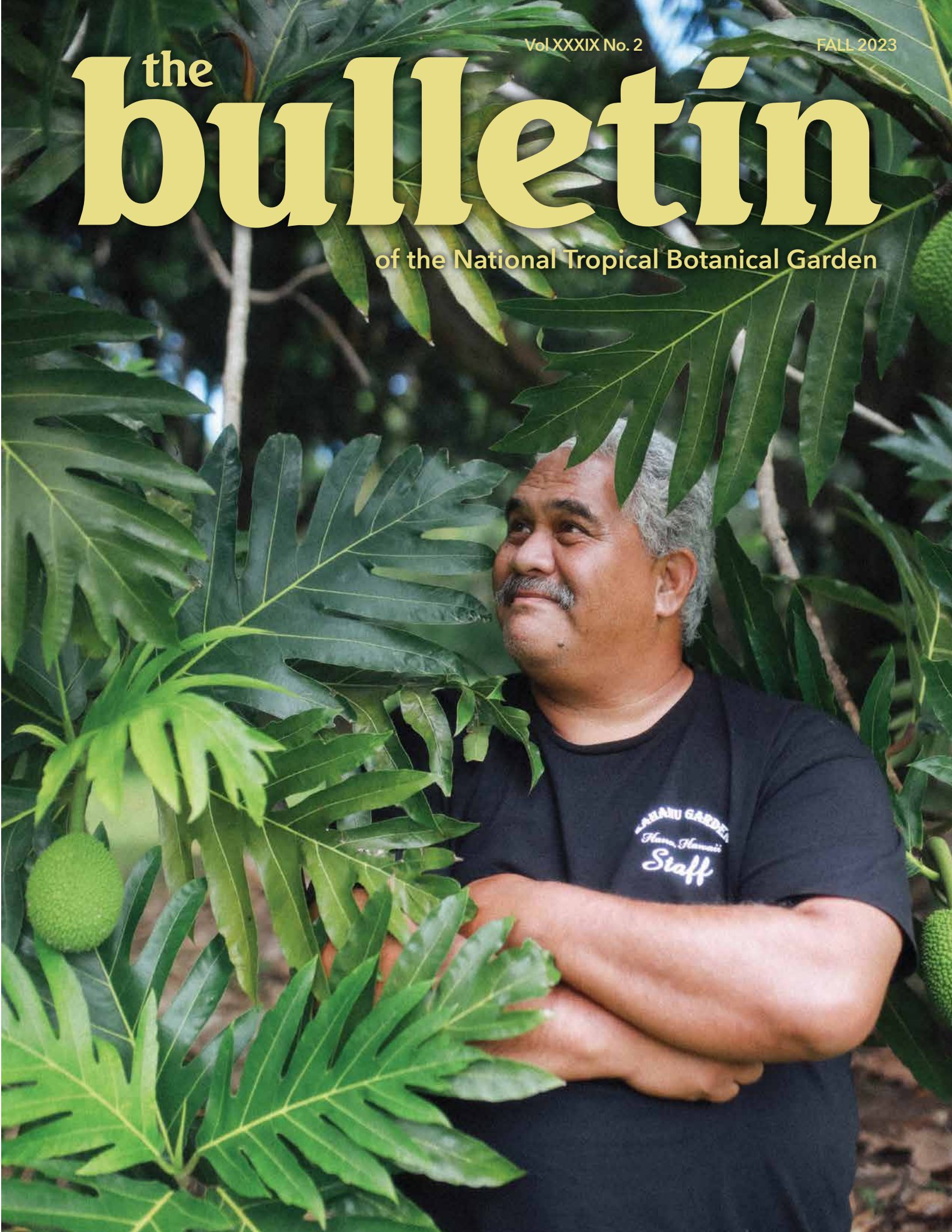


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FALL 2023

the bulletin

of the National Tropical Botanical Garden





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ON THE COVER

Kama Helekahi, a horticulture technician at Kahanu Garden and Preserve on Maui, stands beside one of the breadfruit trees in his care. Read more about biocultural conservation and the relationship between plants, people, and places on page 6. Photo by Shandelle Nakanelua

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.

We encourage you to share this publication with your family and friends. If your household is receiving more than one copy and you wish to receive only one, please inform our Development Office at our national headquarters at: members@ntbg.org.

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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.



Vision

A sustainable future where flourishing relationships are restored between plants, people, and places

Mission

To enrich life by perpetuating tropical plants, ecosystems, and cultural heritage

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Message from the CEO and Director



Just as this issue of the Bulletin was being completed, disaster struck Maui. The terrible loss and suffering in Lahaina and other communities is almost impossible to convey with mere words. We are heartbroken and express our profound sadness and solidarity with all whose lives have been forever changed. In a close-knit community like Hawai'i, we are all in this together and NTBG is committed to supporting recovery over the long term so that we can help hasten the healing and revival of Maui.

What does autumn mean to you? For me, autumn is like reaching the top of a mountain – it's a vantage point from which I can look back and survey ground covered in the first part of the year. It's also a place from which I can look ahead to the end of the year and those that follow.

This fall, from my vantage point, the view is clear and impressive. Our achievements are outstanding, and the critical work that lies before us has come into sharp focus. In the first half of the year, after an exhaustive and inclusive process, NTBG has begun to implement our five-year Strategic Plan (2023-2027).

With a streamlined mission statement (“*To enrich life by perpetuating tropical plants, ecosystems, and cultural heritage.*”), NTBG embraces a plan based on five strategic priorities which will, among other things, center our efforts around biocultural conservation and science, horticulture, and education.

We have also recommitted ourselves to incorporating Indigenous culture and cutting-edge technology into the rigorous pursuit of lab and field-based science, in situ and ex situ conservation, plant discovery, and horticultural excellence. At the same time, we honor and learn from our own communities, Indigenous knowledge, and the wisdom and experience gained and shared with our partners and collaborators.

NTBG remains focused on saving plants threatened by extinction, restoring ecosystems, preserving tropical crop diversity, and biocultural conservation. Our work is predicated on ensuring NTBG is a sound and sustainable organization where our staff, volunteers, and Board of Trustees and Fellows can achieve their full potential.

In this issue of The Bulletin, I invite you to read more about our work, and the causes to which we – and I am sure you too – are so passionately committed. I also encourage you to review our new Strategic plan which can be found on our website (use the QR code below).

As we come to the end of the year, we look ahead with anticipation to 2024 which, on August 19, will mark the 60th anniversary of our founding. NTBG is what I call a “forever organization.” Our values are universal, our goals are timeless, and our vision is critical to helping create a sustainable future where flourishing relationships are restored between plants, people, and places.

This autumn, I am encouraged by what I see happening at NTBG, elevated by your support, and certain that together we will continue to make a positive difference.

With gratitude and aloha,

Janet Mayfield
 Chief Executive Officer and Director

READ AND SHARE OUR STRATEGIC PLAN



A special thank you to our new Fellows and Members!

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

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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JoAnn and James Carvalho
Cheyanne and Steve Caspary

Kate Catron
Chris Chernof
Carina Chiang
Gerald Chudy
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Jeannine and John-Marc Clark
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Penelope Dam and Kent Autrey

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Polly DeAngulo
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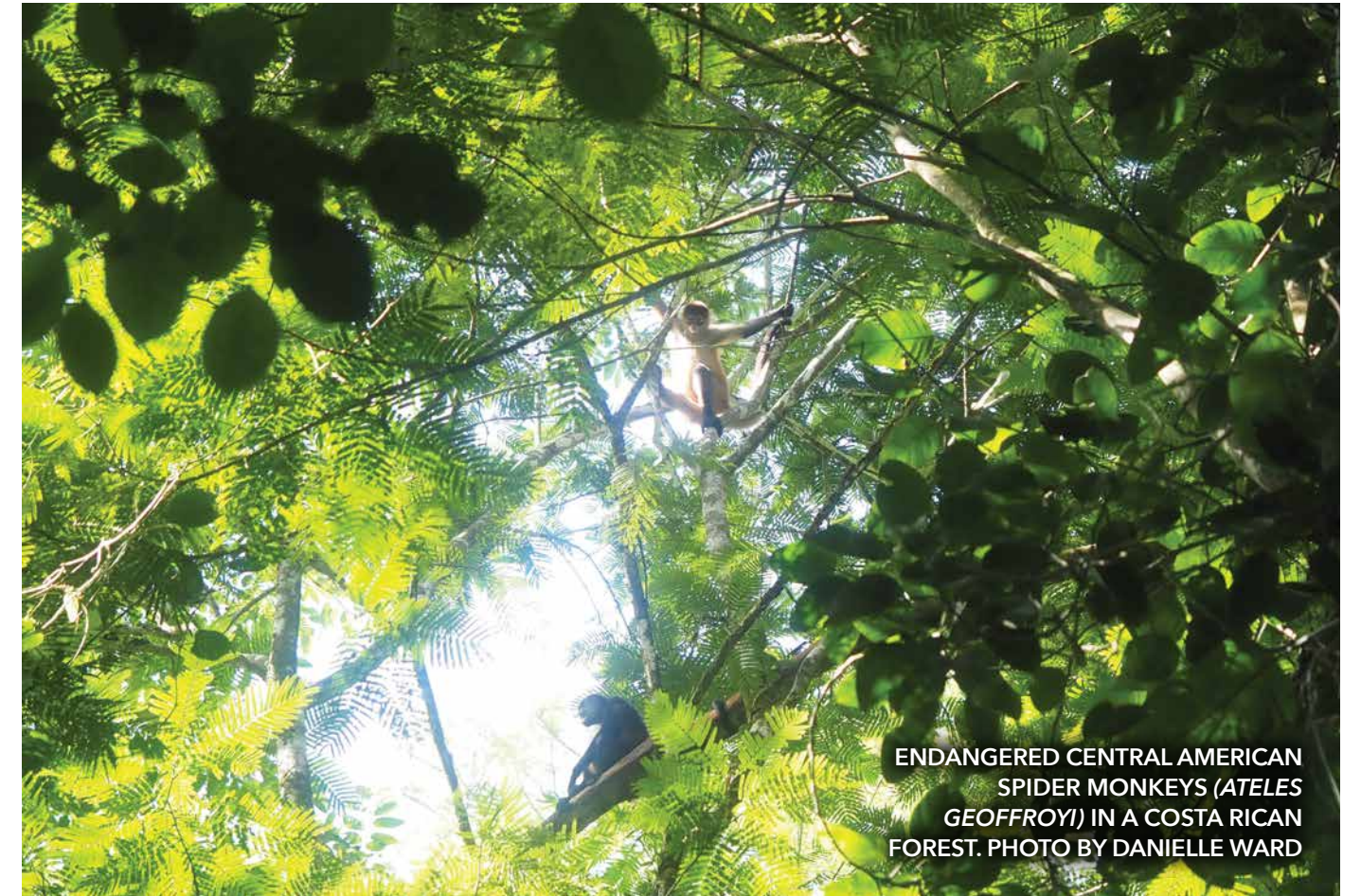
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Jessica and Tom Katzeek
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Jackie King
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Susan and Michael Liuzzi
Tina Lovejoy
Scott Lundgren and Elliott Key
Kon Malgorzata Joanna



ENDANGERED CENTRAL AMERICAN SPIDER MONKEYS (*ATELES GEOFFROYI*) IN A COSTA RICAN FOREST. PHOTO BY DANIELLE WARD

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BIOCULTURAL CONSERVATION

at NTBG *Defining our approach to restoring relationships between plants, people, and places*



At its heart, biocultural conservation recognizes the inseparable bonds between humanity and nature. Many Indigenous cultures share concepts of kinship across species, elements, and places. In Hawai‘i, the idea of ‘ohana (family) transcends humans. For example, kalo (taro) is the older brother of k̄naka (Hawaiians). Native Hawaiian scientist Keolu Fox says, “when I say that the land is my ancestor, that is a scientific statement.”

Anishinaabe writer Patty Krawoc shares the phrase “nii’kinaaganaa,” encapsulating the belief that “the world is alive with beings that are other than human, and we are all related with responsibilities to each other.”

Biocultural conservation accounts for these relationships, honoring the familial bonds that Indigenous communities maintain with biodiversity, integrating the life-sustaining, ecological knowledge cultivated over generations as they care for the land.

Debra Haaland, the first Native American U.S. secretary of interior, said, “Indigenous knowledge must be at the center of our conservation efforts, as we restore a cultural balance to the lands and waters that sustain us.” This call to action is echoed by the United Nations, the International Union for Conservation of Nature, and other partners.

Biocultural conservation integrates communities in collective stewardship and decision-making. It aims to protect not only plants and physical landscapes, but also cultural heritage, languages, practices, and social systems that are connected to the health of our shared environment. In biocultural conservation, our relationship with plants and places deeply matters. Perceiving the reciprocity of this relationship can lead to lasting, transformative change.

At NTBG our mission to perpetuate plants, tropical ecosystems, and cultural heritage is rooted in biocultural conservation. Below are six examples of what this concept means to our staff. Each has their own way of expressing biocultural conservation. As you read, we hope you’ll consider what plants mean to you and, conversely, what you mean to them.

—David Bryant, Director of Communications



LIMAHULI GARDEN VISITOR PROGRAM MANAGER LAHELA CHANDLER CORREA. PHOTO BY ERICA TANIGUCHI (PG. 6). KAHANU GARDEN AND PRESERVE DIRECTOR MIKE OPGENORTH. PHOTO BY SHANDELLE NAKANELUA (PG. 7)



SCIENCE AND CONSERVATION DIRECTOR
NINA RØNSTED. PHOTO BY JON LETMAN

marine biocultural conservation models based on Indigenous knowledge and long-term commitments to sustain resources and ecosystems. These offer an alternative to the polarizing all-or-nothing models of commercial fisheries vs. marine reserves.

There are countless other examples around the world that illustrate how, through a combination of local, national, and international legislation and initiatives, biocultural conservation honors the intrinsic relationships between nature and humanity.

Similarly, at NTBG, we are harnessing our experience and expertise to build conservation programs that align with cultural values and community priorities while enriching life through the perpetuation of tropical plants, ecosystems, and cultural heritage.

– *Dr. Nina Rønsted, Director of Science and Conservation*



I see biocultural conservation as a way of expressing the intrinsic relationship between people, places, culture, and science. It’s a way of acknowledging that we practice science in its Western form, but there’s so much more to our work than that. At its core, these are deep connections and relationships with plants that have existed for generations.

Often what we find is that the ‘ike (knowledge) we have of plants from our ancestors aligns with scientific research and findings. Biocultural conservation is the way we’ve come to express that science has such deep meaning here in Hawai‘i because of the ‘ike from our kupuna (elders) and the deep relationships we share with plants.

– *Lei Wann, Director of Limahuli Garden and Preserve*

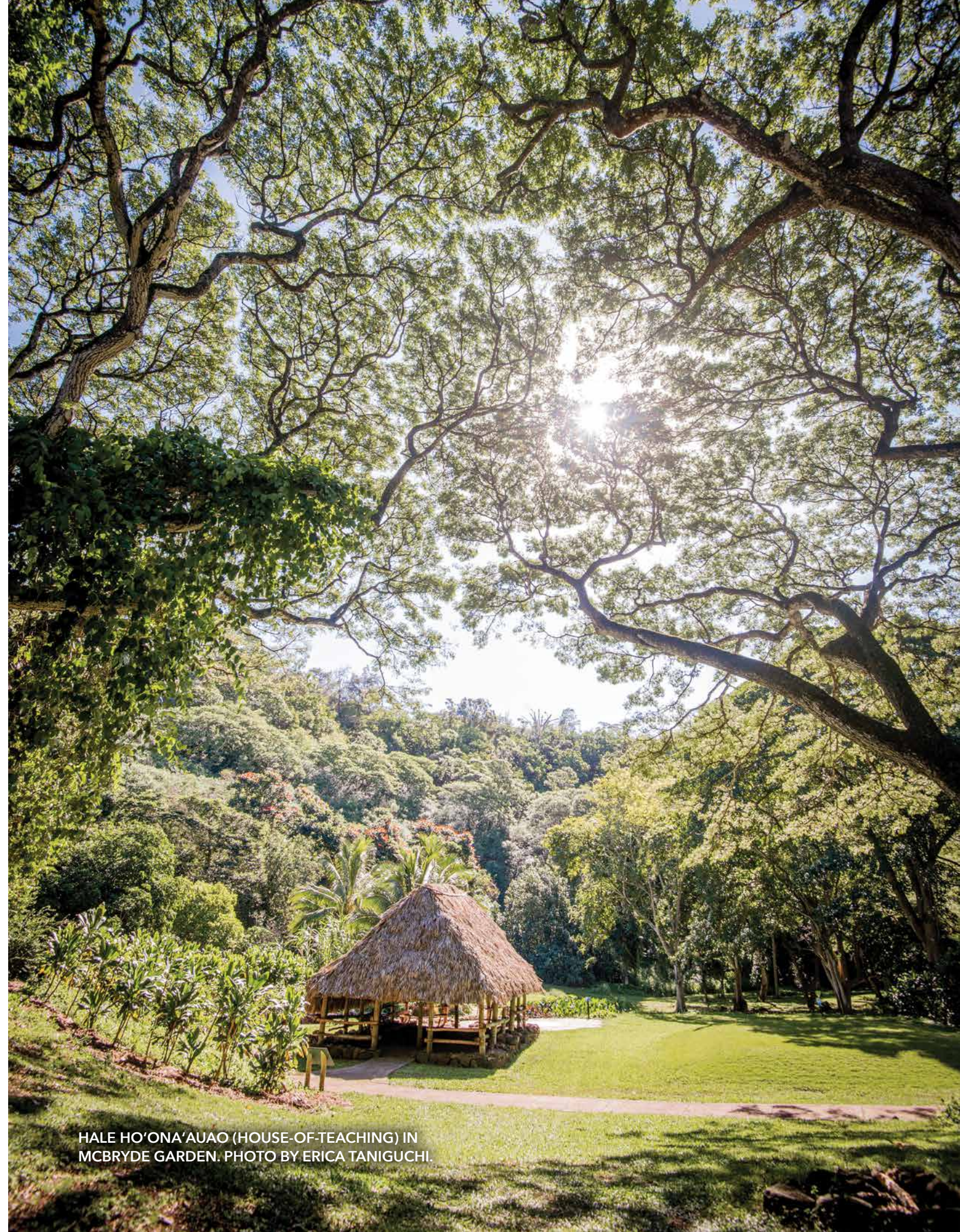


On the global stage, biocultural conservation can be seen in international agreements such as the Kunming-Montreal Global Biodiversity Framework, signed by 188 countries in 2023. The framework’s vision is “living in harmony with nature where, by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people.”

This vision puts the relationships between people and nature at the center of solutions to ensure the best possible data, knowledge, and practices contribute to effective biocultural conservation.

To cite one example, in Colombia, dry forests are categorized as critically endangered ecosystems due to extensive clearing for cattle ranching and agriculture. To address this, a series of forest plots have been established in collaboration with local communities, that not only measure scientific biodiversity indicators, but also use community input to identify issues related to deforestation, biodiversity use, and valuation of ecosystem services. The hope is to find conservation solutions that satisfy both ecosystem protection and local societal needs.

In Canada and Aotearoa (New Zealand), negotiated settlements of Indigenous rights in fisheries management are creating sustainable



HALE HO’ONA’AUAO (HOUSE-OF-TEACHING) IN
MCBRYDE GARDEN. PHOTO BY ERICA TANIGUCHI.

NTBG's

only garden outside of Hawai'i, The Kampong, is in Miami, Florida. Our name, Kampong, can be translated as "village." In this spirit, we use this space to honor the Indigenous communities that once lived here while celebrating the significance of our living collections to the rich tapestry of immigrant communities that make up Miami today.

At The Kampong, biocultural conservation is influenced by those who resided here before us. This includes Dr. Eleanor Galt Simmons, one of Dade County's first licensed female physicians whose office and stable are on the grounds of The Kampong. From the 1890s, Dr. Simmons treated patients, making house calls by horse, buggy, and boat. Today we are planning a guided visitor experience that will interpret medicinal plants used by Dr. Simmons as well as by Native Miccosukee and Seminole peoples.

We also tell the story of plants collected by famed botanist Dr. David Fairchild who introduced thousands of edible and ornamental plants to the United States. David Fairchild named this site The Kampong in 1916.

Another key figure at The Kampong was Catherine "Kay" Hauberg Sweeney, an intrepid and impassioned plant collector who, with her husband, purchased this property in 1963. Mrs. Sweeney devoted her life to ensuring The Kampong remained a refuge for tropical plants and plant enthusiasts. The commitment of these early inhabitants laid the foundation for The Kampong today.



BRIAN SIDOTI, DIRECTOR OF THE KAMPONG.
PHOTO BY ALEJANDRA LIBERTAD

Looking ahead, we continue to add native plants to our collections. In collaboration with faculty of the International Center for Tropical Botany at The Kampong, our pursuit of plant research, public outreach, and education, is rooted in biocultural conservation. We remain focused on three themes: preserving tropical plant diversity; conservation and management of threatened tropical species and habitats; and fostering an understanding of tropical plant-based goods and services such as food, fuel, fiber, and medicine.

—Dr. Brian Sidoti, Director of The Kampong

At Kahanu Garden and Preserve, biocultural conservation teaches us the critical role humans play in the survival of native ecosystems. On the coast of East Maui, tradewinds deliver sheets of Hāna's famous 'ua kea (white rain). Inside Kahanu Preserve's hala (*Pandanus tectorius*) forest, the trees provide shelter beneath its canopy. There we can marvel at the tree's fruit which resembles pineapples arching from the end of branches. The space evokes memories of the people who once used material from these trees to create thatched mats, hats, sails, and lei. Even the tree's hīnano (male flower) was considered an aphrodisiac. Hala's stilt-like roots also prevent erosion along the rocky cliffs where they grow.

Coastal hala forests, like those found in the Kahanu Preserve, have been dwindling across Hawai'i as a result of invasive species and habitat lost to agriculture and development. An introduced scale insect attacks hala, as is evident by the powdery shells sucking life from its leaves. Highly invasive African tulip trees emerge and spread over the hala canopy where they disperse thousands of seeds.

The future of hala forests like those found at Kahanu Preserve is uncertain, but cultural practitioners seeking fresh plant material have the opportunity to remove invasive plants, perpetuating their own practices while helping save young hala trees and contributing to the long-term health of the forest.

This is the interdependence of biocultural conservation at Kahanu

Garden and Preserve. Without hala trees, cultural practices would almost certainly cease to exist. And without human stewards of the forest, the trees would also likely be lost. Through clearing invasive plants and supporting the growth of hala seedlings, we can perpetuate culture, preserve an ecosystem, and provide resources for future generations while protecting the island that protects us.

—Mike Opgenorth, Director of Kahanu Garden and Preserve



WEAVING HALA LEAVES FOR A PAPALE (HAT).
PHOTO BY SHANDELLE NAKANELUA



HALA (PANDANUS) AT KAHANU GARDEN.
PHOTO BY SEANA WALSH

Central to biocultural conservation is human culture and our relationship to the natural world. This connection inherently expands our conservation practices, values, and priorities. Biocultural conservation provides us with more sources of knowledge and expands the range of people who are enthusiastic and invested in our work.

Biocultural conservation guides nearly all we do at Limahuli Garden and Preserve. But often overlooked are defining personal experiences. This is what it feels like to me: the shade of young kukui (*Aleurites moluccana*) saplings serving as nurse trees in newly cleared restoration areas. It feels like the stickiness of hau (*Hibiscus tiliaceus*) branches being stripped for cordage. I hear it in voices raised in oli (chants) at the beginning of each workday, and in the bird cries of ua'u (*Pterodroma sandwichensis*) and 'a'o (*Puffinus newelli*) barking in the Upper Limahuli Preserve.

Biocultural conservation tastes like refreshing 'ohi'a 'ai (*Syzygium malaccense*) fruits plucked from the tree and Tahitian prawns fished from the stream. It is the weight of kōpiko (*Psychotria mariniiana*) branches and alaha'e (*Psydrax odorata*) collected for carving. Biocultural conservation maintains the ungrate fence, but also knows the names of the neighborhood hunters to call when you find a sign of pigs in the valley.

Biocultural conservation is not only theory; it is practice. It is action. It is listening, learning, striving, making mistakes, and trying again. Biocultural conservation is a lei formed from the interwoven strands of people, plants, and places which we are communally, perpetually weaving.

– Dr. Uma Nagendra, Conservation Operations Manager,
Limahuli Preserve

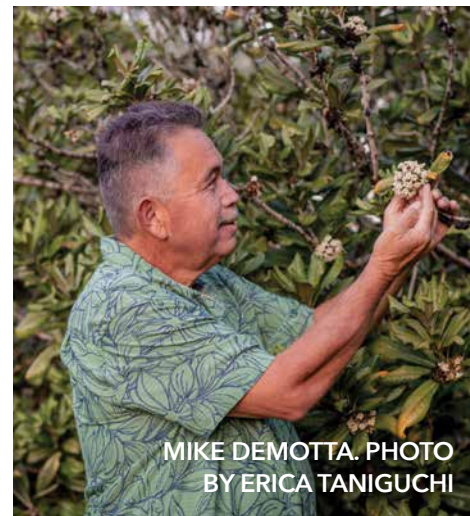
For me, an effective and meaningful biocultural conservation program at NTBG requires a full understanding of Hawaiian values, a Hawaiian world view, and my place in it. Kuleana (responsibility) and aloha 'āina (love of the land) are values that guide my decision-making process.

The first Hawaiians understood that their actions needed to be sustainable so their relationship with the natural world could enhance biodiversity and ecosystem function. Prior to contact with the west, Hawaiians saw the importance of native ecosystem function as kinolau (physical manifestation) of the kini akua (pantheon of gods). All elements of nature – water, earth, the ocean – were kinolau of major deities.

Living with these sacred elements demanded thoughtful actions and deification required Hawaiians to respect and care for nature in a way that benefited people and ecosystems. This enabled Hawaiians to successfully settle in these islands and support a large population without the negative impacts so common today.

We can be guided by these principles, integrating them into the management of our gardens and preserves in a way that mitigates the harm caused by our modern lifestyle. By embracing biocultural conservation, we can acknowledge what we need to change and identify traditional practices that, if revived, can help maintain ecosystem function. A full understanding of how we fit into nature is essential in rebuilding natural systems that are abundant and resilient.

– Mike DeMotta, Curator of Living Collections



MIKE DEMOTTA. PHOTO
BY ERICA TANIGUCHI

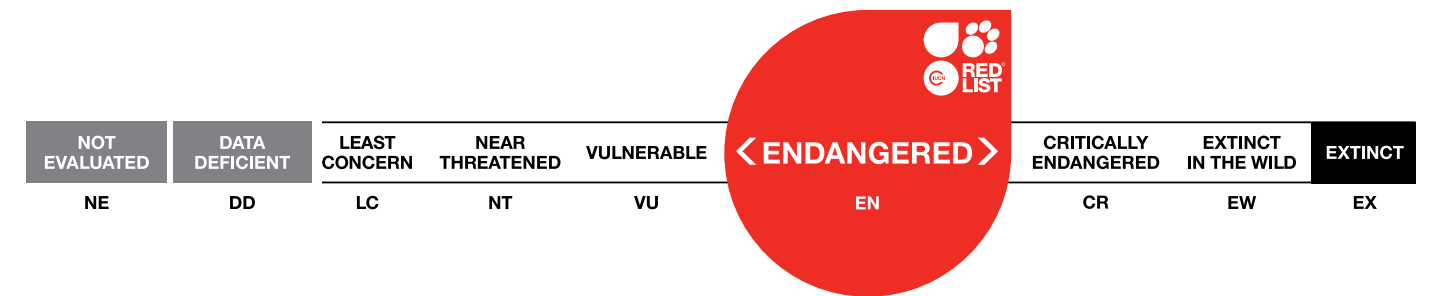


READ AND
SHARE ONLINE

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, nearly half have been assessed, reviewed, and published on the Red List, adding to the more than 62,000 plant taxa published through the latest update of the Red List worldwide.



Species: Koli'i (*Trematolobelia kauaiensis*) Campanulaceae

IUCN RED LIST CATEGORY: ENDANGERED (EN)



PHOTO BY KEN WOOD

Trematolobelia is one of the endemic genera of the Hawaiian lobeliads¹ that form the largest family of Hawaiian angiosperms. *Trematolobelia kauaiensis* (koli'i in Hawaiian) is one of eight Hawaiian *Trematolobelia* species but the only one found on Kaua'i. This single-island endemic tree grows in mesic to wet forests and bears flowers that are believed to have co-evolved with forest birds like the 'i'iwi whose long, curved beak is ideal for drinking nectar and facilitating pollination. An estimated 25,000 mature individuals remain, scattered among five subpopulations at elevations between 700 to 1,200 meters. Persistent threats include habitat degradation, pigs and rats, and competition by non-native invasive plants. Mature individuals, subpopulations, and suitable habitat continue to decline.

An analysis of seed storage potential revealed that *Trematolobelia* was the only genus of six Campanulaceae genera in Hawai'i with seeds exhibiting possible orthodox behavior meaning they are able to tolerate standard

seed storage protocols of drying and freezing. If koli'i seeds follow the same pattern, the species may be conserved ex situ using standard seed storage methods.

Although seeds germinate easily, propagation has been unsuccessful, primarily due to fungus attacks of seeds and seedlings. Recent propagating trials have increased survival rates and efforts to develop successful propagation protocols are ongoing. –Seana Walsh, Conservation Biologist



VISIT THE RED LIST
PROFILE HERE:

¹ Other endemic lobeliad genera include *Brighamia*, *Clermontia*, *Cyanea*, and *Delissea*

Reviving a Traditional Landscape in Limahuli Valley

BY JOSHUA DIEM, MALAMA AINA TECH II



NOAH KA'AUMOANA, MALAMA 'ĀINA SPECIALIST,
HARVESTING KALO IN LIMAHULI GARDEN.
PHOTO BY JOSHUA DIEM

Here, in Limahuli Valley, the mountains rise above the clouds, as though tethered to Earth by the roots and vines of a changing landscape, their black volcanic faces gazing out across the vast Pacific. Carved from basalt, the mountains stand as ancient warriors, abstract and muscular, as if shaped by a wild, surrealistic deity. Here, the pōhaku (stones) have names, stories, and characteristics as distinct as you or I.

As if chiseled by a sculptor, fallen stones populate the valley floor to form boulder fields. Rainwater from cloud forests – the wao akua¹– feeds the stream below, braiding its way to the ocean, splitting the valley into east and west. To navigate the 600-acres of the Lower Limahuli Preserve, imagination is perhaps your most essential companion.

I began my work as a field technician in the preserve. Uncovering the valley's rich history and enduring traditional practices propelled me towards my graduate studies in landscape architecture at Harvard University. What began as a series of inquisitive sketches of these ancient walls, evolved into three years of research for my design thesis. The objective was to uncover the archaeological framework of an indigenous agroecological system within Limahuli Valley, exploring how it can be revitalized and incorporated into broader restoration efforts. Doing so can exemplify a new standard of biocultural conservation. This project presents a vision for reinterpreting the valley's legacy through its stonework.

The site of my research is the 2.8 acre 'ilipa'a (agricultural homestead) built several centuries ago between the Limahuli Stream and the valley's western wall. Standing below Mauna Hou and Maunapulu'ō peaks, the site includes over one hundred interconnected lo'i (flooded terraces) once used for irrigating kalo² (taro).

The primary house site, positioned at the compound's midpoint, allowed its inhabitants to oversee water management and crop rotation. Assuming wetland crop yield was comparable to today, this agricultural system may have sustained a family unit of approximately 20-50 members. We are uncertain of the identity of the 'ohana (family) who once inhabited and nurtured the site or how they or their ancestors moved the stones. Whoever fed from this place, cared for the source of its wai (fresh water).

¹ O Wao akua refers specifically to a high elevation sacred realm of the gods

² *Colocasia esculenta*



REMNANT TERRACES COVERED IN VEGETATION (PG 18). JOSHUA TAKING NOTES IN THE LIMAHULI PRESERVE (PG 19). PHOTOS BY CLAIRE RAGOZZINO. DEPICTION OF NATIVE HAWAIIAN AND POLYNESIAN-INTRODUCED BOTANICAL DIVERSITY IN LIMAHULI VALLEY (PG. 19). ILLUSTRATION BY JOSHUA DIEM

Today, overgrown neke fern³ swamp hides the existence of the puna wai (fresh-water spring) that continues to seep from an opening in the valley wall. Channeled into the ‘auwai puhi (main irrigation ditch), gravity directs the flow of water, initially tracing its line along the base of the pali (cliff). The ditch crosses a small aqueduct-like structure and pools in a check dam. Finally, the water is distributed into the lo‘i kalo. When this landscape was actively cultivated, it must have evoked a profound sense of rhythm and connection.

This ‘ilipa‘a was likely inhabited until the mid-19th century when its abrupt abandonment may have been the result of sweeping changes in property tax laws throughout the Hawaiian Kingdom. These policies reflected the broader social, political, and economic changes in Hawai‘i during that time and left the valley without its stewards.

TAPESTRY OF ANCIENT LANDSCAPES

Walking into the Limahuli Preserve is like traveling through time. Step off the trail and you risk getting lost in a dense tangle of vegetation. All but hidden to the unfamiliar eye, the landscape is a dynamic expression of the interplay between people and their environment with remains of the terraces, irrigation channels, and house sites. Garden plots that once flourished now lie overgrown and hard to recognize.

³ *Cyclosorus interruptus*

⁴ Light Detection and Ranging remote sensing method of measuring variable distances to the Earth

To recover these ruins, the site was surveyed and validated using GPS and Lidar instrumentation⁴. The collected data was then integrated into architectural design software to build models of the site.

The valley’s landscape is a complex tapestry of social, cultural, and ecological narratives that make up the ahupua‘a system of resource management. This centuries-old traditional land division, often similar to the shape of a watershed, allowed Hawaiians to organize and sustain resources through planning, interconnectedness, and cultural values.

Over time, my ability to discern the role of stone within this valley’s ahupua‘a system was refined under the guidance of my mentors and colleagues, Moku Chandler and Noah Ka‘aumoana, both stewards of Limahuli Valley and masters of traditional stone craftsmanship. Through their mentorship, stone has revealed itself. Ancient architecture seemed to emerge naturally from the earth, unveiling its framework and function.

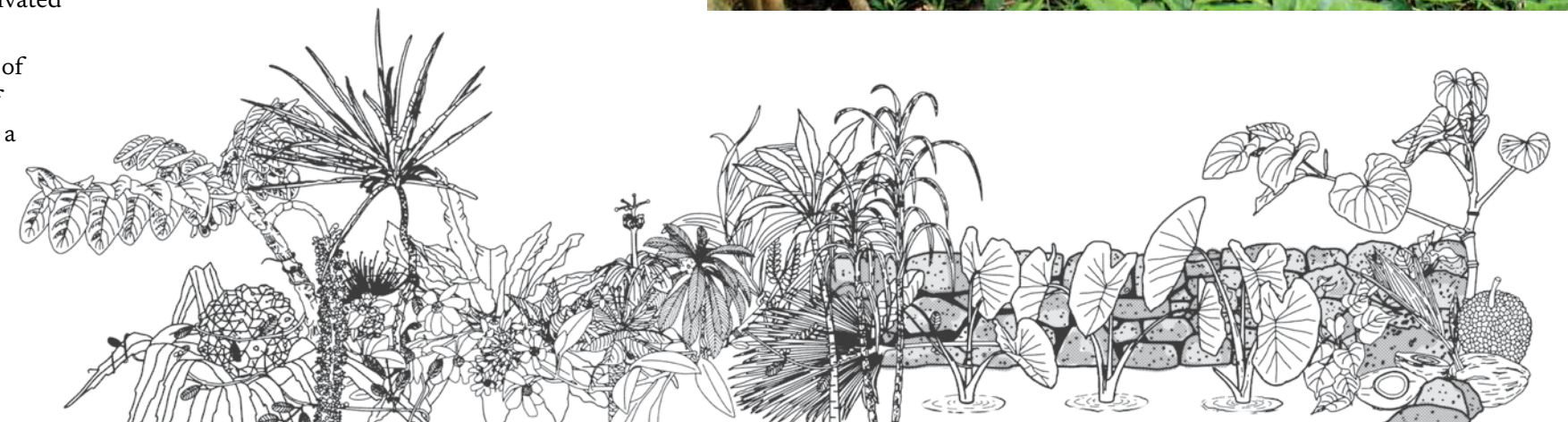
It is not merely the ruins themselves that have captivated me, but rather their spatial relationship with the land’s physical form. There exists a profound sense of alignment, where the landscape became a canvas of stone walls, patterns, and symmetries, constructing a narrative that can be read like braille.

The first Polynesians who arrived here had to adapt to a range of environments, building agricultural systems that mirrored the natural processes and features of each ecosystem. For a river valley like Limahuli, land suitable for growing kalo was typically found in alluvial flood plains adjacent to the stream. By manipulating the water flow in these plains, wetland kalo became the central crop of the early Hawaiians and a symbol of the kinship between humans and the land. The intuitive natural design of these irrigation systems was the result⁵ of generations of cumulative knowledge, tailored to the distinct characteristics of each environment and the creative choices made by the maka‘āinana (people who tended the land).

RESTORATION AND REVITALIZATION

Today, one of the primary objectives of NTBG’s work in the Limahuli Preserve is to restore native forest. But the archaeological clues that remain in the landscape should not be overlooked. As a landscape architect, I think beyond the ecologic functionality of a place to also consider its beauty, stories, and human-introduced qualities. Working in the valley, I have filled my field notebooks with architectural illustrations, documenting my observations

⁵ Source: <https://www.frontiersin.org/articles/10.3389/fsufs.2023.1116929/full>





REMNANT ROCK TERRACE. PHOTO BY JOSHUA DIEM



JOSHUA IN LIMAHLI PRESERVE (ABOVE). PHOTO BY JON LETMAN. MOKU CHANDLER, MALAMA 'ĀINA SPECIALIST, IN LIMAHLI GARDEN (BELOW). PHOTO BY ERICA TANIGUCHI

and understanding of how this landscape functioned in an earlier time. By retracing the genius in the placement of the stones, we can recover a framework from when this site was an integrated forest where agriculture thrived.

This 'ilipa'a site holds great promise for restoration. Much of the invasive understory that has engulfed the valley floor has yet to encroach and many of the rock walls remain intact. The source of irrigation water still flows and, importantly, the site falls within the active restoration zone of the Lower Limahuli Preserve, accessible by a short hike.

The lo'i terraces serve as the foundational architecture that informs the restoration process. Through the strategic and phased removal of invasive canopy trees and the excavation of the 'auwai, water can flow back into the landscape. Native restoration plantings can be interwoven into the water system to create a novel space that embodies biocultural conservation.

The integration of this historical agricultural system has the potential to serve as a haven for endangered water birds, nourish restoration plantings during periods of drought, and utilize natural drainage to improve soil fertility. Furthermore, the reintroduction of traditional farming practices and passive food production is significant as an expression of the community's most cherished values and highest aspirations.

As we strive to restore native forest, it is important that we help perpetuate the agricultural legacy surrounding us. Throughout Hawai'i, other sites of great cultural heritage exist on conservation lands, waiting to be rediscovered and revitalized. Limahuli Valley can serve as a model for a new integrated approach to stewarding Hawai'i's future in a way that builds bridges between the humanities and science. 🦅

Find Joshua's full design thesis online at: Pōhaku, Kalo, Wai: Stewardship in Contemporary Hawai'i

READ AND SHARE ONLINE





PHOTO BY HARUMI NOON

NTBG STAFF SUCCESSFULLY DEFEND PHD THESES

In May, NTBG conservation biologist Seana Walsh and seedbank curator and laboratory manager Dustin Wolkis traveled to Copenhagen where both successfully defended their doctoral theses from the University of Copenhagen. Both sat before their assessment committees at the Natural History Museum of Denmark.

Dustin's PhD thesis was entitled 'Seed Conservation Biology in the Hawaiian Flora,' reflecting his diverse, applied research. His findings describe how he experimented and reviewed challenges at each stage of the seed conservation pipeline. Using novel approaches to answer applied conservation questions, Dustin's thesis included biophysical methodology to explain the mechanisms responsible for the short lifespan of some Hawaiian species. Other chapters examined seed storage behavior, longevity, and germination. The results of this research are expected to significantly advance seed conservation in Hawai'i and beyond.

Later that week, Seana Walsh sat before her assessment committee to defend her thesis which was entitled 'Science-based Conservation Management of Threatened Hawaiian Plants.' The thesis was based on the premise that more applied research is urgently needed to help inform conservation management and restoration of the Hawaiian flora. Her research provides new understanding and data for several species. Other work offers insight into potential responses to anticipated climate change impacts and pollination patterns critical for both in situ conservation and restoration.

Seana and Dustin were accompanied to Copenhagen by NTBG CEO and director Janet Mayfield and Nina Rønsted, director of science and conservation who also served as their academic supervisor. Smiling broadly after a celebratory gathering, they described the experience as "surreal" and expressed appreciation for the widespread support they received. The mood was jubilant, but both said they were eager to return to the Garden and put their newly minted degrees to work. Congratulations Dr. Wolkis and Dr. Walsh!



PHOTO BY DUSTIN WOLKIS

ENVIRONMENTAL JOURNALISM PROGRAM BEARS FRUIT

NTBG's Environmental Journalism (EJ) Program resumed this spring after a four-year break. Using its resources and expertise, NTBG teaches journalists about tropical biodiversity, natural systems, and the importance of reporting on the connections between people and plants.

One example of how the EJ Program contributes to dependable environmental reporting and increased science literacy among the public is the recently published book *Eight Bears: Mythic Past and Imperiled Future* by Gloria Dickie, a 2017 EJ alumna. The book explores the world's remaining eight bear species and how environmental threats such as deforestation, climate change, and extractive industries imperil bears and the plants and

animals that share their habitat. *Eight Bears* takes readers from Andean cloud forests to bamboo jungles in southwest China to India, Vietnam, and to temperate northern forests and the Arctic. The book reveals how bromeliads, bamboo, orchids, and ferns are just as important to some bears as salmon, berries, and seals are to others. Gloria writes, "Ultimately, because of the bruins' outsized presence, conserving bear habitat helps to protect all the species that fall beneath them in the food chain."

Eight Bears is an important reminder that protecting plant life and wilderness is essential to protecting animals and people. Reflecting on how NTBG influenced her writing, Gloria said, "the NTBG Program provided the basis for my understanding of tropical ecology and the interconnectedness of life in these ecosystems. I'd done very little tropical reporting before I did the EJ program so it definitely informed my reporting." NTBG's commitment to supporting science journalism will continue with the next Environmental Journalism Program in 2024.



COURTESY OF WWW.NORTON



PHOTO BY ERICA TANIGUCHI

BREADFRUIT INSTITUTE ADDS NEW PROTOCOLS AND VOUCHERS

NTBG's Breadfruit Institute (BFI) curates and maintains the world's largest and most diverse collection of breadfruit. In pursuit of its mission, the institute is seeking to increase access to the collection and breadfruit knowledge in innovative ways. In August, the institute completed the development of protocols outlining how to document and collect breadfruit plant material for herbarium vouchers that best represent a tree's unique characteristics. Doing so is important for helping to preserve and study this vital tropical fruit crop. The institute's Kupu member Kelsey Rogers, who spearheaded the effort, explained how she and BFI staff have observed, documented, collected, and submitted over 100 breadfruit herbarium voucher specimens.

"Our goal is to get fertile specimens from each tree at Kahanu Garden (on Maui), Limahuli Garden, and McBryde Garden in the Lāwa'i Valley (on Kaua'i) and make high-quality vouchers for NTBG's herbarium." Fertile herbarium voucher specimens are ideal because they display both types of flower structures: male and female (fruit).

Working with herbarium manager Tim Flynn, Kelsey has processed at least 200 documented and stored herbarium vouchers, with 50 new specimens dried, stored, and slated for submission and mounting. Additionally, over 40 breadfruit vouchers, collected by Kelsey and BFI staff, have been sent to the herbarium at the International Center for Tropical Botany (ICTB) at The Kampong. The new specimens (and others that will follow) will increase access to NTBG's breadfruit collection for scientists, students, farmers, and communities everywhere.

The breadfruit voucher collection protocols, Kelsey explained, simplify previous

breadfruit characterization standards developed by BFI and its collaborators, offering a step-by-step guide to measuring, recording, and collecting material for vouchers. Based on breadfruit descriptors developed by Breadfruit Institute director emeritus Dr. Diane Ragone, the protocols aim to give academics and growers a common language that can help them communicate the subtle differences between breadfruit varieties. To complement the specimens, the BFI team has taken photos of the breadfruit tree accessions, freshly collected specimens, and dried herbarium vouchers. The images will be accessible to anyone at NTBG's online herbarium database by the end of 2023.



PHOTO BY MARY DIETRIC



PHOTOS BY NTBG STAFF

SUMMER SERVICE VISITS BY STUDENTS AND VOLUNTEERS

This summer saw lots of activity by visiting students and volunteers. For the third year in a row, two youth travel groups (Moondance Adventures and Wilderness Adventures) brought nearly 60 high school students who volunteered over 170 hours working with the horticulture and grounds crew. Students helped weed, clean, and care for McBryde Garden, while learning about tropical plants and ecosystems. Volunteer program coordinator Sonia Adame said, "our garden staff like working with these students. They are organized, hardworking, and not afraid to break a sweat."

On Maui, Kahanu Garden hosted two Kupu groups which both camped at Mahele farm for a week and worked with staff helping remove invasive species, plant 'uala (sweet potato) and kalo (taro), and built a fence to protect plants from feral pigs.

In June, Seascapes Nursery staff visited Limahuli Garden where they volunteered their labor for the "Nā Pali Wall" display that features plants of the Nā Pali Coast. It was a chance to partner with a local business and support native plant understanding. All summer, other regular volunteers visited weekly or monthly, helping develop new areas. In August, Limahuli staff planned a special service day in the valley for Kupu program members, volunteers, and fall interns.

At The Kampong in Miami, volunteers undeterred by record heat harvested mangos and other fruit from the garden which they sorted, weighed, and delivered to a local food pantry to help fight hunger in their community. Over 1,100 pounds of fruit was donated by The Kampong.

Summer also saw two groups of elementary and middle school students participate in NTBG's new 'Ike Māla (Garden Knowledge) summer program. Sponsored by Kamehameha Schools and in partnership with the Cognition Learning Center of Kaua'i Community College, the program offers a wide range of outdoor activities and learning opportunities in McBryde Garden. This year, more than 40 students planted kalo (taro), 'uala (sweet potato), enjoyed stream fishing, and learned about the important ties between people, plants, and places through traditional values such as malama 'āina (caring for the land), kūleana (responsibility), and 'ohana (family).

In August, NTBG welcomed five fall interns from Texas, California, Hawai'i, Haiti/Florida, and the United Kingdom for the annual 15-week program.

MOONLIGHT & MUSIC
Aug 17, 2024

Celebrate NTBG's 60th anniversary at our premier gala event on Kaua'i! Enjoy live music, dancing, and dinner under the full moon. RSVP to Chelsey Aki at caki@ntbg.org.

PEARL ANNE SIEPP
NTBG Fellow, Supporter
Legacy Society Member

Pearl Anne Siepp (Annie) was a devoted and wonderful supporter for over 35 years. Annie and her husband Ed were passionate about the work of NTBG and loved to support important items the Garden needed, such as a nursery. They treasured their Garden family, and the experiences they shared filled their lives with wonderful explorations, dear friends, and meaningful purpose. Annie also appreciated the value of giving and believed in sharing the bounty in her life. In her estate plan, she designated a generous endowment gift that will impact NTBG for many years to come.

"For Ed and me, our support of NTBG is rooted in our strong belief in the mission of the Garden, supporting and being involved in the growth of NTBG has been one of life's most gratifying adventures."

We are forever grateful to Annie, and it's a privilege and honor to have Pearl Anne Seipp as part of NTBG's Legacy Society. We are also grateful to have Annie and Ed's daughter Anita and son Paul continuing in their parent's footsteps. Anita is currently serving on our Board of Trustees and Paul is a Fellow.

For information regarding setting up your legacy gift to NTBG, please contact Heather George, Director of Philanthropy, at (808) 762-1499 or hgeorge@ntbg.org.



KEYS THATCH PALM (LEUCOSTHRINAX MORRISII)

wish list

Would you like to make a difference today? Purchase an item from our wish list and your donation will go directly to meet immediate program needs. Please send your contribution with the enclosed envelope, including a specific description of the item. If you have any questions or would like to make your donation by phone, call Chelsey Aki at (808) 332-7324 Ext. 209. To make your donation online, go to ntbg.org/support/donate. Mahalo for your support!

BREADFRUIT INSTITUTE

- Personal protective equipment for agroforestry technician - \$250
- Harvest supplies for Regenerative Organic Breadfruit Agroforest (ROBA) - \$250

KAHANU GARDEN

- Field boots for horticulture team - \$500
- New cabinetry for maintenance shop - \$450

THE KAMPONG

- Plant trailer for horticulture team - \$500
- Bicycle rack - \$500

LIMAHULI GARDEN

- Tool shed - \$500

LIVING COLLECTIONS

- Hood filter for Fern Lab - \$700
- Pre-filter for Fern Lab hood - \$175

VOLUNTEER PROGRAM

- Lanyards - \$150

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

Growing the next generation of botanists at the ICTB at The Kampong

BY JON LETMAN, EDITOR



TROPICAL BOTANY STUDENT JENNY MORRIS TAKING FIELD NOTES IN COSTA RICA. PHOTO BY DANIELLE WARD (PG. 26). HAPPY BOTANY STUDENTS OUTSIDE THE ICTB AT THE KAMPOUNG. PHOTO BY GABY ORIHUELA (PG. 27)

Among the many shortages the world faces today, one often overlooked is a lack of botanists. At a time of unprecedented crises, including a dramatic loss of biodiversity, highly trained botanists are in short supply. “Today, we need plant scientists more than ever,” says Dr. Chris Baraloto, director of the International Center for Tropical Botany (ICTB) at The Kampong in Miami, Florida.

For more than a decade, scientists have expressed concern about declining support for plant science education. As academic and funding priorities have shifted, universities have merged fields, deemphasizing botany programs. Reduced training and recruitment, along with retirement, has exacerbated the shortage. Dr. Brian Sidoti, director of The Kampong says, “A fresh influx of trained plant scientists is essential to carry forward research, innovation, and expertise. Their contributions will be pivotal in devising solutions to the global challenges we face.”

Plants not only provide oxygen, food, fiber, fuel, and medicine, they also offer habitat and safe refuge for wildlife and inspiration and recreation for humans. Plants fulfill essential ecosystem services like carbon and nutrient cycling, mitigate the impacts of climate change and storms, and perform other critical functions. But as threats to plants synergize, more plant scientists are urgently needed.

That’s where the ICTB at The Kampong comes in. Chris says the new facility is uniquely equipped to train the next generation of botanists. The ICTB at The Kampong is a collaboration between the National Tropical Botanical Garden (NTBG) and Florida International University. The new facility builds upon a decades-long history of tropical plant collection and research at the home and garden of botanist David Fairchild, who purchased and named The Kampong in 1916.

As Fairchild introduced thousands of ornamental and food plants from around the world, his home and garden became a magnet for fellow scientists and plant enthusiasts. Among them was Harvard botany professor Richard A. Howard who frequently visited The Kampong beginning in the 1940s. Professor Howard first invited graduate students interested in tropical plant science to Miami and later, with Harvard botanist P. Barry Tomlinson, started an immersive course in taxonomy, anatomy, and morphology.

Catherine “Kay” Sweeney, who took ownership of The Kampong after Fairchild and later gifted it to NTBG, supported the Tropical Botany course as an ideal use of the property’s living collections consistent with Fairchild’s legacy.

The course continued under Walter Judd, a professor and curator of the herbarium at the University of Florida. A former student of Richard Howard, Judd expanded the course to four weeks. Over three decades the course trained more than 250 students who have become leaders in tropical plant sciences. When Chris Baraloto arrived in 2015, he was determined to build on that legacy.

THE NEXT CHAPTER IN TROPICAL BOTANY

Standing outside the ICTB's orange and white Miami limestone (oolite) façade, Chris surveys the newly planted landscaping, an assemblage of more than 170 species mostly native to Florida and the West Indies and typical of hardwood hammock dry habitat. Although native, many of the plants are rarely seen, giving the landscaping horticultural, botanical, and aesthetic value that complements the exotic living collections at The Kampong.

Built on a two-acre parcel, the ICTB is connected to The Kampong by physical space and a vision for the future. At the center of that vision are students like those who participated in the Tropical Botany course in May and June of this year. The 16 students, coming from ten countries⁴, represented a range of experiences and backgrounds.

Housed in The Kampong's dormitory, a short stroll from the ICTB, the botanists began their days with morning lectures followed by collecting plant material at The Kampong and nearby gardens, including Fairchild Tropical Botanic Garden and the Montgomery Botanical



TOP: BORIS LLAMAS, A STUDENT FROM GUATEMALA, HOLDING FUCHSIA PANICULATA. PHOTO BY DANIELLE WARD. BOTTOM: CHRIS BARALOTO, DIRECTOR OF THE ICTB AT THE KAMPONG INSPECTS PLANT ID SAMPLES. PHOTO BY JON LETMAN

Center. Afternoons were spent in the ICTB labs studying morphology and anatomy and learning how to identify more than 1,400 species from 850 genera and 200 families. Field trips took them to the Florida Keys, Everglades National Park, and other sites.

With ample space for instruction, research, lab work, and a herbarium with capacity for 120,000 specimens, Chris says the LEED-certified two-story ICTB is equipped to host a broad range of lectures, workshops, symposia, in-person and virtual classes, and meetings. The facility can accommodate graduate students and research assistants in office and multi-function spaces that allow for both collaboration and autonomy. Over time, Chris hopes the ICTB at The Kampong will become known as the preeminent research and teaching hub for scientists focused on neotropical flora.

Botany professor Dr. Lucas Majure (who took over Walter Judd's position at UF) has joined Chris to share teaching responsibilities for the Tropical Botany course. Brian Sidoti also gave a presentation on his subject of expertise, the Bromeliaceae. Brian says the collaboration between ICTB and The Kampong creates a space where graduate and undergraduate students can excel, while maximizing use of The Kampong's housing facilities and living collections as an outdoor laboratory.



⁴ Argentina, Guatemala, Peru, Bahamas, Dominican Republic, Haiti, Nigeria, Tanzania, Spain, and United States



LANDSCAPING OUTSIDE THE ICTB AT THE KAMPONG INCLUDES SPECIES NATIVE TO A FLORIDA HARDWOOD HAMMOCK DRY HABITAT. PHOTO BY JON LETMAN

One of the participants in this year's Tropical Botany course was Jenny Morris, a science officer for the Bahamas National Trust. Jenny stressed the value of living and learning with fellow botanists and having time to discuss botany and science as well as culture, customs, academics, and environmental law from an international perspective. The experience, she says, is critical to becoming an effective teacher or mentor. "I feel like you cannot be an educator if you don't explore first."

Studying alongside Jenny was NTBG plant records manager Kevin Houck who says the course improved his understanding of phylogenetics and taxonomy, fields which will bolster his data management and GIS mapping for the Garden. Taking the course, he believes, also enables him to more effectively coordinate with NTBG's herbarium while strengthening curation and the assessment of collection priorities.

INTO THE FIELD

Following four weeks of instruction at the ICTB at The Kampong, having built rapport and developed practical skills, the students embarked on a two-week trip to the lowland tropical moist forests of Costa Rica. Working with FUNDECOR, a local NGO, the students learned how to conduct a biodiversity inventory, assess the

value of intact forest, and identify land suitable for a biodiversity corridor connecting conservation lands.

New skills gained included setting camera traps, inventorying insects and mammals, and making use of recently acquired plant identification techniques in the wild. Over eleven long days of field work, the students made several hundred herbarium vouchers comprising more than 300 species of 142 genera collected in an area not previously inventoried. This portion of the course, Chris explains, was both physically and mentally demanding, with long hours under difficult conditions, and high expectations.

"There was little 'eco-tourism'-like about it," he says. "We were there to collect meaningful data. The world is changing too rapidly for us to squander our time."

Learning how measuring and identifying trees can help quantify carbon storage and sequestration potential, students met with landowners to discuss perspectives on protecting private land. Their work also demonstrated the high conservation value of a wildlife inventory in fragmented, but diversity-rich target areas. The training gave students a chance to consider Costa Rica's ecosystem service payment model and, Chris says, "will definitely have an impact."



EXAMINING A STRAWBERRY POISON DART FROG (OOPHAGA PUMILIO). PHOTOS BY JENNY MORRIS (LEFT), DANIELLE WARD (RIGHT).

Danielle Ward, a PhD student at the University of California Berkeley, calls the course “intense” but “very positive” and “solutions focused.” She says it required great physical and mental stamina, but added that the ICTB at The Kampong faculty, staff, and facilities provided everything necessary to succeed. She says the highly integrated, unified program and welcoming, supportive staff will contribute to future collaborations between the network of botanists.

Another PhD student, Vanina Gabriela Salgado from Argentina, specializes in studying the large plant family Asteraceae. Coming from a temperate climate, she says the course opened her eyes to the dynamic ways in which diversity changes as it moves south. Vanina emphasized the value of the course for teaching students how to collect plant material in challenging conditions, how to orient oneself in the wild, and how to walk safely in unfamiliar surroundings. These are skills one cannot learn from a book, Vanina says. “There’s nothing like having someone mentor you on that.”

“I know this course is going to have a big impact on my career in the long term,” she adds. “Both personally and professionally it already has.”

Looking ahead, Chris emphasizes the value of this new, more international model for the Tropical Botany course. For the students, some of whom are already working for NGOs, government agencies, or as professors in their home country, the opportunity to undergo intensive training and develop relationships is priceless. Chris sees the Tropical Botany course, and the work being done at ICTB at The Kampong, as the continuation of a storied legacy of plant science education and research.

“There are very few courses like this,” Chris says. “We are unique in providing scholarship funds to those who might not receive such training. At this consequential time for the planet, he believes, opening doors and creating new opportunities couldn’t be more important. “These are the people we need to be training first,” says Chris. “They are the ones working at the forefront of the biodiversity crisis and they will have the most immediate impact.”

For more information about the Tropical Botany course, contact Dr. Chris Baraloto at cbaralot@fju.edu.

READ AND SHARE ONLINE



plant people

People and plants are at the heart of everything we do. Each of us benefits from our relationship with plants and the contributions they make to our lives. Likewise, each of us can contribute to the well-being of plant life.

Q How do you believe caring for plants translates to caring for ecosystems and communities?



PHOTO BY ERICA TANIGUCHI

“Working with nature and the plant world is a very human activity. One of the first relationships we have with the earth is to ensure our own survival. Our relationship with the land is a necessary and beautiful responsibility. It unites us in a way that contributes to the good of our entire community and is an act of practical reverence.”

—Lynne Weiss, Volunteer at Limahuli Garden

“I am a true believer in caring for the ‘āina (land) because the ‘āina takes care of us! After joining ‘Awa Hui o Hana (a community group dedicated to the perpetuation of ‘awa¹ cultural practices), I’ve gained a deeper connection to this plant. It provides healing and soothes the mind. The biggest breakthroughs in Polynesian cultures definitely took place after ‘awa!”

—Nakua Konohia-Lind, Facilities Technician at Kahanu Garden

¹ *Piper methysticum*, also called kava



PHOTO BY MOLLE CHIPMAN

“Growing up on Kaua’i, with so much natural beauty around me, I was taught at an early age the importance of our environment and the responsibility we all have to protect and nurture it. Our communities thrive when our ecosystems thrive, and our ecosystems depend on plants. I hope that we all can work together to preserve and perpetuate this beautiful planet.”

—Jonathan Smith, NTBG Fellow



PHOTO BY SHANDELLE NAKANELUA

an eye on plants

SELECT SPECIES IN FOCUS

Ko'oko'olau (*Bidens waialele*)

The Hawaiian flora is comprised of a remarkable variety of rare flowering plants, many of which grow nowhere else. But the islands are also home to one of the most prolific plant families, Asteraceae, which includes daisies, chrysanthemums, and sunflowers.

Among the approximately 25,000 Asteraceae species worldwide is the genus *Bidens* which has between 150 and 235 species, with 42 in Polynesia alone. Called ko'oko'olau in Hawaiian, *Bidens* is considered a prime example of adaptive radiation in Hawai'i. The genus has been found on seven of the eight high Hawaiian Islands and probably once grew on Ni'ihau. The islands claim 19 endemic species, seven of which occur on Kaua'i, three of them single-island endemics. *Bidens* are highly variable in form, growing in habitats ranging from coastal dunes, lava flows, and cliff faces to scrubland, bogs, and forests over 2,000 meters high.

In 2020, when University of Hawai'i-Hilo botany professor Matthew Knope returned to his family home on Kaua'i during the pandemic, he and NTBG research biologist Ken Wood agreed the time was right to collaborate on describing a highly unusual *Bidens* limited to remote parts of Kaua'i's rain-soaked interior. The *Bidens* in question had been found growing in small populations near the rim's edge of the Blue Hole crater and in scattered talus along the base of cliffs below Mt. Wai'ale'ale. An additional colony was located at the back of the Wainiha Valley, Kaua'i's deepest drainage. Both areas are known for thousand-foot-high cliffs and ribbon-like waterfalls.

Botanists have documented this rare *Bidens* for years, but its lineage was uncertain and additional fertile material was needed for its description. This new *Bidens* species caught the botanists' attention with its low, spreading habit and very unusual inflorescence which had long stalks terminating with a nodding flower head, similar to the bird-pollinated *Bidens cosmoides*. This undescribed *Bidens* was considered most closely related to *B. valida*, a Kaua'i endemic found in several remote mountain regions of southeastern Kaua'i.

Over multiple field trips, Matthew and Ken made herbarium vouchers and collected viable seeds which have since been grown at NTBG's conservation nursery. Utilizing collections from various botanists over the years, Matthew and Ken proceeded with a taxonomic assessment, describing its distinctive morphology, habitat, and conservation status. The formal written description was submitted for peer review along with photos, maps, and an illustration by NTBG partner and botanical artist Wendy Hollender.

Over a period of nine months – relatively fast in the world of taxonomic publication – the new *Bidens* was described and accepted as a new species. Matthew and Ken gave it the name *Bidens waialele* (lit. “leaping waters”) in recognition of its habitat. In June, the paper was published in the International Journal of Plant Sciences in a special issue honoring the legacy of noted Asteraceae specialist Vicki A. Funk.

With an estimated 700-800 remaining individuals, *B. waialele* meets the criteria to be listed as Critically Endangered on the IUCN Red List of Threatened Species. According to Matthew, *Bidens* represents “one of the most rapid and explosive plant diversification events in the Pacific.” What contributes to this diversity and wide dispersal? Ken explains that the tiny barbs and bristly nature of the seeds easily stick to birds, making them more likely to be carried long distances. He adds that *Bidens* probably evolved alongside Hawai'i's yellow-faced bees and various diptera (flies) which served as pollinators and the plants may have been a favorite food of the flightless geese and duck-like fowl that once lived in Hawai'i.

Surely, the first humans to reach Hawai'i admired *Bidens* for its delicate green foliage and bright yellow flowers. *Bidens* mu'o (branch tips) have long been prepared as a medicinal tea, consumed to fight colds and promote general health. Indeed, other *Bidens* species are used medicinally around the world. Lei Wann, director of Limahuli Garden and Preserve, began drinking ko'oko'olau tea as a child. She describes the taste as mildly sweet and earthy and says there are still families who visit the Limahuli Valley to gather *Bidens*, a plant that is both rare and yet familiar to many.

READ AND
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BIDENS WAILELE COLORED PENCIL AND WATERCOLOR
ILLUSTRATION BY WENDY HOLLENDER



National Tropical Botanical Garden

3530 Papalina Road
Kalāheo, Hawai'i 96741 USA



NTBG'S FLORIDA GARDEN, THE KAMPONG, IN SOUTH MIAMI'S COCONUT GROVE NEIGHBORHOOD, IS AN OASIS OF CALM AND BEAUTY WITH A STUNNING VIEW OF BISCAYNE BAY. PHOTO BY JON LETMAN