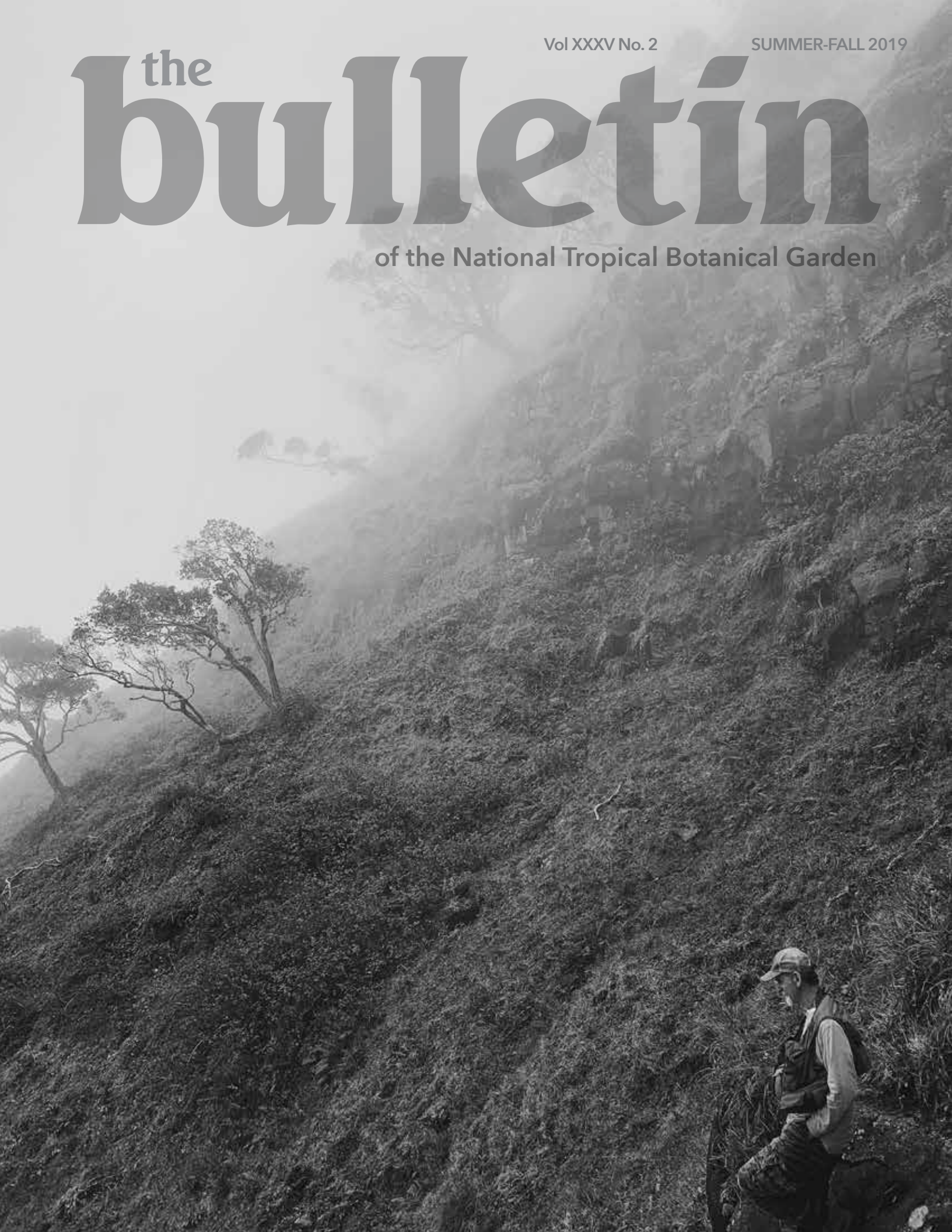



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SUMMER-FALL 2019

the bulletin

of the National Tropical Botanical Garden





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ON THE COVER

NTBG Research Biologist Ken Wood on a steep mountain slope near a previously known population of *Hibiscadelphus woodii*. Read how NTBG's conservation staff used drones to rediscover this endemic species that had previously thought to have gone extinct. Photo by Ben Nyberg





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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OUR MISSION

To enrich life through discovery, scientific research, conservation, and education by perpetuating the survival of plants, ecosystems, and cultural knowledge of tropical regions.

The National Tropical Botanical Garden was chartered by an Act of United States Congress in 1964. The objectives of the institution were set forth in the Charter:

- to establish, develop, operate and maintain an educational and scientific center, with libraries, herbaria, laboratories, and museums...to encourage and conduct research in basic and applied botany;
- to foster and encourage fundamental research in tropical plant life and study the uses of tropical flora in agriculture, forestry, horticulture, medicine, and other sciences;
- to share knowledge acquired relative to basic and applied tropical botany through publications and other media;
- to collect and cultivate tropical flora and to preserve for the people of the United States species of tropical plant life threatened with extinction;
- to provide a facility which contributes to the education, instruction, and recreation of the people of the United States.



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Message from Janet Mayfield

They say “beauty is in the eye of the beholder.” Take the picture on the right. It’s doubtful the image would stir the emotions of most people. However, if you were a plant growing in the garden (or one of the many people who cares for and supports the garden), this rather ungainly contraption would be a truly gorgeous sight.

This self-cleaning filtration station represents the culmination of a project to develop the Luawai Reservoir as a consistent, sustainable water source for our McBryde Garden. This may sound simple, but before we could even begin this project, the reservoir had to be dried out and one hundred years’ worth of accumulated silt had to be extracted. We then installed a dedicated intake system and the filtration device that you see here. The next step was to deliver that precious water to the plants.

Water is indeed essential for all life, making up around 70 percent of our bodies and as much as 95 percent of plants. Therefore, it’s not surprising that it is the most essential requirement for plants. Whether we are keeping our living collections healthy, working in restoration sites, or advancing the work of the Breadfruit Institute, every drop is important.

So simple, yet so complex, we humans try to control water but nature is not bound by our desires or plans. The balance between too much water and not enough can be washed away in a matter of hours. Each of our five garden locations in Hawai’i and Florida has experienced severe weather conditions that have wreaked havoc on our invaluable — often irreplaceable — living collections and the environment we so carefully manage and steward.

You might imagine that in tropical Hawai’i and subtropical Florida we have reliable and abundant rainfall and therefore plenty of water. In fact, changing and increasingly unpredictable weather patterns make it absolutely essential that we place an even greater focus on water security for each of our five gardens and preserves.

Unfortunately, there are no guarantees. The likelihood that NTBG will face more flooding, extreme rainfall, coastal inundation, and prolonged drought or other water-related problems is almost certain. Challenges notwithstanding, we are committed to developing dependable sources, efficient delivery systems, and increased capacity for rain catchment. With your support, we can better achieve those goals.



Stop for a moment and envision a single drop of water — it seems almost insignificant. Yet if we multiply that drop by tens of thousands, we can bring seeds to life and sustain trees that nourish, heal, and inspire. Our appreciation for every drop is why NTBG is committed to conserving those vital resources and improving how we use water in order to continue saving plants and saving people.

Janet Mayfield
Chief Executive Officer and Director



Aided by drones, NTBG rediscovers *Hibiscadelphus woodii*

PERCHED *on the* EDGE

BY BEN NYBERG, GIS & DRONE
TECHNOLOGY COORDINATOR



BEN NYBERG PREPARES HIS DRONE.
PHOTO BY MARK QUERY

Flashback to 1991 as NTBG Research Biologist Ken Wood dangles from ropes, exploring uncharted territory in Kaua'i's Kalalau Valley. Botanists had theorized that a yet-to-be-found *Hibiscadelphus* species could exist in the mesic forests of northwest Kaua'i, so when Ken saw it, he knew immediately what it was: a new-species of *Hibiscadelphus*!

In the 1990s, NTBG botanists had developed their own distinctive roping technique to survey vertical cliffs, contributing to astounding results: the discovery of 11 new plant species in the Kalalau area alone. The 1991 *Hibiscadelphus* discovery would go on to be scientifically described in 1995 by NTBG's (now) Science and

Conservation Director Dr. David Lorence and Research Associate Dr. Warren Wagner who named the new species *Hibiscadelphus woodii*, in honor of its discoverer.

Over the next two decades, NTBG staff gave their all to protect *H. woodii*, but attempts at grafting, seed propagation, and cross pollination all failed. After three of the four known individuals perished in a rock slide in the late 1990s, the lone individual remained until it was found dead in 2011. It appeared the species had gone extinct. This exceptionally rare genus had lost six of seven documented species.

Fast forward five years to 2016 when, in search of a tool that would enable the survey of extreme cliff habitats, I

established a drone program at NTBG. Limahuli Garden and Preserve proved to be a great training ground for this new technology. Early results were positive as we found new populations of highly endangered plants such as *Euphorbia eleanoriae* and *Plantago princeps* var. *anomala*, both of which were known from less than 50 individuals left in the wild.

As discussions on the how to expand NTBG's nascent drone program ensued, Ken and I bounced lists of potential target plants off of each other in weekly lunch meetings. In 2018, we decided to apply for a grant to the Mohamed bin Zayed Species Conservation Fund submitting a proposal aimed specifically at re-finding the "thought to be extinct" *Hibiscadelphus woodii*.

We selected *H. woodii* because the steep habitat had been nearly impossible to survey and drones were proving they could potentially unlock these otherwise inaccessible cliffs. Fortunately our application was accepted and we were able to upgrade our equipment before starting field work in the summer of 2018.

A particularly rainy summer was the first of many challenges we faced. Beginning our search where *H. woodii* had been previously found, we embarked on long, steep, downhill hikes to the edge of the Kalalau cliffs. On our first day in the field, misty conditions cut short our survey and damaged the drone controller. Three subsequent attempts were rained out and before long winter was looming ahead.

In January, Ken and I, accompanied his long-time field partner botanist Steve Perlman, hiked down to the edge of the Kalalau Valley where we resumed our search for *H. woodii*. After two 25-minute flights over our area of interest, nearly 100 photos revealed we were no closer to finding the plant.

Binoculars aided in the selection of a secondary survey area in an adjacent valley, much further down the precipitous slope.

Indicator species, such as the silvery *Nototrichium sandwicense*, hinted at an intact native cliff system, but as our third flight commenced, the wind picked up and a fine mist started falling. The quadcopter descended 400 feet into position, but the elements made plant identification difficult. I snapped as many photos as possible hoping to catch a glimpse of the small, yellow flower.

With deteriorating weather conditions, we decided to attempt one last flight covering the remaining section of sheer cliff face, 1,000 feet below where we stood. While the drone had revealed plant communities comprised mostly of natives, none of us were confident we had seen the *Hibiscadelphus*.

Back in the computer lab at NTBG's Botanical Research Center, I started post-processing the drone's images. I assumed the tree would be distinct and easily visible in a photograph, but as I meticulously reviewed each photo, my hopes faded.

Shot by shot, I studied the photos until in the right-hand corner of photo #228 I spotted something interesting. Could it be?

I had never seen a live *Hibiscadelphus* but was eager to show Ken who is seasoned in identifying native plants. Together we examined herbarium specimens and historic photos from the original discovery. When we revisited



HIBISCADELPHUS WOODII.
PHOTO BY KEN WOOD



KEN WOOD SURVEYS THE NĀ PALI COAST.
PHOTO BY BEN NYBERG

the drone photo on my computer, a wave of joy washed over us — indeed, there it was! We had rediscovered *Hibiscadelphus woodii*!

Our exuberance quickly gave way to a determined focus on what we needed to do next. Additional surveys were necessary to confirm the identification, but we were rained out over three consecutive days. On the fourth day, the rain broke and we were able to fly again.

Returning to our launch point on the Kalalau rim, I used the drone to relocate the *Hibiscadelphus* and was thrilled when we located two additional individuals. We used high-resolution video to search for potential access routes, but the cliffs are simply too high and sheer to allow any avenue to the plants.

That brings us to today. Now that we have proven the value of drones in finding rare plants, the question is:

what's next? Research is underway with collaborators at the University of Sherbrooke in Quebec, Canada to employ cutting mechanisms which may provide a platform for collecting plant material using a drone. In the near future, software development may open doors to smart surveys and AI post-processing.

For me, this interface between conservation and technology is truly exciting. Rediscovering a new population of *H. woodii*, a plant taxa known only from a very limited area of this single island, offers real hope in the face of daunting numbers. Since the year 2000, Hawai'i may have lost some 27 plant species, a number poised to grow as habitat is lost, invasive species expand, and other climate and environmental factors advance. This new technology provides a promising avenue for finding, collecting, and saving plants that might otherwise be lost forever. 🌿

supporting roots

Q & A with Kimo M. Keawe



When he was a high school student in Honolulu in the 1960s, Kimo M. Keawe visited a friend on Kaua'i who took him to the Allerton Garden. There he met the garden's namesake, John Gregg Allerton. That experience left a deep impression and many decades later, after retiring from a career in resort management, Kimo wanted to return. Although today he's busier than ever — serving on the local planning commission, at the Kaua'i Museum, and traveling with his wife Robyn — Kimo also volunteers at NTBG's South Shore Conservation and Horticulture Center several times a month.

How did you start volunteering at NTBG?

About 12 years ago I was developing a Native Hawaiian plant garden for a resort in Princeville. My architect suggested I contact NTBG as they are the foremost authority in the field. I had always wanted to learn more about NTBG, so after I retired in 2015, I started volunteering in the herbarium and nursery.

What appeals to you about volunteering at the Conservation and Horticulture Center?

As a Native Hawaiian I want to do my part in preserving rare and endangered plants that are found only on Kaua'i. They were used for medicine, cordage, fishing, and were very important to my ancestors. Our efforts can make a difference to save these plants.

Many of the plants grown by NTBG are outplanted in remote preserves or restoration sites unseen by the public. What is the importance of growing these plants?

The *ohē mauka* or *Polyscias bisattenuata* is a prime example of how a concerted effort to save a threatened species can bring it back from the edge of extinction. Here in the Conservation and Horticulture Center we worked for months sorting seeds and learning how to grow plants from our “plant whisperer” (Nursery Manager) Ashly Trask. It was so gratifying to see those 6,000 new plants leave the nursery for their final destination.

Can you describe NTBG's role in the community here on Kaua'i?

NTBG is involved in many community programs but I think the most important is working with local schools at all levels. From garden tours for elementary school kids or the 2016 Nature Connects LEGO sculpture tour, each one leaves a lasting impressions on our keiki — our children — exposing them to the study and career potential in the plant field. High school students, internships, and hands-on projects within NTBG's various gardens help keep plants healthy and prevent extinction.

What can you say about the relationships between people and plants at the Conservation and Horticulture Center?

Every week I look forward to my time in this corner of paradise working with great people who have a desire to exchange knowledge. I have met fascinating people from around the world who share a common interest in plants. Together we tell stories about our lives, our families, and our local culture. No matter where you are from, we have so much in common as a worldwide community.

As someone who regularly works with these plants, what can you tell NTBG members about the impact of their support?

In order for NTBG to continue its mission as a global leader in plant conservation, it needs the support of individuals who make it possible to continue making a difference one plant at a time. Just last month we learned that there are now only a handful of *Kadua st.-johnii* plants left growing on the sheer cliffs of the Nā Pali Coast. Two of those now have cages over them to protect them from wild goats. Without these measures, it would be only a matter of time before another Hawaiian plant is lost forever.

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 redoubled efforts to assess the more than 1,200 native plant taxa in Hawai'i. To date, over 500 (approximately 40 percent) have been assessed, reviewed, and published on the Red List. Among these, 266 have been assessed as Critically Endangered, 98 as Endangered, 60 as Vulnerable, and 51 are listed as Extinct or Extinct in the Wild, adding to the more than 20,000 plant taxa published on the Red List worldwide.



Species name: *Capparis sandwichiana* (maiapilo) (Capparaceae)

CONSERVATION STATUS: VULNERABLE (VU)

Capparis sandwichiana, a native Hawaiian caper, is a beautiful shrub found on cliffs, lava flows, emerged coral reefs, and in rocky gulches of coastal areas. It is endemic to several of the Northwestern Hawaiian Islands (Midway, Pearl and Hermes, and Laysan) and the eight main Hawaiian Islands. This species is threatened by non-native plants, goats, rats, fire, sea-level rise, and coastal development. Although the total population numbers in the thousands across its range, subpopulations and suitable habitat continue to decline.

NTBG staff monitor and collect seed from plants in the wild and curate ex situ conservation collections. Currently, among 51 accessions, over 10,000 seeds are stored in our Seed Bank and Laboratory, 333 plants are growing in our nursery, and 46 individuals are planted out with permanent tags in our Allerton, Kahanu, Limahuli and McBryde Gardens. On Kaua'i, wild individuals are tagged with unique identifiers to enable consistent monitoring and the ability to link collections back to maternal founders. — Seana Walsh



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Support the National Tropical Botanical Garden with your gift today.

Plants provide our food, our shelter, and the air we breathe. Your gift can help ensure the survival of the Earth's most endangered tropical plants and the people and animals that depend on them.

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the green thumb

When the first navigators sailed to Hawai'i centuries ago, they brought with them two dozen or more of their most useful plants. Today we call those Polynesian-introduced crops "canoe plants." My own favorite canoe plant is the 'uala or sweet potato (*Ipomoea batatas*). In Japan, where I grew up, we call it *satsumaimo*. It is believed there may have once been over 200 'uala varieties in Hawai'i.

I love 'uala because they are easy to grow and mature quickly — between three to six months depending on the variety. What's more, 'uala greens are completely edible and packed with nutrients, minerals, and vitamins (especially A and C). The green and purple leaves also make a nice ornamental crop.

You may want to visit your local farmers market or talk with a local grower to ask what varieties will do best in your own area. Once you have sweet potato, they can easily be grown by cuttings or slips from old vines. Try to take three to four bundles of 10-inch long vines including the tips. Plant them together in a slightly wet mound of almost any soil type other than clay to which 'uala can't adapt.

After you've planted your cuttings, it's important to water them regularly until the roots are established and the leaves begin to fill in. My favorite part of growing 'uala is harvest time. It can be so fun — like egg hunting at Easter. When you see the heads of the tuber poking out of the ground, you know they are ready. If you plant 'uala at the end of summer, you just might have a fresh crop by the holiday season ahead. Think of stir-fried 'uala greens on your Thanksgiving plate or a sweet potato pie for Christmas. Let's plant 'uala now!

—Yuko Shinoda, Living Collections Assistant, Kahanu Garden

garden sprouts

News from around the Garden



PHOTO BY SHANNON HIRAMOTO

RECYCLED BANNERS ARE IN THE BAG

When spring cleaning yielded past event vinyl banners that would otherwise be thrown away, NTBG Volunteer Coordinator Jessica Clabo contacted Shannon Hiramoto, owner of Machinemachine, a Kaua'i business specializing in original clothing and accessories made of recycled materials. Shannon gladly accepted the old banners which she cleaned and transformed into zippered pouches, purses, and totes. The handmade, one-of-a-kind bags are splash-proof and sturdy – perfect for keeping things dry at the beach or on a hike, tucking away wet swimwear, or carrying a cell phone, cosmetics, or keys. Shannon's customers love the unique designs and fact that they're diverting waste from the landfill. As a small business owner, Shannon appreciates collaborating with NTBG and says the banner bags have inspired her to partner with other organizations, upscaling trash into treasures. <https://machinemachineapparel.com/>



PHOTO BY SEANA WALSH

SUCCESSFUL SEED COLLECTION

NTBG's contribution to a seed collection project concluded in May after staff, interns, and volunteers collected over 7.5 million 'ōhi'a (*Metrosideros* spp.) seeds for the E Mau Ana Ka 'Ōhi'a (Perpetuating 'Ōhi'a) Project. The effort (with support from the Hawai'i Tourism Authority) enabled NTBG to add to the establishment of a genetic safety net of Hawai'i's most important forest tree. Over 5 million seeds are now stored in NTBG's seed bank with an additional 2.5 million seeds in partner facilities on Kaua'i and O'ahu as back-up ex situ collections. Collected seeds can be used for disease resistance testing and future restoration if the fungal-caused disease Rapid 'Ōhi'a Death (ROD) damages previously unaffected native forests. Conservation Biologist Seana Walsh called the program a "huge success," noting the collection of all 'ōhi'a taxa and from all seed zones in which 'ōhi'a occurs.



PHOTO BY LEIALOHA NAKAYA

PHOTOGRAPHING CULTURAL KNOWLEDGE

In April, students from Ke Kula Ni'ihau O Kekaha public charter school on Kaua'i visited McBryde Garden for a project that combines photographing plants and animals with perpetuating a unique Hawaiian dialect. The middle and high school students walked the length of McBryde Garden taking photos which they later paired with their own descriptions written in 'Ōlelo Kanaka Ni'ihau, the dialect of Ni'ihau island. The booklets will be used by younger students to study Hawaiian values and ideas, inspired by photos taken in the garden. McBryde Garden docent and volunteer Kelley Phillips, who also serves on the school's board, explained that the aim was for students to create educational material combining indigenous culture and language with environmental studies in a creative way. NTBG is one of the few organizations in Hawai'i where the Ni'ihau dialect is spoken by some staff in the work place.



PHOTO COURTESY OF FIU

TROPICAL SPRING CLEANING

This spring, Florida International University (FIU) students and faculty came together for a bit of pre-construction clean-up at the future site of the International College of Tropical Botany (ICTB). A collaboration between FIU and NTBG, ICTB provides research-based knowledge and tools to discover, preserve, and sustainably use tropical plants while fostering education. Pictured here, ICTB Director Christopher Baraloto (right) works with an FIU student to spruce up and install native plants near the Commodore trail running along The Kampong, NTBG's south Florida garden.



PHOTO BY JON LETMAN

ENVIRONMENTAL JOURNALISM AT NTBG

NTBG's 17th Environmental Journalism Program took place in May with reporters from Canada, Taiwan, and the U.S. gathering on Kaua'i for the five-day immersive program designed to increase understanding of tropical ecology and island systems in order to help foster better informed science and environmental reporting. This year's EJ participants included reporters from National Geographic, Public Radio International, Yale Environment 360, Smithsonian magazine, Gizmodo, Scholastic books, and other media outlets. The increasingly popular Environmental Journalism Program will be offered again in May 2020.



PHOTO BY JON LETMAN

LIMAHULI GARDEN HAS RE-OPENED!

Following record-breaking rainfall and flooding on Kaua'i's north shore in April 2018, Limahuli Garden reopened for tours in June. The so-called "rain bomb" (nearly 50 inches fell in 24 hours) caused significant damage to Limahuli's infrastructure. Thanks to NTBG's dedicated staff, volunteers, and supporters, and with help from the community, repairs have been made and recovery efforts completed.

Limahuli Garden's visitor hours of operation remain the same: Tuesday through Saturday, from 9:30 am to 4 pm. What's new is the advanced reservation program for joining tours. The program will contribute to more effective management of vehicle flow to and from the garden and associated impacts. To make a reservation for Limahuli's self-guided tour, visit <https://ntbg.org/gardens/limahuli>. To make a reservation for Limahuli guided tours, please call the Visitor Center at (808) 826-1053.

Those who take Kaua'i's new north shore shuttle to visit Limahuli Garden and full-time residents (with a Hawai'i driver's license) will not require advanced reservations for self-guided tours (just be sure to have proof of shuttle reservation). Find more information about the new north shore shuttle at www.kauainsshuttle.com.

Adopting more sustainable practices will allow the Garden to benefit the community and the area's natural and cultural resources, while offering even more memorable experiences to all who visit. The steps we all take together to preserve this fragile environment will also protect the rural atmosphere and natural beauty of Limahuli Garden and surrounding areas, ensuring they will remain for generations to come.



LIMAHULI VALLEY.
PHOTO BY WAYNE RICHARDSON IV



THE ARTIST IN HER KAUA'I STUDIO.
PHOTO COURTESY OF KING TAM ESTATE

Botanical Artist
Geraldine King Tam
Leaves NTBG

An Enduring Gift

BY MARY KENNEDY MAHONEY

In March of 2018, the family of botanical artist and life-long educator Geraldine King Tam (1920–2015) bequeathed her final paintings of Hawaiian flora and fruit to the National Tropical Botanical Garden. In addition to 18 beautifully executed watercolors outstanding for their attention to scientific accuracy, 175 of Geraldine's pencil drawings and watercolor studies have also been donated and will serve as tools for education and sources of inspiration.

Geraldine's relationship with the Garden began in the 1980s when she and her husband Reuben Tam, also a noted artist and educator, retired to Kaua'i where he was born and raised. In advance of their retirement they purchased a large plot of land within sight of the Pacific Ocean where they later designed a home with individual studios for both artists. Together they planted and nurtured many flowers and fruit trees which became subjects for Geraldine's rich botanical watercolors, providing inspiration and fueling their passion to paint.



'SEA GRAPE' BY GERALDINE KING TAM



'RED JADE VINE' BY GERALDINE KING TAM

When her own garden didn't provide a living model for the visual notions she sought to create, Geraldine turned to NTBG. Both Director of Science and Conservation, Dr. David Lorence and Tim Flynn, Herbarium Collections Manager Tim Flynn, at NTBG's Botanical Research Center were helpful in procuring "live models" as Geraldine frequently called the plant life from which she painted. She insisted that all her paintings come from actual plants in all their seasons in order to more fully represent the complete plant cycle.

"Painting from nature takes both timing and time," she often said, referring to individual works that sometimes took over a year to compose. Her research made for beautifully rendered works of art that might also include a series of small details at the bottom of the page to illustrate a blossom or seed.

Geraldine's works were meticulously created in stages as she determined visual layout encompassing the plant form's negative and positive space on paper. She started with a pencil sketch where much of the composition came to life. A finished pencil drawing was then so lightly traced onto a medium weight watercolor paper. Before any Winsor & Newton pigment landed on the page there were many studies of the work in progress to determine just the right mix, shade or tint to match the live model posing in a vase adjacent to her drawing board.

Geraldine King Tam was born in 1920 in Toronto, Canada to Chinese immigrants. Valedictorian of her high school class, she was

"Painting from nature takes both timing and time"

further educated at McMaster University in Hamilton and The Ontario College of Education at the University of Toronto. After teaching for two years, she enrolled in Teachers College at Columbia University in New York where she received an M.A. in Art Education. It was there that she met and married Hawai'i-born artist and poet Reuben Tam (1916-1991) in 1946.

Geraldine began in earnest her work as an art educator at the prestigious Dalton School in New York City where she taught an array of art disciplines. Her art room was a laboratory for creative process and expression as students explored methods and materials. She was also a successful freelance fabric designer where hints of plant forms manifested in patterns. Given that her husband was a painting instructor at The Brooklyn Museum Art School, their summers were reserved for growing and nurturing their personal visions. They summered off the coast of Maine on the island of Monhegan, known as a gathering place for artists.

It was in those 30 coastal island summers that Geraldine began her lifelong passion illustrating plants. She drew and painted a portfolio of over 200 Maine wildflower illustrations of which 50 were featured in a solo exhibition entitled "Wildflowers of Coastal New England" held at the New York State College of Forestry at Syracuse University in 1968.

Following their move to Kaua'i in 1981, Geraldine's work was no longer constrained. She was initially overwhelmed by the size of Hawaiian flora and a change in her technique reflected the exotic and lush Hawaiian fruits and flowers with bold color and textures.

During his tenure as Director of NTBG (1975-1992), Dr. William Theobald recommended Geraldine's work to the Hunt Institute for Botanical Documentation at Carnegie Mellon University in Pittsburgh, Pennsylvania. In 1994 she hosted James

J. White, Curator for the Hunt, at her home and studio where he admired her collection of completed watercolors and chose one to be featured in their upcoming International Exhibition of Botanical Art and Illustration. Geraldine was thrilled for this honor and relationship and gifted the Hunt all of her Hawai'i watercolors to date. Having survived Kaua'i's harrowing Hurricane 'Iniki in 1992, she had a keen appreciation for work being stored in a protected environment for future generations of scholars and artists.

In 1995 Geraldine King Tam was honored as a Living Treasure by the Kaua'i Museum and in 1998 her Florilegium PARADISUS Hawaiian Plant Watercolors was published by the Honolulu Academy of Arts featuring 60 of her paintings. Dr. David J. Mabberley of the Royal Botanic Garden in Sydney, Australia provided the text for this beautiful and informative body of work. Coinciding with the release of PARADISUS, the Honolulu Museum of Art hosted an exhibit featuring Geraldine's paintings. She had additional works displayed at the Kaua'i Museum, Bishop Museum in Honolulu, and a piece featured at Royal Botanic Gardens, Kew.

Until late in her life, Geraldine was a vital member of Kaua'i's art community and a strong supporter of arts education. Art was a lifelong pursuit for Geraldine, and informed her work as a textile designer, botanical painter, and art educator. In her retirement on Kaua'i, Geraldine's passion for painting the fruits and flora of Hawai'i earned her national recognition for her stunning works of visual artistry and botanical precision. It's only fitting that her final works remain on Kaua'i under the guardianship of the National Tropical Botanical Garden. 🌺

Mary Kennedy Mahoney is a volunteer at NTBG. As a former gallery director and artist, she was friends with Geraldine King Tam for over 25 years. She lives on Kauai.



ALL PHOTOS BY TONY NOVAK CLIFFORD

Kahanu Garden's New Visitor and Education Center Opens

BY MIKE OPGENORTH, DIRECTOR OF
KAHANU GARDEN AND PRESERVE

After years of being known for the 'rustic charm' of our humble and admittedly under-sized entrance kiosk, exciting changes are afoot at Kahanu Garden and Preserve where our recently completed Visitor and Education Center is now open.

It used to be that visitors who found their way to the end of the dirt road were unsure if they had indeed arrived at the National Tropical Botanical Garden's Hāna, Maui site. Kahanu Garden is home to the awe-inspiring Pi'ilanihale Heiau, a towering lava rock

edifice revered as a place of worship and designated a National Historic Landmark, and yet our old visitor's kiosk was small and challenging for staff and visitors, especially on rainy days.

With more than 15,000 visitors to Kahanu Garden each year, we have long wanted a visitor center that could accommodate and educate tourists and community members in a facility befitting the world class archeological, botanical, cultural, and scenic wonders of Kahanu Garden.



Now, after many years of preparation and planning, the Kahanu Garden Visitor and Education Center is open. Driving through the garden's front gate, visitors are welcomed with a plantation-style charm reminiscent of old Maui. Weary travelers, having driven the thirty-some miles of dense jungle hairpin curves and switchbacks along the often one-lane Hāna highway can take a break and relax in the roomy, open floor plan of the new center.

The handsome green one-story building is adorned with native Hawaiian landscaping, rock art, and stately 'ōhi'a (*Metrosideros polymorpha*) posts at the front entrance to support the building. Climbing half a dozen steps leads to an open-door plan that invites visitors inside where they'll find a bright, warm interior clad in koa (*Acacia koa*), breadfruit (*Artocarpus altilis*), kamani (*Calophyllum inophyllum*), and other Polynesian hardwoods.

In the center of the building, a majestic photograph of Pi'ilanihale Heiau offers a unique perspective as if you were at the base of the towering stone structure viewing the emblematic pig-shaped rock formation and stacked walls that surround.

The Visitor and Education Center also includes murals crafted by Hāna's youth using local hardwoods, many of which can be found in the garden. The artwork throughout the building tells a story. Above all of the doors are murals that depict the heiau, the voyage from Tahiti to Hawai'i, and a collage of Polynesian ethnobotanical plants depicted in stained glass.

Upon entering, visitors are greeted with a warm "aloha!" and given a short orientation before being invited to explore the garden. In addition to learning about NTBG's mission and what Kahanu Garden has to offer, the Visitor and Education Center carries garden-themed souvenirs and local crafts that reflect the plants in the garden. Items such as woven lauhala (pandanus) bracelets, māmaki loose leaf tea, books about tropical plants, and other items are available for purchase.

Also, within the center, is space for signage and mid-20th century brochures and news clippings that tell stories of the surrounding plants, people, and culture. Here visitors can learn how Kahanu Garden was established in 1974 thanks to the great generosity of the Kahanu family and

Hāna Ranch who gifted two parcels of land to the Pacific Tropical Botanical Garden (now NTBG).

The building itself was built through a collaboration between Kahanu Garden staff, the contractor, Kipahulu Construction, and a Hāna-based nonprofit, Ma Ka Hana Ka 'Ike. This project allowed high school students to learn important building and teamwork skills from their mentors and professionals. The students poured their heart and soul into the building construction and into the art they created.

Ma Ka Hana Ka 'Ike (literally: *in doing, one learns*) is focused on programs that help the Hāna community through grass-roots building projects, organic farming at Mahele Farm (which is part of Kahanu Garden property), and revitalizing the art of pounding taro (*Colocasia esculenta*) into poi. Through the collective collaboration, the building portion of the project took place between June 2017 and April 2018.

Outside the center, guests can enjoy the wrap-around balcony that includes comfortable benches to enjoy a

view of the breadfruit collection. Perhaps it is at this point visitors begin to slow down and realize there's no need to rush or stick to a schedule. Kahanu is one of those rare places where you can spend more time, enjoy the garden, and really be present in the moment.

The completion of Kahanu Garden's Visitor and Education Center represents more than a new building. It reaffirms a key value of NTBG as we work to grow plants, and grow people. The garden itself has evolved through the completion of this project and we look forward to the center honoring the significance of this place and the wondrous botanical collections within.



Kahanu Garden and Preserve staff wish to extend our sincere thanks to all the Hāna community, Ma Ka Hana Ka 'Ike, our Garden colleagues, volunteers, supporters, and to our ancestors for paving the way.

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 \$75 to \$500 with a level to fit everyone from individuals to families. **Contact: members@ntbg.org**

NEW & REJOINING FELLOWS FEB-APRIL 2019

Vaughn Hills De Guigne
Laura Hassel
Ashley Heath & Jaren Conklin
Jessie B. Hill & Ming Fang
Joanna Luo & Adam Purvis

NEW & REJOINING MEMBERS FEB-APRIL 2019

Nancie & Neil Abercrombie
Christine Aguirre
Carla Aleman & Maria E. Prieto
Marilyn & Terry Allen
Carolina Amram-Bush
Andrea Bahr & Cathy Bahr
Brenda Barker & Tyler Williams
Eddie Lee Beetschen & Mark Wagner
Linda & Kevin Berry
Daniel Blagojevic & Christoph Kovacic
Christine Bourdette & Richardo Lovett
Rebecca & Eric Burns
Lauren & Michael Busch
Maria & Gregory Byrd
Amy Call & Reave Finkel
Deborah & George Chapman
Peter Coates
Jerry Coleman-Dodson
Cynthia & Jason Collins
Camila Cote
Melanie & Robert Cronk
Taciana De Aguiar

Gail & Dino De Ranieri
Billie Dawson & Neil F. Brosnahan
Summer Dillberg & Mary Bartlett
Maria & Jody Drulard
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Elaine & Gregory Echols
Michelle & David Fastenau
Susan & C Bradford Foster, III
Gail O'Brien & Thomas Gaffney
Terri & Lee Gately
Tanya S. & Andrew Gershon
Cathy L. Granholm
Janet & Wylie Greig
Laura Snyder & Jonathan Gross
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Barbara & Rick Lane
Harriet Nicole Lawrence
Krista Leemhuis
Terry Leppo & Brian Glenn

Michael Letzring
Allison Freidin & Greg Levy
Pat Linton
Suzanne Wiggins & David Littman
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The National Tropical Botanical Garden is a participating member of the American Horticultural Society's Reciprocal Admissions Program which offers free admission and/or additional benefits at over 300 gardens throughout North America and the Cayman Islands. For more information please visit: <http://ahsgardening.org/gardening-programs/rap>

wish list

Small investments make a big difference for our programs and projects. If you would like to fund a wish list item, please contact development@ntbg.org or call us at (808) 332-7324 Ext. 212. Mahalo for your support!

FOR NTBG (GENERAL)

Volunteer NTBG logo t-shirts - (200 shirts x \$15 [\$3,000 total])
Volunteer logo lanyards - \$500

FOR GARDENS ON KAUAI

Camcorder, tripod, memory card to record lectures - \$300
2 standing desks (Finance Dept.) - \$200 each
100 guest umbrellas - \$250

FOR SCIENCE & CONSERVATION AND LIVING COLLECTIONS PROGRAMS

2 office chairs - \$130 each
Computer monitors (23" or larger) for plant records - \$200
Helicopter trips for conservation work - \$1,200 per trip
Emergency water storage tank for nursery - \$600
Kew Bulletin subscription - \$900
4x4 field work truck - \$15,000

FOR THE KAMPONG IN MIAMI

Speakers for Schokman Education Center stage - \$600
Replacement gas-powered backpack blower - \$400
Battery powered backpack blower - \$600
2 tankless water coolers - \$300 each
Digital camera - \$300

FOR KAHANU GARDEN ON MAUI

4-wheel drive vehicle - \$20,000+
12 hand pruners for staff and volunteers - \$45 each
Picnic tables for guests - \$200 each
5 safety signs - \$100 each

FOR THE BREADFRUIT INSTITUTE

Membership fee for Alliance to End Hunger - \$1,250
Kevlar gloves and eye protection - \$300
2 chef knives - \$150

Mahalo to our Corporate Leader
Koloa Rum Company for their sponsorship
of NTBG's Moonlight & Music fundraiser.



PREMIUM HAWAIIAN RUM

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Your business can join us as a Corporate Partner by becoming a business member, donating a product or service, sponsoring an event, arranging an employee engagement day, or providing a project grant. For more information, please contact Heather George, Director of Philanthropy at 808-332-7324 ext. 210, or hgeorge@ntbg.org.

Plants Need Cars Too!



Donate your gently used vehicle to NTBG

and receive a tax donation! Cars and pickup trucks (especially 4-wheel drive) in good working order can be put to use at many of our garden locations to help us maintain the gardens and host visiting scientists. Contact Development at (808) 332-7324, extension 238 for more information.



Your Legacy to the Garden

Aloha! As the new Director of Philanthropy at NTBG, I am thrilled to be working with all of our members, volunteers, board members, and staff to raise funds in support of our vital mission.

Although I have been working in fundraising and environmental conservation for several years, I am new to this extraordinary world of tropical plants. The more I learn about this organization, the more passionate I become about the need and importance for what we do, including bringing rare and endangered species back from the brink of extinction.

As part of my education, I have been reading about the legendary David Fairchild, William Hillebrand, Sir Joseph Banks, and others. These giants of botanical history have made countless contributions to our knowledge and understanding of the tropical plant world, and leave rich and enduring legacies for us all.

As you may know, some of these important writings are housed by NTBG in the Sam and Mary Cooke Rare Book Room at our headquarters on Kaua'i, and at The Kampong, our garden in Florida. We take our responsibility to preserve these priceless treasures seriously, and we are honored to make them available to the public for research and viewing.

But what do these historical figures and their legacies have to do with you today? Because of your interest in preserving our planet's natural resources and your connection to NTBG, we would like to invite you to consider a planned gift to the garden. We believe that everyone can contribute to furthering scientific discovery, educating people about the value of tropical ecosystems, and protecting biocultural diversity. Through a gift lasting beyond your lifetime, you can fulfill your own legacy to the planet by strengthening our core programs. Please feel free to contact me to help you make these arrangements, or answer any questions. I can be reached at hgeorge@ntbg.org or (808)762-1499.

Mahalo,
Heather George, Director of Philanthropy

P.S. My first day on the job here was exciting, not only because everything was so new, but also because we received an unexpected generous distribution from the charitable remainder trust of one of our long-time supporters. We are honored by this significant contribution, and we are stewarding this and every planned gift with a steadfast commitment to fulfill our donors' legacies.

Come to the rescue as a Volunteer!

Become an NTBG volunteer at one of our five locations and help preserve tropical plant diversity. Depending on the garden location, a host of volunteer activities are available from working in one of our nursery facilities or gardens, to greeting visitors and helping at fundraising events.

Have fun, meet new friends, learn about plants and make a difference today!

For more information visit ntbg.org, email volunteer@ntbg.org or call 808-332-7324 ext. 232



an eye on plants

SELECT SPECIES IN FOCUS

Breadfruit (*Artocarpus altilis*)

As a University of Hawai'i graduate student in the early 1980s, Dr. Diane Ragone became captivated with the most important food-producing tree crop in the Pacific. That tree — breadfruit — changed Diane's life, while she transformed people's understanding of what breadfruit could do.

In her quest to collect, study, and curate what would eventually become the world's most extensive living collection of breadfruit varieties and closely related *Artocarpus camansi* (breadnut) and *A. mariannensis*, Diane recognized that achieving breadfruit's full potential was limited by seasonality, prompting her to seek an answer to the question: Is it possible to have year-round breadfruit production?

While long-lived and easy to grow, depending on the variety, breadfruit typically has one longer fruit-bearing season followed by a shorter season over a four to six month period, leaving six to eight months of the year without fresh breadfruit.

Called 'ulu in Hawaiian, breadfruit has sustained people for centuries, but its lack of year-round production has been a limiting factor in achieving a reliable, steady supply and greater commercial viability. Traditionally, Pacific Islanders have prolonged the availability of breadfruit through preservation methods such as drying and fermentation.

Diane knew seasonal scarcity could also be addressed by the careful selection of diverse varieties which would better enable breadfruit to serve as a reliable staple for reducing hunger in the tropics.

The seasonality of tree crops like apples, pears, citrus, nuts, and legumes has been studied by land-grant universities and farmers for decades, but the same was not true for breadfruit, largely because it wasn't possible to get adequate quantities of good quality, uniform planting material.

That changed as Diane curated and built the breadfruit collection at Kahanu Garden on Maui and established the Breadfruit Institute (BFI) which, thanks to its efforts in partnering with Cultivaris (Global Breadfruit), and the University of British Columbia Okanagan, to name but a few, have been able to advance the pursuit of year-round production.

In 1996 Diane embarked on a ten-year study of 150 varieties represented by 200 trees growing at Kahanu Garden. Five years into the study, Diane graphed dates for male flower production, five stages of fruiting, and yield estimates.

She examined which varieties were producing fruit month by month over the course of each year. Closely studying production peaks (between September and December in Hawai'i) and dips, Diane focused

on the varieties that provided fruit when others didn't.

Drawing on years of records and field notes she'd recorded throughout the Pacific, Diane selected a group of 20 varieties to capture the maximum genetic diversity in order to achieve overlapping production. Each variety was examined intensively for nutritional value and other characteristics. That group was then pared down to around 10-12 varieties to be targeted as candidates for mass micropropagation and global distribution.

The Breadfruit Institute was the first to conduct such a study and today shares its methodology and offers data collection recommendations to other institutes and researchers. Additional breadfruit seasonality studies have since been conducted in New Caledonia, Fiji, Kiribati, and currently at the University of Hawai'i for which Diane has served as an advisor and provided trees through the Plant a Tree of Life project.

Today, as scientists report the grave environmental threats resulting from the global loss of biodiversity in the wild, after working with breadfruit for over 35 years, Diane has demonstrated the value of collecting, studying, and preserving agricultural biodiversity in order to overcome the limitations of seasonality, proving how diversity in crops can greatly enhance food security and provide environmental benefits as well.



PHOTO BY JIM WISEMAN



National Tropical Botanical Garden

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READ HOW NTBG STAFF REDISCOVERED THE
KAUAI ENDEMIC *HIBISCADELPHUS WOODII*
ON PAGE 4. PHOTO BY KEN WOOD