae mountains of west Oʻahu uncovered a population of approximately 60 individuals growing on dry cliffs. In 2022, NTBG's drone team was conducting surveys in Waimea Canyon in the same area where the recently described *Schiedea waiahuluensis* was discovered when they spotted a plant resembling Wahine Noho Kula. Using a remotely controlled robotic arm known as the Mamba, the team successfully collected a sample of plant material and were able to confirm it was indeed the rare violet, the first recorded occurrence of this species on Kauaʻi.

Subsequent drone surveys have located and identified four subpopulations totaling nearly 100 individual plants on Kauaʻi, making it the largest known population of this species. Once again, the combination of old-fashioned botanical field work and cutting-edge technology has provided renewed hope for discovering and rediscovering rare plants and saving endemic species in some of the world's most inaccessible cliff habitat.



Oli Hoʻoulu
(Chant for Growth)

Composed by Dr. Taupōuri Tangarō

E ke Akua nui, Akua iki,	Great forces, small forces,
Akua loa, Akua poko,	Expansive energies, concentrated energies,
E wehe ka lani! **(Kākou) Wehea!**	Open the heavens (We) Open!
Kauhola ka lani! **(Kākou) Kauhola ʻia**	Unfold the heavens (We) Unfold
Wāwahi ka lani! **(Kākou) Wāwahi ʻia**	Break open the heavens (We) Break open
E Kūlanihākoʻi kau maila i luna e hū!	Kūlanihākoʻi, let the waters swell and pour from above!
A ua maila ua	As the rain falls, raining
A kupu maila kupu	That causes sprouting, sprouting
A muʻo maila muʻo	That forms buds, budding
A liko maila liko	That send leaves unfurling, leafing
A lau maila lau	That forms mature leaves, leaves
A lālā maila lālā	That sends branches, branching
A kumu maila kumu	That establishes a trunk, a trunk
A kumu paʻa hina ʻole ē	A tree rooted firm and unshaken
E hoʻoulu mai, E hoʻoulu mai	Bring forth growth, bring forth growth
A ulu maila ē	Let life flourish
A he leo wale nō ē	My intention is given voice

This oli is a planting chant, calling upon the elements to invoke growth. It asks Kūlanihākoʻi, the celestial water source, to overflow with moisture—essential for the success of planting. The chant then follows the natural cycle of plant growth, symbolizing the stages of life: from the first drops of rain to the sprouting seed, the unfolding leaves, and the strengthening of the trunk until the plant is firmly rooted and unshaken. This mirrors not only the physical process of planting but also the deeper commitment to nurturing what is sacred.

Over the next five years, NTBG will look to planting oli for inspiration as we strive to deepen our understanding and commitment to biocultural conservation and Indigenous knowledge systems. Each year will be guided by a phase in the growth cycle: hua (seed), kupu (sprout), lau (leaf), lālā (branch), and pua (flower). 2025 is the year of the hua, celebrated in the above artwork by Keanu Wilson. Join us as we share stories and reflect on the lessons that hua can teach us about our interconnectedness in the web of life.

an eye on plants

SELECT SPECIES IN FOCUS

Kukui (*Aleurites moluccanus*)

If you stand on the crumbly, red rim of Kaua'i's Waimea Canyon and gaze into the distance, below you will see ancient valleys and gorges cut deeply into the island. Much of the arid ochre-red canyon is cloaked in dark green native and mixed forests. Look closely, though, and you'll notice patches of lighter shades of silvery green foliage that appear to flow like vegetative lava, as if spilling from the folds and spires of the island's rugged interior.

The scenery is breathtaking but in this respect, Kaua'i is not unique. The same silvery green trees growing in patches and rivulets are found on all the large Hawaiian Islands in forests and mountains and in great abundance in the most ordinary of human landscapes—planted in residential neighborhoods, on golf courses, and next to commercial and government buildings. This most common of trees, however, is treasured as a symbol of enlightenment, a source of illumination, and is Hawai'i's official state tree.

The tree, of course, is kukui. While not native to Hawai'i, kukui or candlenut as it's known elsewhere, naturalized and has long been an integral part of the Hawaiian landscape, a familiar form that softens its surroundings, and lends warmth wherever it grows.

Examine the newly minted Native American one dollar coin honoring highly respected Hawaiian 'ōiwi (Native) scholar and writer Mary Kawena Pukui and you'll notice she wears a lei of kukui. Beside her is the phrase: Nānā I Ke Kumu ("Look to the source").

In his popular field guide *Plants of the Canoe People*, former NTBG ethnobotanist Arthur Whistler, described myriad uses for kukui throughout the Pacific including for making dyes for tattooing and decorating kapa (bark cloth). Kukui bark, Whistler wrote, was used for waterproofing cloth and painting canoes while other parts of the tree have uses that are medicinal, cosmetic, decorative and can be used as timber or toys, with oil-filled nuts that are edible (in small amounts), acting as a laxative (in larger doses).

It is the kernel of the nut (*"technically a seed, not a nut,"* Whistler wrote) for which kukui is favored. Ridged, hard, and black when polished, the walnut-sized, kukui nuts contain oil that can be burned in a variety of ways, thus it is called candlenut and seen as a symbol of enlightenment. NTBG's senior research botanist Dr. David Lorence, agrees with Whistler, saying that the kukui nut is more of a drupe-like seed found inside a thick leather-like outer coat. Those "nuts," when they fall, easily self-germinate and spread, indicating the presence of humans or animals.

A member of Euphorbiaceae (spurge family) native to the Indo-Malay region, kukui's scientific name of the genus *Aleurites* refers to aleurone, meaning flour or meal, while the species *moluccanus* is a nod to the Maluku Islands between Indonesia's Sulawesi and West Papua where early collections were made.

Candlenut also grows in Australia where Dave Lorence and herbarium curator Tim Flynn collected seeds from a tree in the rainforests near Lake Euramoo in northern Queensland in 1992. Upon their return, they planted seeds in the Lāwa'i Valley, one of which has grown into a massive tree scarcely recognizable as kukui as it towers high above the Spice of Life trail in McBryde Garden.

Shorter, more familiar Hawaiian varieties of kukui have been planted on the campus of Kaua'i's Island School where NTBG's long-time education partner and Hawaiian studies kumu (teacher) Sabra Kauka appreciates watching Hawai'i's tree of enlightenment grow alongside her students. Sabra describes how she and her kids collect kukui leaves, tying them together into a chain-like garland called a lei hīpu'u. She also teaches her students how to roast and light nuts like candles, burning on bamboo skewers. Kukui nuts, Sabra explains, can be baked and crushed, leaving the oil to rise for use in traditional healing and lomilomi massage.

Hiking in Waimea Canyon, Sabra is delighted to look down, deep into the valleys where, she says, the tell-tale silvery green patches of kukui are a sign of fresh water and suggest there were probably villages or habitation sights nearby.

"Kukui is so important," says Sabra, "there are lessons in those trees."

PHOTO BY ERICA TANIGUCHI

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REDUCE
REUSE
RECYCLE

PRITCHARDIA WOODII IS AN EXAMPLE OF THE ADAPTIVE RADIATION THAT HAS RESULTED IN TWO DOZEN SPECIES OF LOULU PALMS KNOWN ONLY FROM THE HAWAIIAN ISLANDS. READ MORE ON PAGE 6. PHOTO BY ZACHARY PEZZILLO