the TROPICAL GARDEN

It's Mango Season!

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FEATURES

DEPARTMENTS

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A longtime Fairchild volunteer once told me an odd story from the early days of the Garden. Back in the 1940s, she said, University of Miami (UM) football players would sometimes assist with heavy lifting projects around the Garden. Any time there were massive boulders or tree trunks to be moved, Dr. David Fairchild would phone the UM football coach and make a plea for help. I have never found proof of this in our archives, but the story fits with what we know of Dr. Fairchild's creativity and persuasiveness. It also reflects a collaborative spirit that still exists between our Garden and local universities.

Today we still have massive projects we can't do ourselves, and we receive help from UM, Florida International University (FIU) and Miami-Dade College (MDC) in unexpected ways. Today, our priorities are less focused on boulders and tree trunks, and more directed toward community outreach. The most ambitious of our outreach initiatives is The Million Orchid Project, and all three schools have found creative ways to lend a hand.

Take, for instance, the development of STEMLab, the fantastic orchid propagation lab built within the frame of a decommissioned Miami-Dade County Public Schools bus. The Design Build Studio of the UM College of Architecture developed the plans and completed the entire transformation from bus to laboratory. Architecture students did all the work, creating a unique teaching space that has already served more than 3,000 local seventh grade students during its first year of operation. STEMLab now visits public middle schools throughout the county, providing hands-on experience with rare orchid propagation. UM and FIU undergraduate interns serve as STEMLab instructors.

How about the development of a smartphone application for The Million Orchid Project? Researchers in the FIU Geographic Information Systems Center approached us with the idea, funding and a plan to make it happen. Once the system is deployed, community members will use their smartphones to keep track of all the orchids being planted throughout South Florida. After testing the concept around the FIU campus, GIS center researchers now have a working version to be released later this summer.

We recently partnered with MDC to develop a new orchid lab at the MDC InterAmerican Campus (in Miami's Little Havana neighborhood), where we are recruiting local students into the science, technology, engineering and math (STEM) educational pipeline. We are using The Million Orchid Project as a central concept for teaching STEM topics, engaging students in research along the way. That project, just getting started this summer, is funded by the National Science Foundation.

Of course, we still work closely with the biology departments of UM and FIU, and we continue to host faculty and graduate students from both universities in our labs and offices. In every way possible, we collaborate on botanical research and teaching. In addition to those traditional relationships, we will keep inventing new ways to spread The Million Orchid Project through our community. As we place more and more orchids high up in neighborhood trees, maybe we should call in the UM and FIU basketball teams for help!

Best regards,

Carl E. Lewis, Ph.D., Director

@ZapataNannette

Georgia Tasker was the garden writer for *The Miami Herald* for more than 30 years, and now writes and blogs for Fairchild. She has received the Garden's highest honor, the Barbour Medal, and a lifetime achievement award from the Tropical Audubon Society. She is also an avid photographer, gardener and traveler. She graduated cum laude from Hanover College in Hanover, Indiana.

Kenneth Setzer joined Fairchild as a writer and editor with the marketing team in 2013. He contributes to print and digital media. Setzer enjoys writing about natural and human history and is an enthusiastic photographer, with a particular fascination with fungi. His educational background is in linguistics, with a B.A. from Queens College, City University of New York, and an M.A. from Florida International University.

Emily Warschefsky, is a Ph.D. student in Florida International University's Department of Biological Sciences and is supervised by Drs. Eric von Wettberg and Maureen Donnelly. Her research uses genetics to explore the history of the mango and its wild relatives, and she has traveled to and collaborated with institutions from around the world, including Singapore Botanic Gardens, Bogor Botanical Gardens, and Forestry Research Institute Malaysia.

Javier Francisco-Ortega, Ph.D., is a faculty member at Florida International University (Department of Biological Sciences) with a research appointment at the Garden. He joined FIU and Fairchild in 1999 and has a broad interest in plant taxonomy, conservation genetics, molecular phylogenetics and botanical history. During the last few years, he has performed research on the history of plant exploration.

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ON THE COVER
Mangos from the Fairchild Farm.
Photo by Kenneth Setzer/FTBG

July

JUNIOR NATURALIST SUMMER CAMP
Ages 6-9
9:30 a.m. - 3:30 p.m.
Six one-week sessions through Friday, July 28.
For more information, go to www.fairchildgarden/summer-camp or call 305.663.8094

SCIENCE DETECTIVE CAMP
Ages 10-13
9:30 a.m. - 3:30 p.m.
Three one-week sessions: From Monday, July 10 through Friday July 28.
For more information, go to www.fairchildgarden/summer-camp or call 305.663.8094

Summer Camp After Care
3:30 - 5:00 p.m.

August

PLANT ID WORKSHOP
Friday, August 4
1:00 p.m.

September

PLANT ID WORKSHOP
Friday, September 1
1:00 p.m.

October

PLANT ID WORKSHOP
Friday, October 6
1:00 p.m.

79TH ANNUAL MEMBERS' DAY PLANT SALE IN CONJUCTION WITH BIRD FESTIVAL
Coming in October

CARS IN THE GARDEN
Sunday, October 29
9:30 a.m. - 4:30 p.m.

HOWL-O-WEEN AT FAIRCHILD
Tuesday, October 31
9:30 a.m. - 4:30 p.m.

Tours of the Garden

TRAM TOURS OF THE GARDEN WEEKDAYS (M-F)
Every hour, on the hour
10:00 a.m. – 3:00 p.m.

WEEKENDS
Every hour on the hour
10:00 a.m.– 4:00 p.m.

TOURS EN ESPAÑOL
Sábados y Domingos,
1:30, 2:30 y 3:30 p.m.

DAILY WALKING TOURS
10:15 a.m., 11:15 a.m., 12:15 p.m., 1:15 p.m. and 2:15 p.m.

BUTTERFLIES: WINGED WONDERS AND THE PLANTS THEY LOVE
Saturdays and Sundays,
10:15 - 11:00 a.m.

Tours added daily.
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(L-R) Javier Francisco-Ortega, Simone Oliphant, Keron Campbell and Tracy Commock during the McNair Induction Ceremony at FIU on April 12, 2017.

Ronald E. McNair Program Prepares Undergrads for Doctoral Studies

Simone Oliphant, a Jamaica native, joined Florida International University in 2016. A biology major and a member of the university's Honors Program, she is one of 27 FIU undergraduate students awarded the prestigious Ronald E. McNair Post-baccalaureate Achievement Program fellowship. This program, which gives selected students full tuition and stipends, prepares undergraduate students for doctoral studies through involvement in research and other activities. Supported by the U.S. Department of Education, it aims to attract students from underrepresented groups into scientific research.

Oliphant will be mentored by Dr. Javier Francisco-Ortega, professor in FIU's Department of Biological Sciences and a Fairchild faculty member. Her research will be conducted in collaboration with Tracy Commock and Keron Campbell from the Institute of Jamaica, as well as Fairchild Herbarium Curator Dr. Brett Jestrow. This summer, Oliphant will undertake research at Michigan State University in East Lansing. In August, she will join Fairchild, working with researchers in the DiMare Science Village.

The McNair Scholars Program recognizes the life and achievements of Ronald E. McNair, an American physicist and NASA astronaut, who died during the launch of the Space Shuttle Challenger in January 1986.

(L-R) Fairchild's Conservation Team of Jimmy Lange, Jennifer Possley and Peter Vrotsos in Camp Everglades.
Photo by Jo Ann Dollard

Fairchild's Connect To Protect Network held its annual meeting . . . in a pine rockland!

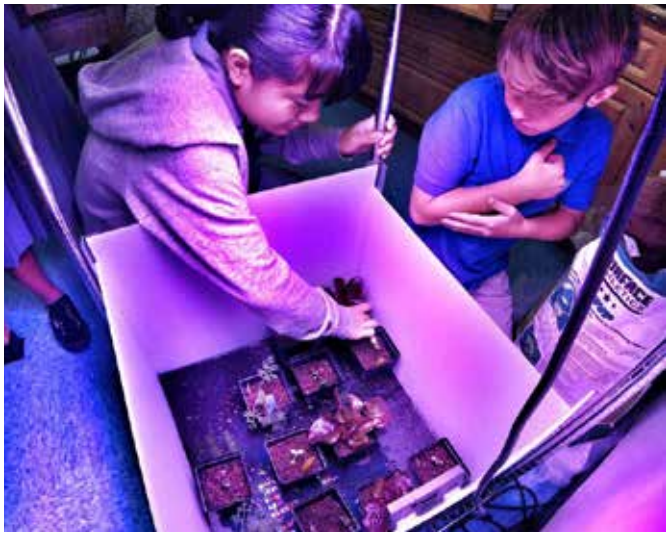
On Saturday, April 29, Fairchild's Connect to Protect Network held its annual meeting in the great outdoors, at the Boy Scouts of America "Camp Everglades" in Everglades National Park. Roughly 30 CTPN members joined Fairchild's Conservation Team and camp caretaker Jim Happell for an enjoyable morning of hiking, a hands-on propagation activity and a workshop on rare plant mapping. With their energy and enthusiasm, members helped CTPN staff gather seeds for the collections and gather rare plant occurrence data. After various morning activities, members and staff enjoyed lunch—a delicious smorgasbord put together by CTPN members. The event concluded with a raffle of several rare pine rockland species. What a treat it was to relax in the shade, share conversation and enjoy a great spread. Thank you to all involved who made this such a memorable day!

(L-R) Keron Campbell and Tracy Commock performing molecular research in the Fairchild laboratories.

Botanists from Institute of Jamaica Visit Fairchild

This April, two researchers from Jamaica conducted important plant molecular research at Fairchild's laboratories, supported by a grant from the Mohamed Bin Zayed Species Conservation Fund. Tracy Commock, director of the Natural History Museum of Jamaica, Institute of Jamaica, and Keron Campbell, curator of the herbarium of the Institute of Jamaica, performed molecular systematic research pertinent to the Caribbean endemic genera *Dendrocousinsia* (Euphorbiaceae family), *Lachnorhiza* (Asteraceae family), Ekmania (Asteraceae family) and *Acanthodesmos* (Asteraceae family).

Commock and Campbell are both PhD students at the University of the West Indies at Mona, under the supervision of Dr. Phil Rose in the Department of Life Sciences. Dr. Brett Jestrow, Fairchild's Herbarium curator, and Dr. Javier Francisco-Ortega, professor in FIU's Department of Biological Sciences and a Fairchild faculty member, are members of their graduate committees, and hosted Commock and Campbell during this visit.



Growing Beyond Earth

As we wrap up the second year of Fairchild's highly successful Growing Beyond Earth project, a citizen science initiative in partnership with NASA, more than 5,000 South Florida students tested over 90 species and varieties of edible plants. This year, students from 131 middle and high school explored germination rates, growth habits and edible biomass production in varieties of tomatoes, peppers and leafy greens. In doing so, they experimented with various fertilizers to determine which would improve fruiting and increase growth rates. Overwhelmingly, students identified Extra Dwarf Pak Choi and Misome, a hybrid form of Asian greens, for their outstanding biomass production and growth habits that meet the requirements set forth by the "Veggie" researchers at NASA's Kennedy Space Center. The data collected by the students was sent directly to the research team who will evaluate the data over the summer and select the next generation of edible crops for further testing at their facilities.

Avocados

YOUR SPOON WILL SWOON

By Mary Neustein

The avocado, Persea americana, which is native to Tropical America, has shown indications of dating back nearly 10,000 years in central Mexico. From the Spanish word aguacate, it has taken on many names throughout the world and is also known as the alligator pear, which best describes its pear shape with greenish, bumpy, leathery skin.

When you cut into an avocado, its greenish, buttery-yellow flesh is loaded with heart-healthy fats, various nutrients such as Vitamins K, C, B5, B6, E and potassium, and it is rich in fiber. Containing no cholesterol or sodium, one-half of a medium Florida avocado has a mere 160 calories, 2 grams of protein, 15 grams of healthy fats, 9 grams of carbs and 2 grams of protein. Of the 9 grams of carbs, 7 are fiber, leaving you with only two "net" grams of carbs and making the avocado a low-carb, friendly plant food.

Luckily, avocados are available year-round in supermarkets. Not just the main ingredient for a tasty guacamole, avocados can be the star ingredient for salads, refreshing cold soups or even a dessert!

Here is a quick 15-minute gluten free, vegan and paleo recipe that has the freshness, crunchiness and smooth buttery flavor of our tropical fruit the avocado. Your spoon will swoon as you dig in to all of this freshness!

AVOCADO, JICAMA AND CUCUMBER *SALAD*

Serves 4

Ingredients

2 avocados, any variety will do
2 cups of jicama—about ¼ of a small jicama
2 whole medium cucumbers (about 2 cups)
2 tbsp. fresh lime juice
1/8 tsp. sea salt
1/8 tsp. chili powder
1/8 tsp. smoky paprika
Cilantro—chopped and added per your taste

Directions

1. Peel and slice cucumbers lengthwise down the middle and scoop out seeds with a spoon. Julienne the cucumber and place into a large glass mixing bowl.
2. Peel jicama, and with a sharp knife cut in half, then into julienne-size matchsticks, enough to fill 2 cups; place jicama in the bowl with cucumbers.
3. Mix cucumbers, jicama, lime juice, salt, paprika, chili powder and cilantro (to taste). Chill for a minimum of 30 minutes before serving.
4. Prior to serving, slice one of the avocados into bite size pieces and toss gently into the salad. Use the second avocado as garnish—slicing it into long, thin pieces and fanning the slices on the side of the plate. If desired, garnish with additional cilantro.

The Fairchild Challenge: 15 Years of Truly Impactful Science Education

By Amy Padolf. Photos by Education Staff

This year marks the 15th anniversary of Fairchild's award-winning environmental science education program, The Fairchild Challenge. The Fairchild Challenge is a multidisciplinary STEM education competition designed to increase students' environmental awareness, scholarship and stewardship, while offering a clear educational pathway that develops leadership in environmental science and diversifies the scientific workforce. What started as a way to bridge the disconnect between high school students and the environment through a series of multidisciplinary activities designed to reach kids—no matter where their interest lies—became a program that casts a wide net and provides opportunities for students to go outside, find their voice and become stewards for their environment. Based on the overwhelming need of the community and nation for programs that focus efforts on STEM education, we have refined The Fairchild Challenge. Today, students have the opportunity to contribute to local and national conservation initiatives, conduct authentic research, write, create, design, engineer, perform, debate and even cook, with botany as the integrating context—all with the hope of inspiring the next generation of scientists and educated voters.

In partnership with Miami-Dade County Public Schools (MDCPS), the program has been integrated into the district's curriculum as a significant component for schools to be awarded STEM Certification and as a remediation tool for schools with lower overall grades in science. "The Fairchild Challenge has become an integral part of the MDCPS community and is continuing to be integrated across the curriculum, providing an invaluable asset to the school district," said Cris Carranza, administrative director of MDCPS's Division of Academics, Accountability & School Improvement. "[It is] allowing us to expand learning beyond the classroom."

Unlike many programs, The Fairchild Challenge recognizes that there is considerable power in working with like-minded individuals and organizations with complementary expertise in order to broaden its reach and impact. Graduate students from both Florida International

University (FIU) and the University of Miami (UM) have integrated their research questions into the program in order to gather important data. Through The Million Orchid Project, for example, Fairchild researchers have been able to determine the best growth medium for growing native orchids, based on student data. NASA was able to confirm that Chinese cabbage was a viable candidate for growing in outer space and has since tested it on the International Space Station, with help of Fairchild Challenge middle and high school students. The University of Rhode Island, in partnership with FIU graduate students, has confirmed the changing range of native and nonnative lizards. Elementary students successfully showed the impact of tree canopy on the urban heat island effect for The Nature Conservancy.

With significant ongoing support from The Batchelor Foundation, we have been able to grow the Challenge from 10 local high schools in 2002 to 310 elementary, middle and high schools in Miami-Dade, Broward, Monroe and Palm Beach counties, plus five partner sites nationally and internationally. Since the program's inception, we have engaged more than 500,000 students and 20,000 teachers, and have awarded $100,000 in school garden grants. The program has also awarded $70,000 in college scholarships to deserving high school seniors who planned to attend a local university and study biology, and more than $250,000 in cash prizes to schools so they can continue environmental science projects.

With the Challenge's continued growth, we are able to provide programming that augments the school curriculum by allowing students an opportunity to apply seemingly lofty scientific concepts through research, engineering, mathematics, performing and visual arts, and the social sciences. And, with the participation of schools like Miami Palmetto Senior High School, which received the Fairchild Challenge Award for the 15th consecutive year, we continue to grow and evolve the program to meet the community's changing needs.

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Barbara Goleman Senior High School

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Air Base K-8 Center for International Education

Elementary School
La Scuola

For more information, please visit www.fairchildchallenge.org or Twitter @FairchdChallnge

Become a **Fairchild Volunteer** and let a **few hours of your time** blossom into a world of **new experiences**!

Fairchild volunteers serve the Garden, the South Florida community and the world through their hands-on, interactive participation in Fairchild's programs and activities, while meeting others who share their interest in plants, people and gardens. Current volunteer opportunities include hosting, guiding students on field trips and gardening on a horticulture team.

To learn more about becoming a Fairchild volunteer, please visit us at www.fairchildgarden.org/volinfo or call 305.667.1651, ext. 3360.

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Myles Covington and Fairchild's Ghost Orchids

By Julieta Jacob, Fairchild Volunteer

Myles Covington, a volunteer at Fairchild's Orchid Micropropagation Laboratory, has played a key role in The Million Orchid Project by successfully growing the rare, leafless ghost orchid, of which only about 2,000 remain in Florida. Covington recently graduated from Cutler Bay Senior I Prep. He will attend Florida International University to study biology, while continuing to work with ghost orchids at Fairchild. Volunteer Julieta Jacob interviewed him for TTG.

How long have you volunteered at Fairchild, and why did you decide to volunteer?
In the summer of 2016, after participating in The Fairchild Challenge, I was accepted for an internship in the biology laboratory to do work with the Florida butterfly orchid (*Encyclia tampensis*). When the internship ended, I did not want to leave; I liked coming to Fairchild. I now work with Dr. Jason Downing, Fairchild's orchid biologist, at the lab. … I am responsible for most of the orchids we grow, but I specialize in ghost orchids.

Tell me about your work with ghost orchids.
During the internship, I was always here early and I stayed late, so Jason asked me if I could help him with the ghost orchids. He handed me a container with ghost orchids, and I had no clue what they were. He placed it in my hand, and said I was holding one of the few populations of one of the most endangered orchids in the world. From that point on, they became my responsibility.

I am responsible for making plant food, also known as orchid media. Most of the orchids live in sealed containers with plant food. After a while, orchids use up all ingredients of the media, and they have to be put in containers with new plant food so they will continue to grow. I know it's time to transfer them to a new container when they start yellowing or shivering up.

When the ghost orchids are of decent size, I move them outside to see how well they grow. This is an important part of the process, because it is where they will be prepared to be reintroduced to the wild, and also the hardest part because this is where most of the orchids die.

Before I came here, Fairchild had ghost orchids, but since they are lot more sensitive than the rest of the orchids, they were not doing well. They needed special attention, which I was happy to give. I now have ghost orchids planted out in the Garden by the laboratory and in the laboratory basement. There is also another set in my school so that I can work with them through the week. They are thriving.

Have you seen the flower of a ghost orchid?

In search of the Haitian Oil Palm *Attalea crassispatha* Revisiting after 25 years

By Brett Jestrow, Ph.D.; William Cinea; and Alan Franck, Ph.D.

The Haitian oil palm has a long history in science and here at the Garden. First described in 1703 by the famous botanist Charles Plumier, the palm is only known from southwestern Haiti, between Les Cayes and Port-au-Prince. The first record of seed leaving Haiti dates from 1938; from a few of those seeds that were sent to the young Garden, one venerable palm is still alive and well.

The only careful study on the *Attalea* palms of Haiti was published in 1993 by Joel Timyan and Samuel Reep. Their work in Haiti spanned a couple of years and focused on locating all of the nation's palms—they identified a grand total of 25 individuals. This study also led to a large seed distribution, both within Haiti and to botanic gardens around the world. The majority of the 66 *Attalea* individuals currently growing at Fairchild came from this distribution of seeds. While Attalea palms are planted across Fairchild, a large group from these seeds is found near the Davis House in the very southwest of the Garden, and is often highlighted on the tram tours. Fairchild now hosts the largest collection of mature *Attalea crassispatha*, even more than are known to exist in Haiti.

Last year, the Prince Bernhard Nature Fund awarded William Cinea of Haiti's Cayes Botanical Garden a grant to support a project on these rare palms. *Attalea crassispatha* are not only rare—all other species of Attalea are from either Central or South America, making the Haitian species a true outlier. Furthermore, the Haitian Attalea in not subtly distinct from other species. It is readily recognizable and, according to a 2016 molecular study, thought to be a distinct lineage dating back approximately 18 million years.

Our goal was to rediscover the 25 *A. crassispatha* palms Timyan and Reep documented, and describe their current status. Have they succumbed to the pressures of human disturbance, or is the species in the midst of resurgence? Our project also aimed to collect DNA samples and germplasm to recover whatever genetic diversity still exists for the species. This is an important point, because even though we grow many *A. crassispatha* palms at Fairchild, we do not know if these plants cover the genetic diversity of the species. In January of 2016, in spite of the devastating Hurricane Matthew, two of us, Dr. Alan Franck of the University of South Florida and Dr. Brett Jestrow of Fairchild, arrived in Les Cayes. After a couple of days spent hosting a plant identification workshop and symposium, the actual expedition began. Of course, attempting to track down all of these palms—which botanists had not visited in 25 years—was not an easy task. Fortunately, during the previous year William Cinea had organized preliminary inquiries, and in so doing, made a truly fortuitous connection. He found Ossin Jean, the very same field guide from the project of 25 years earlier.

Growing in a courtyard garden, this *Attalea* was planted by Ossin Jean 25 years ago.

Haitian *Attalea* are known from two areas, near the two communes of Cavaillon and Fonds-des-Nègres. Here, the expedition truly began, with a meeting with Jean, who was kind enough to join us. We set off for the Fonds-des-Nègres area, where the palms are widely distributed as lone individuals in the midst of active agriculture. We soon found our first palm, which was not only healthy, but was actively dropping fruit. Jean quickly cracked a couple open and ate the nuts, before helping to collect seed for both the Cayes and Fairchild gardens. The nuts of the Haitian *Attalea* are indeed edible, and, as we learned during our travels, are held in high regard, actively harvested across the Fonds-des-Nègres region. They are locally called "kokowos," and it seems one need only arrive within a mile of a palm, and then everyone immediately recognizes the name and knows where the specific palm occurs. Jean, a true lover and connoisseur of kokowos, remembered the palms of the area and had visited each of the palms

TOP: Ossin Jean holding a spathe from the first *Attalea crassispatha* we found in Haiti.
ABOVE: A view from the dry valley near Cavaillon, with a stand of Haitian oil palms in the distance.

TOP: A seedling of Attalea grown locally in Fonds-des-Nègres; the seed resembles a miniature coconut.
ABOVE: The team hiking through pasturelands in search of palms.

over the years in order to collect the nuts. With no more seed eating on the expedition, we collected a leaf sample for DNA and continued onward.

The most commonly visited and photographed individual Attalea in Haiti grows next to a house on the main road between Les Cayes and Port-au-Prince. Easily located, a small bodega across the road occasionally sells a style of candy locally called "tablet" made from baked sugar and *Attalea* nut. After a discussion with the landowner, we were invited onto his property and given a tour. The owner explained that he had recognized the palm's rarity, as he did not know of any other such palms in the area, and had taken it upon himself to begin propagating the palm by seed. He showed us a few of the seedlings, and further explained that he had grown a few dozen more in the past. After asking where these plants went, he explained that he had given them to friends in the area to plant in their gardens. Exciting news! This is the first time that the Attalea had been found to be locally propagated in Haiti; it seemed kokowos might just be gaining in popularity.

While this plant grew near a main road, most of these lone palms were found farther afield. The more palms we visited, the more we noticed that each palm in the Fonds-des-Nègres area had its own unique character. One was extremely tall, reaching over 50 feet. One had notches chopped into its truck, making the climb a little less dangerous. Another had a large hole at the base of its trunk of a local religious significance, truly the first holy palm that Franck and Jestrow had ever seen. But of all these characters, one deserves special attention and explanation. In southern Haiti, trees and palms are often used for storing corn, keeping the corn far off the ground and discouraging rodents. Typically people use the common native palm Roystonea

ABOVE: One of two stands of *Attalea* in the dry valley near Cavaillon, showing wind damage from Hurricane Matthew.
BELOW: Heading back from our day with the palms of Cavaillon.

borinquena, the national tree of Haiti that is centered on the national flag and crest. By drilling a hole through the trunk, a piece of wood can be positioned and corn hung from it high off the ground. It's a dramatic presentation, and amazingly the palms seem to survive, if not thrive. When Brother Marie-Victorin visited Haiti in the early 1930s, he took note and carefully photographed the same technique with other trees. But of all of the *Attalea* palms known in Haiti, only one is used for this purpose.

After visiting all of the known sites of the wild Attalea palms in Fonds-des-Nègres, Jean again proved his knowledge and experience. When the palm seed was collected 25 years ago, about half of the seeds were grown and distributed in southern Haiti. Jean showed us a few of these cultivated palms growing in courtyard gardens. One tree in particular Jean had planted himself, and we found it in great health, flowering, fruiting and being actively harvested.

After Fonds-des-Nègres, we turned our attention to the region of Cavaillon. Here we parted ways with Jean, as he had never been to the palms of this area. Theogene Pierre-Andre, a longtime associate of Cayes Botanical Garden, now led the way with map in hand. Armed with a couple of seeds, Pierre-Andre asked locals if they recognized them or knew anything about kokowos. We did not have to spend much time asking, and soon a local jumped in the car and showed us the way. We found ourselves walking through a broad, dry valley—quite different from Fonds-des-Nègres—where all of the palms grew relatively close together. From a single vantage point in the valley, we could see all 12 palms that occur in the area, comprised of two clusters on either side of the valley. People living in the area remembered the collectors of 25 years ago, and we even got to meet the son of the guide who helped them.

In total, we found 25 mature wild plants of the *Attalea crassispatha* growing in Haiti—surprisingly, the same number found so many years ago. While a few of the older palms had died, a few younger plants were found in their place. While apparently stable, the number of palms is so low that the threat to their survival still exists. For this reason, we are actively propagating and growing more of this rare palm. Half of the seeds collected on this trip are now at Cayes Botanical Garden, and half were distributed to Fairchild and the Montgomery Botanical Center. We plan to further study the genetic diversity of the species and to produce large quantities of diverse seed for future conservation efforts—and perhaps even one day for food.

MANGOS

From Wild to Table

Why the search for our cultivated foods' wild origins is so important.

By Kenneth Setzer

Unlike previous years' events, this year's Mango Festival at Fairchild does not feature mangos from any particular country. Instead, this year celebrates "from wild to table." But what does that mean? What's wild about mangos? As with most questions in life, the answer is not entirely clear.

The search for the wild origin of our cultivated foods has enticed many agricultural explorers to remote and dangerous locations. Frank Meyer, in the service of Dr. David Fairchild, searched in China a century ago for the wild ancestor of the peach, and he found it! He described it as "a small green peach the size of a marble." Not what you'd except to find at the supermarket, but its rootstock, for example, could be used to grow more appealing peaches in difficult situations. A more modern view suggests we decipher the peach ancestor's DNA for strengths bred out of the more marketable peaches. Meyer also collected wild pears for the USDA, as they were the only varieties resistant to fire blight.
So many of our staple foods, especially grains, have been hybridized and cultivated for thousands of years. Corn, rice, wheat and countless others all originated from a wild source that our distant ancestors ate. They realized they could transplant these food sources or grow them from seed in more convenient locations, where they could be guarded, easily accessed and tended. Our ancestors naturally chose the plants that they found best: usually those bearing larger fruit, with greater yields, smaller seeds, etc.

These early farmers also realized they could modify the plants by selective parentage—a natural, though human-directed, form of genetic modification. This is at the root, so to speak, of farming and modern civilization itself. We can feed a lot of people this way, and even offer food like (nearly) seedless watermelon or bananas that are all pretty much equal in size, flavor and ripening times.

But we also lose quite a bit of diversity in practicing this kind of growing, known as monoculture. Not just in flavors and varieties that appeal to human tastes, but in genetic variety. Take the Cavendish banana: Its lack of diversity means the banana industry is facing a real threat from Panama disease. This fungus is lethal to the Cavendish, but not to some other banana varieties, most of which are not commercially grown. This is the danger inherent in monoculture.
The same is true for almost all of our cultivated foodstuff. Given rising global temperatures, new diseases and pathogens, storms and risk of saltwater intruding into our drinking water supply, it's important to cultivate for variety, and for plants that may tolerate conditions unsuitable to even their close relatives.

Back to the mango: There are something like 600 varieties known. To confuse matters further, the Indian vs. Southeast Asian cultivar dichotomy leads to more questions about what exactly makes a mango (see "The Mysteries of *Mangifera*," page TKTK). The very question of what "species" means comes into play here, and far greater minds than mine haven't definitively answered it.

Finding a truly wild ancestor of the mango might not be possible; it may no longer even exist.

So what does "wild to table" mean? To me, it means bringing back some of the diversity lost through millennia of cultivation, avoiding monoculture, researching through DNA and old-fashioned plant exploration what may or may not be "out there" still. Preserving diversity of crops will almost certainly prove vital, but we need to find that diversity first. Let's not forget exploring for new tastes, new textures and "wild" food, whatever it is, with more nutrients, with new, useful compounds and for the simple joy of eating!


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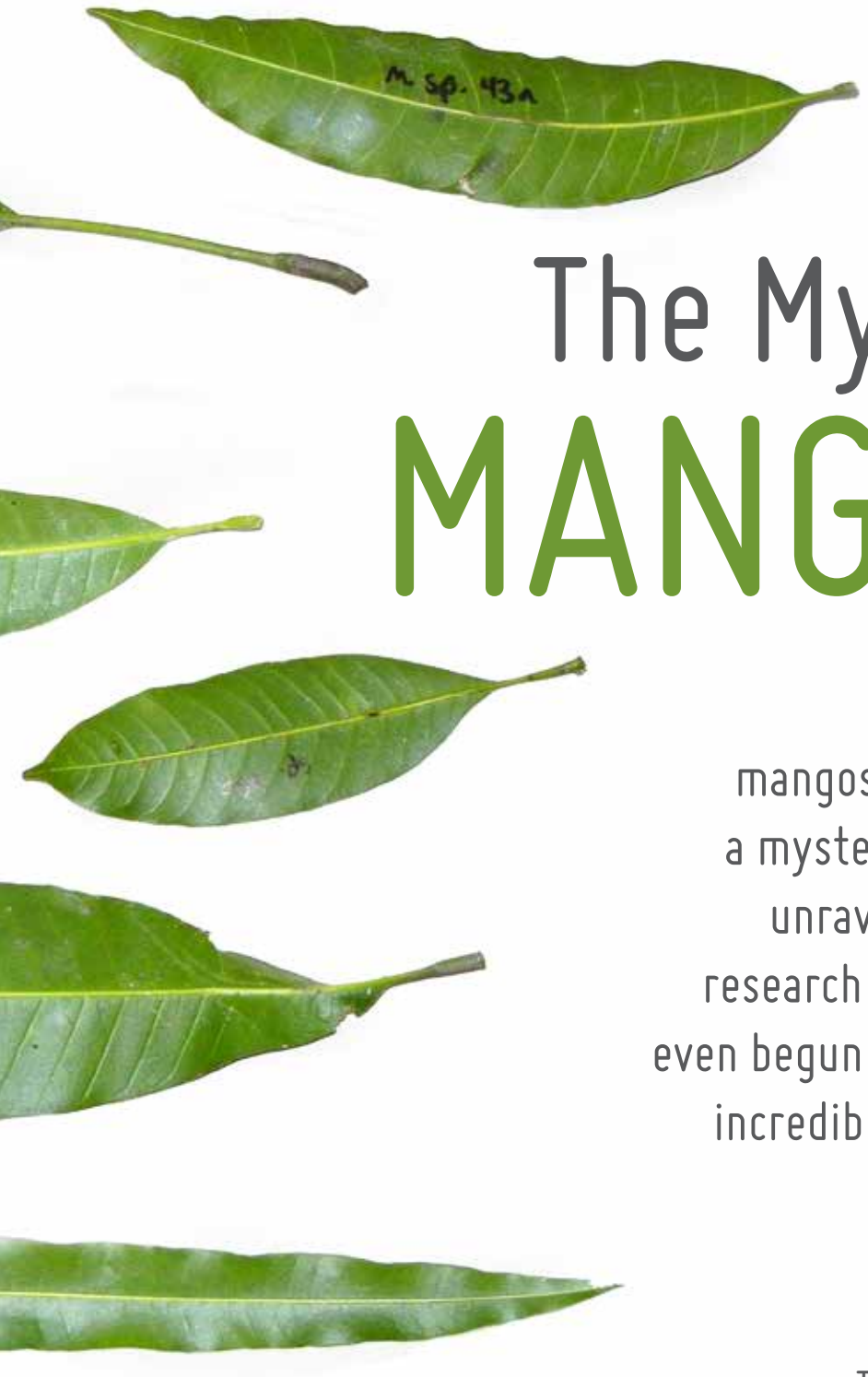


The Mysteries of MANGIFERA

We think we know our mangos, but much of their origin is a mystery researchers are trying to unravel through exploration, DNA research and other methods. They've even begun to ask if all cultivars of this incredibly diverse fruit are truly the same species.

Text and photos by Emily Warschefsky

In South Florida, we know our mangos. During our sultry summers, they seem to drip off the trees scattered throughout our neighborhoods. Those of us who stick out the steamy weather are lucky enough to experience the amazing diversity of mango size, shape, color, texture and, best of all, flavor. Yet the mango cultivars that we know and love—from the blushing 'Haden,' to the glowing 'Nam Doc Mai,' to the rich 'Alphonso'—represent only a small part of a large and somewhat mysterious genus of plants that are unique, diverse and important in their own right, but are little-known outside of their homeland in Asia.

The mango belongs to the genus Mangifera, which contains approximately 69 species in total, and is part of the poison ivy family, Anacardiaceae (this explains why some people develop contact dermatitis from mango sap). *Mangifera* species are native to South and Southeast Asia, with a range spanning from India eastward to the Solomon Islands. While the heart of *Mangifera* diversity lies in the wet, tropical lowland forests of Borneo, Sumatra and the Malay Peninsula, some species can grow in very different environments, including savannahs, mangrove swamps and elevations over 3,200 feet. All 69 *Mangifera* species are trees, and most grow to be quite tall, reaching 120 feet or greater, with long, straight trunks that are valued for timber.

Like many tropical tree species, *Mangifera* do not grow in dense stands, but are very sparsely scattered throughout the forest, and individual trees typically do not flower every year. The combination of the height of *Mangifera* trees, their low density in tropical forests and their sporadic flowering makes it difficult to locate, identify, study and collect *Mangifera* in the wild. This is one of the primary reasons why there remains some uncertainty about how many species of *Mangifera* exist.

While few wild *Mangifera* species produce fruits that are as delectable as mango, local people in South and Southeast Asia consume fruits from some 26 other species of *Mangifera*. Some,

like *Mangifera foetida*, or horse mango, are cultivated in the home gardens, or kampongs, of villagers in Malaysia and Indonesia. The unripe fruits of *M. foetida* and many other *Mangifera* species are frequently used to make sambal, a spicy, pickled dish.

We humans are not the only ones who love to eat *Mangifera* fruits—in the wild, they are a favorite of such iconic megafauna as hornbills, orangutans, rhinos and elephants. With the disappearance of these important seed dispersers and the forests themselves, many *Mangifera* species are in danger of vanishing. Unfortunately, less than half of *Mangifera* species are currently preserved in ex-situ collections like botanic gardens, and only about a dozen species are growing outside of Asia.

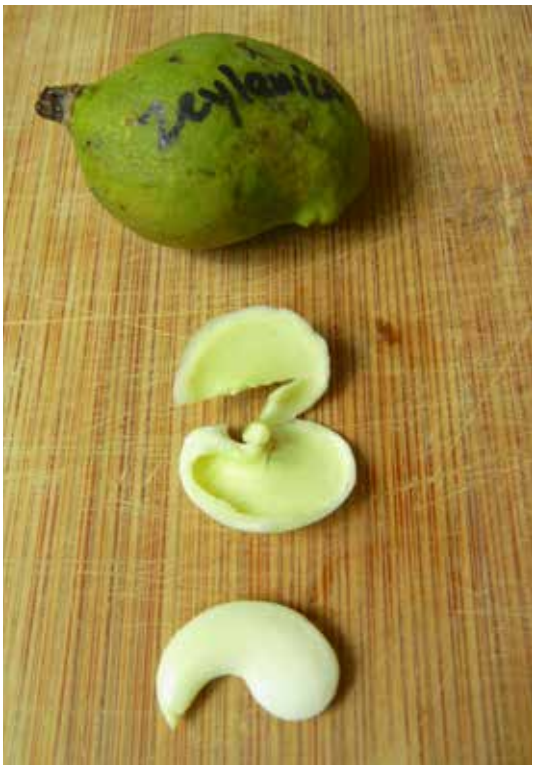
Exploring for Wild Mangifera — In the Field and in the Lab

Although wild Mangifera species can provide valuable context for scientific studies focused on cultivated mango, few, if any wild species are typically included in such research due to their poor representation in herbarium and living collections. As a PhD student at Florida International University, I set out to catalog the diversity of this important genus of plants, and to use wild Mangifera species to provide a broader understanding of the history of the mango itself.

For my research, I visited herbaria, botanic gardens and forest research plots in Singapore (Singapore Botanic Gardens, Gardens by the Bay), Malaysia (Pasoh Forest Reserve, the Forest Research Institute Malaysia, Sandakan Herbarium), Indonesia (Bogor Botanical Gardens, Purwodadi Botanical Garden) and the United States (Miami-Dade's Fruit & Spice Park, the USDA's Chapman Field Subtropical Horticulture Research Station, and Fairchild) to study and collect samples from as many Mangifera species as I could find.

By working closely with collections abroad, I experienced firsthand how difficult it is to determine whether individuals are from the same species or not just by looking at them. It is particularly tough in plants—individuals of the same species can look very different depending on their stage of life (seedling vs. sapling vs. mature tree), or growing conditions (sun/shade or nutrient availability), and it is often impossible to definitively identify a species without looking at its flowers, which are not always available. For these reasons, I used DNA sequencing to help decide which individuals belong to the same species and which represent different species.

I also used DNA sequences to learn about how different *Mangifera* species are related to one another. I then applied the knowledge of these relationships in different ways. For example, since many species in the genus are cultivated for their fruit, you might assume that these species are closely related to one another, while species that produce unpalatable fruits are more distantly related. However, my analysis shows that this is not the case; species that are cultivated for fruit are scattered throughout the genus. Similarly, I can investigate fruit color, adaptations to different environments and many other characteristics.



Understanding the relationships between *Mangifera* species also has direct applications to mango breeding and cultivation. Mango is most likely to be able to interbreed with its closest relatives, and these species could therefore be used in breeding programs to introduce important traits like disease resistance. In addition, mango growers can use closely related species as rootstocks for mango, which may allow mango to be grown in different soil conditions or possibly even produce a dwarf mango tree.

Teasing Out the Mango's True History, and Why Some Mangos May Not Actually be Mangos

Finally, understanding how mango is related to other species of *Mangifera* provides critical insight into where and how the mango was domesticated. The traditional story of the mango goes something like this: the mango is a single species, *Mangifera indica*, that grows wild in the foothills of the Himalayas, was domesticated in India around 4,000 years ago and was introduced first into Southeast Asia before being transported along trade routes to the rest of the world's tropics and warm subtropics. This storyline is supported by linguistic and archaeological evidence, but is certainly not infallible. In fact, it is entirely possible that some mangos are not mangos at all.

Most mango enthusiasts know that mango cultivars can be separated into two main categories: Indian types and Southeast Asian types. These cultivar types produce fruits that differ in appearance and flavor. Indian types tend to have more orange-red coloration when ripe, are more oval in shape and have a strong flavor. Southeast Asian types usually turn yellow or stay green upon ripening, are flattened with a pronounced "nose" or paisley shape and have a mild flavor. Another key difference is that Indian cultivars are generally monoembryonic, meaning they produce a single embryo in each seed, whereas Southeast Asian cultivars are often polyembryonic, and produce multiple embryos in a single seed. In addition to the differences in fruit traits, recent studies of DNA sequences from mango cultivars, including my own analysis, indicate that Southeast Asian and Indian mangos are also genetically distinct from one another. However, the conventional historical account of the mango fails to explain the presence of two such distinct types of mango cultivars.

So, what can explain this tale of two mangos? Pinpointing a cause for the divergence between Indian and Southeast Asian mangos is difficult, but there are a few likely scenarios that primarily involve three key variables: the number of domestication events, the order/location of the domestication events and the number of species involved. The likely scenarios:

1. One species, a single Southeast Asian domestication

It may be that the mango was first domesticated in Southeast Asia from a single wild species, and was later introduced into India, where it was cultivated intensively and improved. The initial domestication event in Southeast Asia would have produced early Southeast Asian cultivars, and further cultivation and selection for different traits in India could have produced a secondary population. While wild M. indica is not thought to occur in Southeast Asia, it is possible that the wild populations from that region have disappeared over time.

However, based on genetic analysis of mango, this scenario does not seem likely.

2. One species, two domestications

Mango may have been domesticated from the same wild species, M. indica, independently in India and Southeast Asia. Wild mango may have had a rather broad range, with genetically distinct populations in both India and Southeast Asia. If domestication happened in both locations independently, it could explain the differences we see in mango cultivars.

3. Multiple species, one Indian domestication

Of course, the presence of two different cultivar types does not preclude India from being the origin of domestication of the mango. It is possible that mango was domesticated from a single wild species in India, and upon introduction to Southeast Asia, the center of diversity of mango's wild relatives, cultivated *M. indica* hybridized with one or more of these wild *Mangifera* species, producing a unique set of cultivars. This would not be much of a surprise, as many tree crops, including apple and most citrus fruits, are the result of hybridization between two species.

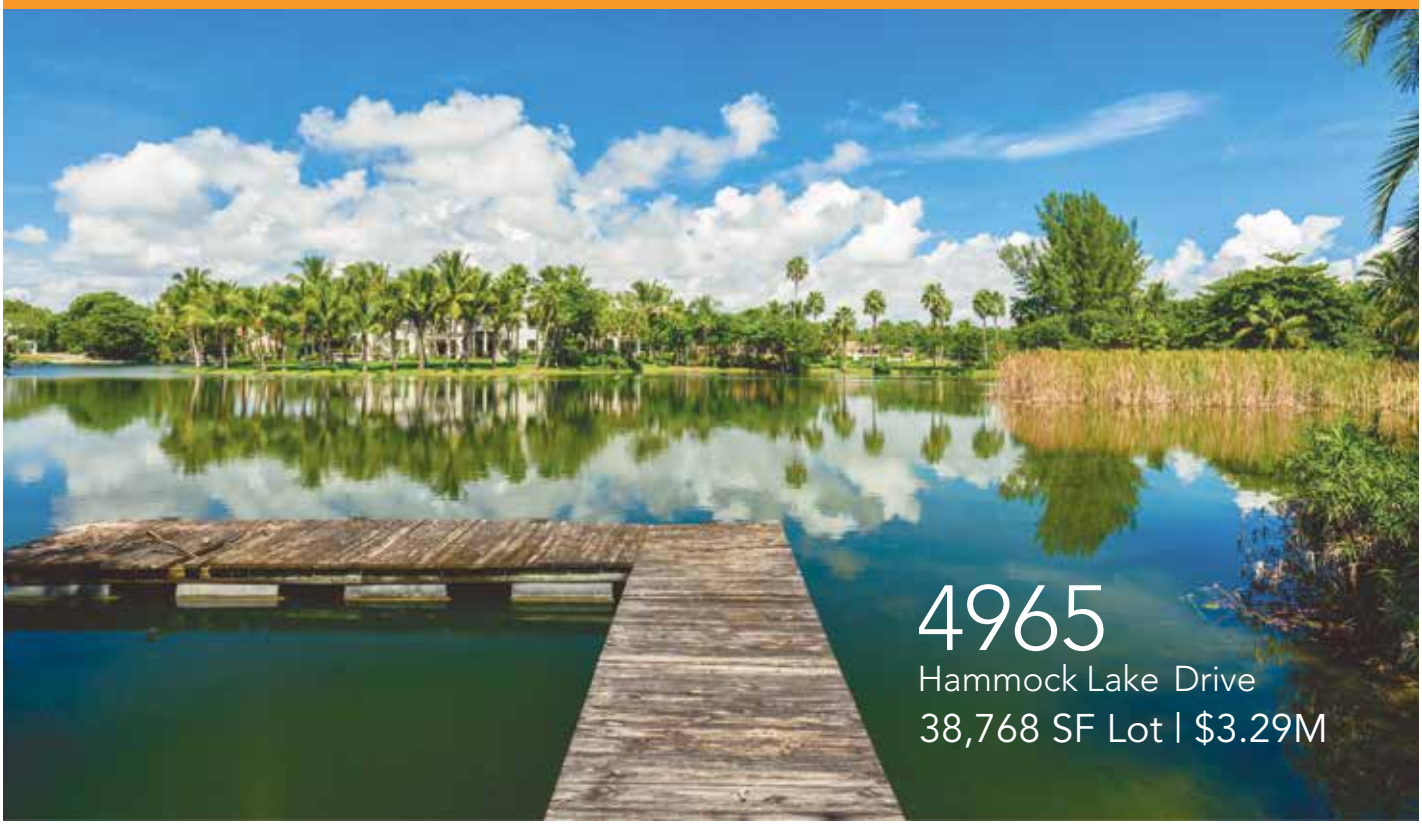
4. Two species, two domestication events

Finally—and let me warn you, the very suggestion of this is controversial—there is a possibility that some mangos are not mangos at all. Within the *Mangifera* genus, there are a few species that very closely resemble mango. It is entirely possible that the mango we think we know is, in fact, the descendent of two distinct, closely related species that were domesticated in India and Southeast Asia separately. Although Indian and Southeast Asian cultivars can interbreed, this is not unusual for closely related tree species. While the idea that mango is two distinct species may seem unbelievable, botanists have proposed it in the past as a way to reconcile the two distinct cultivar types, and recent genetic analysis indicates it could actually be the correct answer.

A great deal of work still needs to be done in order to arrive at a more definitive answer as to which of these scenarios is the most likely explanation for the differences observed between Southeast Asian and Indian mangos.

Surprisingly, one of the most important gaps in our knowledge about the mango is because it is difficult to say exactly where, or even whether, wild populations of *M. indica* still exist. Historically, botanists claimed that truly wild *M. indica* were found in the valleys of Northeastern India, Bangladesh, Nepal, Bhutan and Northern Myanmar. However, deforestation in these regions has been heavy, and it is difficult to acquire access to these areas as a foreign researcher. I have spoken with scientists from around the world, and not one of them has been able to tell me they have seen wild *M. indica* with their own eyes. These elusive populations of wild mango could hold the key to understanding the domestication of this fruit. For now, though, we can only revel in the mysteries of Mangifera's diversity—after all, who doesn't love a good mystery?

Serene lakefront living in gated Hammock Lakes



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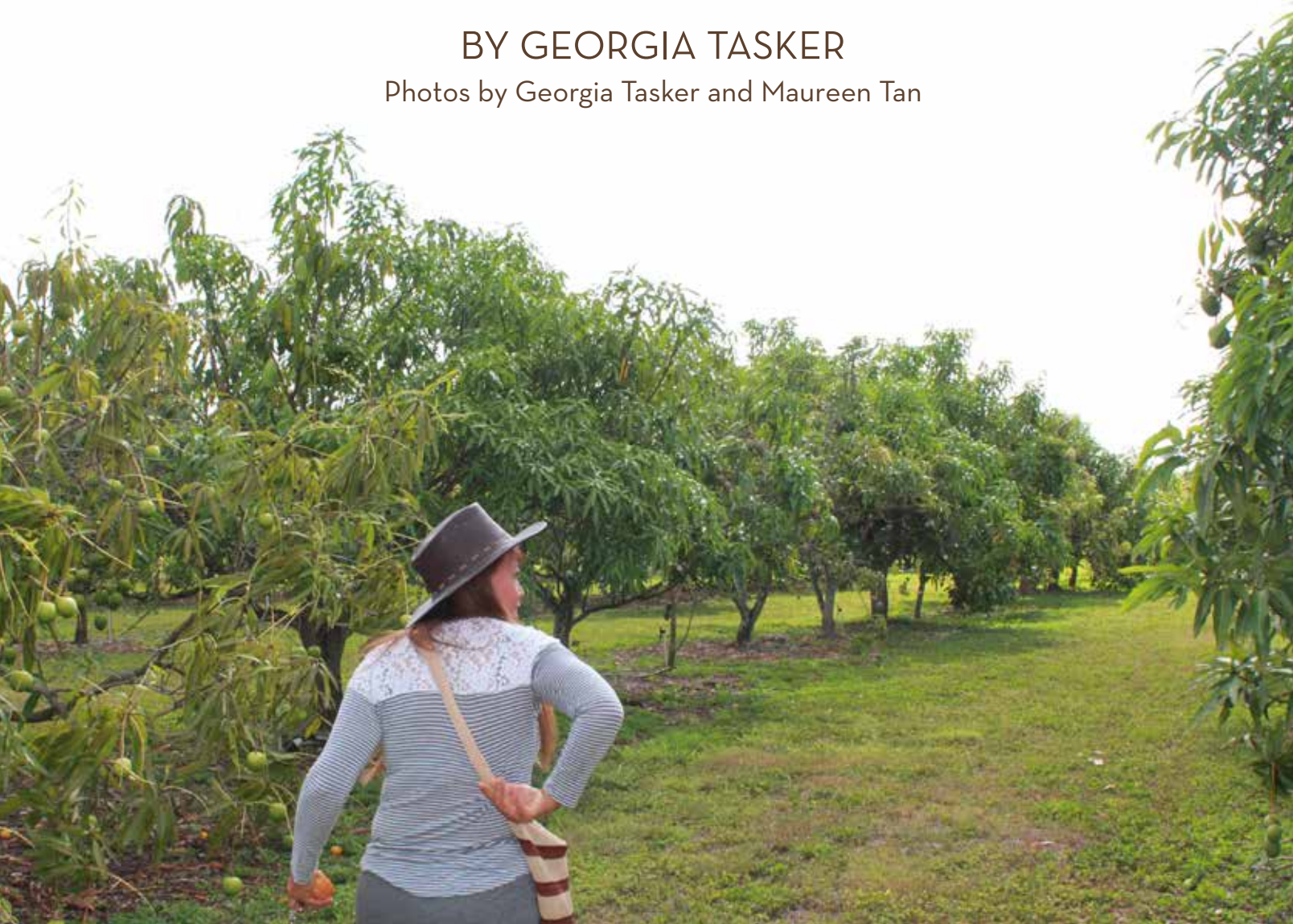
A LIBRARY OF LIVING TREES

Mango, avocado, mamey sapote, sapodilla and canistel are among the many trees at the Fairchild Farm—a crucial global germplasm bank.

BY GEORGIA TASKER

Photos by Georgia Tasker and Maureen Tan



The Fairchild Farm houses the most important collection of mangos in the world, with 650 cultivars that have been gathered from around the world – including wild mango species. While mangos hog all the attention, other tropical fruit collections are also quietly adding to the global germplasm bank.

Avocado, *Persea americana.*

Some 180 different avocado cultivars grow at the Fairchild Farm. In "The World Was My Garden," Dr. David Fairchild wrote: "Midsummer of 1916 saw Wilson Popenoe off for the avocado regions of Guatemala, where he spent the next two years in the most productive exploration for the best varieties of this fruit, then new to the Anglo-Saxon world."

What Fairchild wrote was new to the Anglo-Saxon world a century ago now is consumed in the United States at a rate of 7 pounds per capita (according to 2014 data from the Agricultural Marketing Resource Center).

From 2005 to 2008, Fairchild's Dr. Noris Ledesma, Fairchild's curator of tropical fruit, and Dr. Richard Campbell, Fairchild's director of horticulture and senior curator of tropical fruit, engaged in a three-year avocado collecting program in Central America, the Caribbean and Puerto Rico, with a $20,000 grant from the Vaughn-Jordan Foundation. The team was searching for West Indian cultivars. In addition, Ledesma and Dr. Carlos Balerdi, a University of Florida fruit expert, spent two years going door-to-door in South Florida to amass a 60-cultivar "Heritage Collection" of avocados is grown in South Florida. The 'Popenoe,' 'Kampong 2' and 'Russell' are familiar cultivars in the collection.

The avocados, along with many cultivars of jackfruit, canistel, mamey sapote and sapodilla, make up what Ledesma calls a priceless "library of living trees."

Wilson Popenoe tracked down the history of the avocado in his "Manual of Tropical and Subtropical Fruits," originally published in 1920.

"The first written account of the avocado, so far as known, is contained in the report of Gonzalo Hernandez de Oviedo (1526), who saw the tree in Colombia, near the Isthmus of Panama," he wrote. Three races of avocado were distinguished in 1653 by Padre Cobo: West Indian, Guatemalan and Mexican. The Haas avocado, grown in California, is Mexican, hailing from high elevations; trees in South Florida are West Indian, Guatemalan or West Indian-Guatemalan hybrids, grown on West Indian rootstock from lowland areas. All are grafted, since the fruit does not come true to seed.

The avocado's first introduction to Florida was made in 1833, when Henry Perrine sent trees from Mexico to his land grant south of Miami. It was the Trapp family in Coconut Grove that, in 1901, pioneered the Trapp avocado, which proved the most profitable for the young Florida avocado industry in the 1920s, Popenoe wrote. Trapp Avenue in the Grove today commemorates the family, whose house on South Bayshore Drive is on the U.S. National Register of Historic Places. The 'Trapp' avocado is shaped like a grapefruit.

The success of avocado groves in Miami-Dade, particularly after Hurricane Andrew destroyed so many citrus groves, has hit a bump in the road with the spread of the fungal disease called laurel wilt. More than 13,000 commercial avocado trees have been killed since 2012. The red bay ambrosia beetle originally was considered the vector, but it is now known that several other ambrosia beetles also can carry the fungus.

As laurel wilt spreads, Ledesma is optimistic that resistant varieties of avocado will be found among those banked at the Farm. So far, the disease has not appeared in the Farm's trees. (All the trees at the Farm are tested every six months for disease.) "Resistant avocados will survive and we can revive the industry here from our collections," she says.

Mamey sapote, *Pouteria sapota*,

with its rough brown skin, is less appealing to North American tastes, Ledesma says. "In this country, fruit is thought of as colorful, not brown and woody." Yet, Cubans long have loved this fruit that comes from that island, Central America, Mexico and Costa Rica. About 50 different cultivars of mamey sapote are being grown at the Farm, including 'Lobo' and 'Lorito.'

The flesh of mamey sapote is salmon-colored. Only about 350 acres of mamey, mostly the 'Pantin' cultivar, are growing in South Dade, as it prefers acid soils. The fruit often is sold at the Robert is Here fruit stand. If its typical price of $3.50 a pound sounds high, that's because it takes two years to go from flower to mature fruit. And the only way to tell if it is mature is to scratch the hide with a fingernail to see the color. All stages of development can be found on a tree at the same time.

Full of vitamins A and C, mamey sapotes are most often used in ice cream, milkshakes or eaten fresh. Popenoe reported that in Cuba, the fruit is used as a filler in making guava-cheese, and a thick jam called *creama de mamey colorado*. It is a member of the Sapotaceae family.

Sapodilla, Manilkara zapota, is a wonderful shade tree that bears scurfy or almost scaly- textured, brown-skinned fruit, "giving the fruit a striking resemblance to an Irish potato," Popenoe wrote. But like the mamey sapote, it's what is hiding inside that counts—a deliciousness reminiscent of pears and brown sugar, making it a wonderful dessert fruit.

"For the regular person, a mango is a mango, until they get to taste the different cultivars. The same is true of the sapodilla," Ledesma says. Forty cultivars were collected in Central America. Nicaragua proved rich in flavorful types, especially on the island of Ometepe, which is in the center of Lake Nicaragua and is home to two volcanoes. There, trees have gradually moved up in altitude and the fruit "are as big as mameys," she says.

When mature, the sapodilla's flesh is yellow, so once again a fingernail can be employed as a tool for determining maturity. Or, when the fruit twists easily from the stem without leaking latex, it is mature. It will ripen in four or five days in a fruit bowl. Julia Morton's "Fruits of Warm Climates," says the fruit should be eaten firm-soft, not mushy. Ledesma says, "Asians like mushy fruit and will pay good money for them." Campbell has a goal to produce a crunchy-textured fruit. Rochelle: I put this in past tense since Richard no longer works for the garden.

For many years, the latex of sapodilla, which is also a member of the Sapotaceae family, was tapped to produce "chicle," a basic ingredient of chewing gum. Remember Chiclets?

Canistel, *Pouteria campechiana,* is from southern Mexico, Belize, Guatemala and El Salvador. It is yellow-skinned and spindle-shaped and comes with latex characteristic of the Sapotaceae family. It is sometimes called egg fruit, and there is a small collection of a dozen cultivars at the Farm, such as 'Trompo,' 'Bruce' and 'Fairchild 2.'

"The flavor is rich and so sweet as almost to be cloying, and is somewhat musky in character," Popenoe wrote. Morton wrote that some fruits are muskier in odor and flavor than others. She also noted that an "excellent, non-musky, fine-textured, rounded type of medium size" had been selected for growing in Martin County. In South Florida, canistels mature from December to March.

"Anything you can make with pumpkin you can make with canistel," Ledesma says. "It has the perfect nutrition for baby food."

Jackfruit, *Artocarpus heterophyllus,* thrives at the Farm in two long rows. One is the original collection of 35 cultivars from India, Thailand, the Philippines, Indonesia and Australia. A second row is composed of hybrids, which are being grown close together to promote competition and hardiness. The goal: a 2-pound fruit. The reality: 40-pound fruits, among of the largest in the world.

Jackfruit is an important fruit in Jamaica and Asia, Ledesma says. The seeds have a high protein content and can be roasted with garlic for a delicious snack.

THE SHOP AT FAIRCHILD
Summer Favorites!

By Erin Fitts @ShopatFairchild

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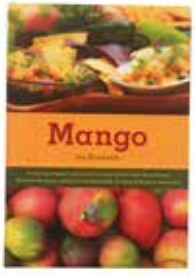

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THE STORY OF THE GARDEN CROCODILE

How a rare native American Crocodile may have made its way into the Garden—and whether you should be worried about it.

Text and photos by Kenneth Setzer

Occasionally basking along shore, crocs prefer water and are more active at night.

One great benefit of botanic gardens is the wildlife they foster, whether intentionally or not. Fairchild is visited by lots of unusual creatures, and for the last few years has been home to an American Crocodile (*Crocodylus acutus*)—a rare native with ancestry rooted in deep time.

A glance at a map shows Fairchild is bounded by residences to the west and south, but for the most part to the north and east stretches Matheson Hammock Park—a picnic and outdoor recreation area that leads directly to Biscayne Bay and the Atlantic as you travel east. Matheson Hammock Park supports large coastal mangrove areas, and in turn, the creatures dependent upon mangroves. Crocodiles prefer estuaries and coastlines, and are sometimes among those mangrove dwellers.

At their northernmost range in South Florida, crocodiles are a tropical animal, more common in the Caribbean and Central America. Indeed they were nearing extinction in the United States, with only about 400 to 500 individuals left, when they were federally listed as endangered in 1975.

So how did the crocodile get here? The expanse from the coast to the Garden's easternmost area consists of less than 3,000 feet of wetlands in a straight line—easily traversed by an animal equipped for life both on land and in water. Or, the crocodile could have entered through the marina at Matheson Hammock, south into the canoe launch canal, and then traveled a straight shot of only about 1,500 feet of marshy areas crisscrossed with canals to reach the Garden. University of Florida Wildlife Biologist Joe Wasilewski says the crocodile at Fairchild looks to be a male, and that, "when they reach about 6 feet, they develop territorial issues and males are driven away by more dominant males." So it's possible the croc was seeking territory of its own when it came upon the Garden's brackish lakes.

Though not known to seek open ocean, different crocodile species are found in many parts of the world, with the American crocodile present in 17 countries. It's been reported repopulating the Cayman Islands, which would require covering nearly 200 miles of ocean from the nearest part of Cuba, so the sea is no impediment.

Wasilewski says it's not surprising that there is a crocodile in Fairchild's neighborhood, as they've been found here before, and "the American crocodile population is at historic levels of about 2,000, with far less area to inhabit than

when they were declared endangered in 1975." However, it's not incredibly likely Fairchild will be host to any more crocodiles, at least not any males. "They are territorial and once established will keep other males away," Wasilewski reiterated. He has even tracked cannibalism in young crocodiles—possibly a natural, if not pleasant, method of population control.

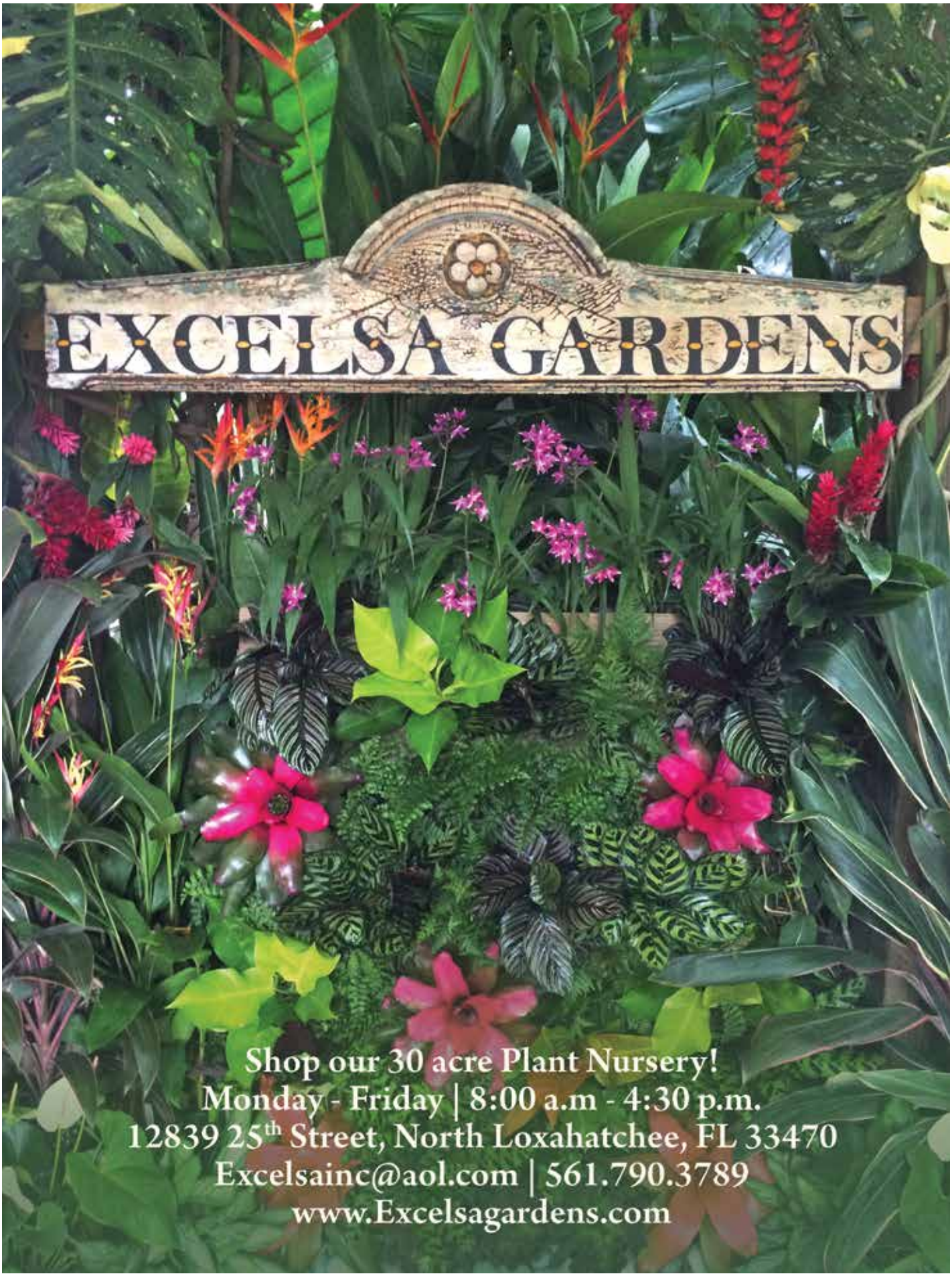
Federal protection and the efforts of dedicated wildlife professionals have combined to increase the population of this incredible animal. Interestingly, Wasilewski points out that some human-made features have helped the crocodile recover. The Turkey Point Nuclear Generating Station's cooling canals are well-known crocodile nesting sites. Contrary to what many believe, Wasilewski says it's not the temperature of the canals that attracts crocodiles, but the construction that formed berms and small ponds ideal for the drier conditions and lower salinity crocodile hatchlings need.

Alligators are far more numerous than crocodiles in the United States, and their range extends up to North Carolina and west along the Gulf Coast of Texas, so if you encounter one of these two huge reptiles, it's more likely to be an alligator. Alligators have much broader and rounded snouts, while that of the croc is narrower with a pointier tip. Think of a "U" shape versus a "V" shape. To my eyes, the tip of the gator snout often looks much more bulbous than a croc's. Otherwise, there are the teeth. Crocodile teeth are slightly pointier and less rounded than those of an alligator. And with mouths shut, crocodile teeth are far more visible, especially the lower teeth. Generally, alligators look very dark to me, nearly black, while crocodiles look lighter gray to tan.

But the million-dollar question, of course, is, "Is it dangerous?" While Australian saltwater and Nile crocodiles are considered aggressive, the American croc is known to be shy and rather—should I anthropomorphize?—introverted. While alligator attacks occasionally make news, crocodiles are not known to attack humans and often flee at our approach. Of course, if someone suddenly invaded your home and personal space, would you not fight back? That's what would happen if you forced a croc confrontation, and it would not end well for you or the animal. Crocodiles are more than happy being left alone.

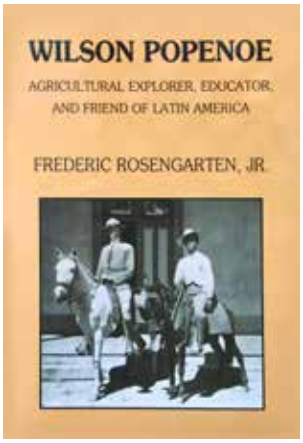
This uncommon animal is federally protected, so besides being an incredibly reckless thing to do, harassing a crocodile in any way—including feeding one— is illegal. If, while wandering our wondrous Garden, you come across this ancient saurian, keep your distance and avoid it but don't panic; it won't approach you. Just enjoy knowing it shares a love of Fairchild.

The American crocodile basking along a lake at Fairchild, probably thermoregulating with its open mouth.



"Wilson Popenoe" by Frederic Rosengarten Jr.

Reviewed by Georgia Tasker



The Nabal avocado, collected in Guatemala in 1917, grows at Chapman Field, the Subtropical Horticulture Research Station of the United States Department of Agriculture. Wilson Popenoe collected budwood for the avocado from a tree that grew among coffee bushes in the Finca Santa Lucia, Antigua. The parent tree was accidentally destroyed that same year by a laborer planting coffee, three months after its fruiting season in February and March.

Young Popenoe was sent to Guatemala by Dr. David Fairchild in 1916 and 1917. He traveled 3,000 miles by horseback, examining thousands of avocado trees, tasting and describing the fruit, photographing parent trees, returning again and again. He finally selected 23 cultivars. He cut budwood, which he wrapped in moist sphagnum moss, then mailed to Washington, D.C., in tin tubes or heavy oiled paper. The scions were grafted onto already-growing rootstock, and subsequently shipped to the Miami Plant Introduction Garden in Buena Vista; in 1924, they were shipped to Chapman Field. One hundred years later, there is a single survivor.

The story of this plant explorer is told by Frederic Rosengarten Jr., in his 1991 book, "Wilson Popenoe: Agricultural Explorer, Educator and Friend of Latin America." Popenoe's father, Fred Popenoe, had invested in a gold mine in Costa Rica, moved his family there and lost his shirt. Then, they moved to California, where Fred Popenoe opened a nursery, and sent 19-year-old Wilson and his older brother Paul to North Africa and Arabia for a year to collect date palm offshoots. Once shipped home, they became the basis of the date palm industry.

When he returned to the United States, Wilson went to Washington to meet Dr. David Fairchild. Fairchild convinced young Popenoe to forego college after one year and to strike out for Brazil, India, Guatemala, Mexico, Costa Rica and Colombia—searching for navel oranges, mangos, avocados. It wasn't a hard sell. The romance of the plant exploring life had seized his imagination as he read about the adventuring life.

Rosengarten, a Princeton University graduate who lived in Guatemala for many years, worked with Wilson Popenoe for several months. When it came time to write the book, he had access to unpublished autobiographical notes, as well as many scientists and acquaintances, Wilson's son Hugh Popenoe and his nephew Dr. John Popenoe, former director of Fairchild Tropical Botanic Garden.

LEFT: Naval Avocado at Chapman Field collected in 1917 by Wilson Popenoe.
Photo by Georgia Tasker/FTBG

ABOVE: Conformation of the collection date.
Photo by Georgia Tasker/FTBG

Rosengarten has captured the telling details of Popenoe's life and work, which make this a lively and adventurous read. In Guatemala, "[d]ay after day, we made camp by the side of the trail, usually under one of the thatched shelters which were provided for that purpose," he wrote. "Often we shared the rude hospitality of these spots with a group of Indians or with a mule-train." Before dawn, Popenoe and his assistant Jose Cabnal would boil a cup of coffee, eat a couple of eggs and a toasted tortilla, and set out for the day. Back in the states, Popenoe was sent to Riverside, California, to give a talk about his expedition, and "was as lean as a ramrod after all those months in the saddle and weighed only 120 pounds" even though he was nearly six feet tall, Rosengarten wrote.

Wilson Popenoe's book "Manual of Tropical and Subtropical Fruits" was published in 1920. Today, it is "a unique source of background information," Popenoe wrote in the reprint introduction.

Popenoe's subsequent work included a three-year stint running the office of Foreign Seed and Plant Introduction in Fairchild's absence, an experience so unpleasant he resigned from the USDA and took a job with United Fruit Co. During that period, he married his first wife, Dorothy, at Fairchild's home "In the Woods."

He next established the Lancetilla Agricultural Experiment Station at Tela, Honduras, bringing in 800 economically important plants for trial, including the African oil palm. He was director for several years before becoming chief agronomist for United Fruit. He and Dorothy had five children, but in 1932, Dorothy is believed to have eaten an unripe akee and died of violent convulsions. By that time, the couple had purchased and began restoration of a 17th-century house in Antigua, Guatemala, that had been badly damaged in the 1773 earthquake that flattened much of the town. Today, Casa Popenoe is on the list of tourist attractions in that restored colonial city.

In "Reminiscences of early plant introduction in South Florida," written in 1938 for the Florida State Horticultural Society, Dr. Fairchild wrote: "Wilson Popenoe's explorations of Central America after avocados deserve to go down into history as one of the most thorough pieces of horticultural plant hunting work ever carried out."

RIGHT (L-R)
Wilson Popenoe,
Robert Montgomery and
Dr. David Fairchild.
Photo: Archives/FTBG

By 1940, Popenoe took charge of a cinchona plantation for Merck, the pharmaceutical company. The Guatemalan plantation was a large-scale natural source of quinine outside the Dutch East Indies, where the Dutch held a monopoly.

By 1941, United Fruit asked Popenoe to select a site for an agricultural school, for which it donated $3 million as seed money and added another $3 million during the next 20 years. Popenoe found 3,500 acres in Honduras and called it Zamorano, and it was devoted to Latin American students of tropical agriculture. Today, the Escuela Agricola Panamericana el Zamorano in Honduras is a private university that specializes in sustainable agriculture and environmental education, agribusiness and food science. It has 1,000 students.

Popenoe's second wife, Helen, whom he married in 1939, died in Antigua in 1961. He remarried a third time, to longtime friend Alice Weiss, who welcomed visitors to Casa Popenoe with him. He received three honorary doctorates; high honors from every Central American country and Cuba; a gold medal from Antigua for the restoration of Casa Popenoe; and the Frank N. Meyer Medal for Plant Genetic Resources for plant exploration and introduction.

In "Reminiscences of early plant introduction in South Florida," written in 1938 for the Florida State Horticultural Society, Dr. Fairchild wrote: "Wilson Popenoe's explorations of Central America after avocados deserve to go down into history as one of the most thorough pieces of horticultural plant hunting work ever carried out."

SUCCULENTS ARE A WAY OF LIFE

Set them up in the right conditions, and cute, tough, little succulents will thrive with very little care.

Text and photos by Kenneth Setzer

Succulents! These cute little plants are more popular than ever due to their great variety of shape, color and pattern, plus a reputation for being tough as nails. They have indeed taken advantage of difficult environments to thrive and diversify. You may be surprised to learn that succulents are not a family of related plants; rather they've each developed succulence as a way of life, and their forms reflect this. Their fleshy, stubby leaves can form great mandala rosettes while their (often) short stature adds to their cuteness.

Most succulents are fairly small and compact. Some, like the baobab tree, grow to arborescent heights. These plants have in common the ability to store water in their leaves, stems or roots. Some also engage in CAM photosynthesis, which keeps their stomata closed during hot, dry days. These adaptations make succulents the camels of the plant world. There are different definitions of what qualifies as a succulent, but for this article I'm concentrating on the smallish plants easily kept in pots. While many thrive on neglect, there are steps to ensure their health and longevity.

Soil

Nearly all plants hate wet feet! Succulents' ability to survive drought also means they can't tolerate prolonged wet conditions. For soil, you can buy premixed cactus and succulent mix, or make your own. I mix coconut coir, perlite and a little potting mix. You can recycle the coir used as pot liners by cutting it into small pieces. Unlike peat, coir is renewable, holds some moisture and traps air, drains well and discourages mold growth.

The result should be very coarse soil that holds water long enough for roots to absorb it, but drains fast enough that roots won't rot. It's a good idea to repot newly purchased plants. They are not generally sold in soil good for long-term growth.

Water

Proper watering is crucial for succulent survival. Err on the side of under watering. Generally, succulents like thorough watering followed by a period during which their soil completely dries. Symptoms of overwatering include blackened, wrinkled, softened areas—particularly in the lower stems, as well as leaves that fall off very easily. Intense summer rains pose a problem for plants that like lots of sun but not lots of water. I move some under a glass patio table during downpours so they get light but are spared the torrent. Excess under watering results in newer leaves being wrinkled or crispy, with general lack of growth. However it's normal for older, lower leaves to turn brown and fall off.

captions

Light

Perhaps surprisingly, not all succulents need full sun. Certainly, some—like the popular rosettes of blue-green *Echeveria*—need full sun. But many, like *Haworthia*, prefer shade. Here "know what you grow" is important. You'll need to research your plant to learn its light requirements. However, a sure sign a succulent needs more light is if it grows leggy and looks stretched. Providing more light won't reverse that growth pattern; you can keep it as is or cut the top off, let the cut end callus over for a couple days, and replant the cutting into soil. A purple or red plant that reverts to green may also be lacking sunlight. It's vital to monitor your newer plants, as even the extreme sun lovers can burn in our afternoon summer sun.

Propagation

Making more succulents is so much fun because it's so easy. Many succulent leaves will grow new plants. Gently twist one off, allow the cut end to callus over and dry for a couple days, then place on a layer of soil or perlite in bright shade. Lightly and regularly mist, and a new plant should appear from the cut leaf end. Usually plants with thick leaves connected to a stem are best for this, as opposed to *Aloe* for example. Burro's tail (*Sedum*) propagates nicely from leaf cuttings. *Kalanchoe* species produce ready-rooted offsets along their leaf (more accurately called phylloclades) margins. These pups will drop off on their own.

Many succulents produce offsets, called "hen and chicks." The chicks will appear at the base of the mother plant or horizontally along stolons, and can be left or removed and replanted. From seed is yet another way to propagate, but it can be tricky.

Pots and Surface Dressing

Most succulents have shallow roots, so one can get very creative with pots—just make sure the container has drainage holes. People have grown them in old shoes, in pocket containers on walls or nestled among rocks in a rock garden. Rough-hewn stone, like tufa pots, complements succulents nicely.

A general guide for arranging an assortment is to use a taller plant towards the back, such as a taller *Aloe*, *Euphorbia tirucalli* (aka sticks on fire) or *Portulacaria*. Plant a shorter groundcover filler for the middle, such as *Echeveria*, *Crassula* or *Sempervivum*. Last, plant the front edge with a cascading succulent like the many *Sedum* species. The trick is combining plants with similar light requirements.

Surface coverings of pebbles, aquarium gravel or recycled glass chips help drainage, keep soil in place and are an opportunity to complement or contrast your succulents' unusual colors. Succulents give us a chance to practically paint and design with plants, just give them the little care they need, and remember the key to their success: drainage!

ANCIENT NAMES

By Georgia Tasker

It is not surprising that the botanical names for many of our fruits come from the indigenous names used for them. When Wilson Popenoe named the 23 cultivars of avocado that he sent to the United States from Guatemala (see page xxx), he gave them Mayan names.

Artocarpus heterophyllus is the jackfruit, closely related to breadfruit (*Artocarpus altilis*), which is the meaning of the genus: *artos*, bread and *karpos*, fruit. *Heterophyllus* means having diverse leaves.

Pouteria campechiana, the canistel, gets its genus name from an Aztec origin; *campechiana* is for the Campeche state in Mexico, where the canistel probably originated.

Persea americana, the avocado, comes from the Greek word *persea* for an Egyptian tree. The name "avocado" is a corruption of the Spanish *ahuacate* or *aguacate*, which is an adaptation of the Aztec *ahuacatl*.

Pouteria sapota, the mamey sapote, is a Latinized version of a Guiana vernacular *pourama, pouteri*. *Sapota* is believed to have been derived from the Aztec *tzapotl*, according to "Fruits of Warm Climates" by the late Julia Morton. *Tzapotl* is a general term applied to soft, sweet fruits.

Manilkara zapota, the sapodilla, includes *Manilkara*, from the South American name for Malabar in Southern India, where sapodilla is widely cultivated. Sapodilla is from the Spanish *zapotillo,* from the Nahuatl (Aztec) word *tzapotl*.

Mangifera, the genus of the mango, combines the Indian word for the fruit, mango, with *fero*, which means to bear.

The genus *Freycinetia*, with about 250 species, is, after *Pandanus*, the second largest genus of the family Pandanaceae. This genus of mostly climbing vine-like plants, sometimes called 'climbing pandans,' also includes some scrambling shrubs.

FAIRCHILD'S FANTASTIC ***FREYCINETIA*** FROM THE *CHENG HO* TO TODAY

Text and photos by Chad Husby

Freycinetia has a wide distribution from Sri Lanka in the west to the far reaches of the Pacific Islands, including Hawaii, in the east, and New Zealand in the South. The highest diversity of species is in New Guinea and Indonesia. Their leaves have spiny edges, though generally less rigid and spiny than Pandanus. At the base of their leaves are distinctive thin flanges, called auricles, that can be quite colorful in some species, but eventually fall off. The stems tend to be flexible and adhere to tree trunks or other surfaces by means of many clasping roots and can climb all the way to the tops of the tallest trees. The main stems also produce many lateral branches and in some cases a Freycinetia plant can cover an entire tree trunk, but, unlike some fig species, they do not "strangle" trees.

Freycinetia have quite showy inflorescences with colorful bracts subtending one or several spikes of small flowers (without petals or sepals) clustered around a central

axis. Although individual Freycinetia tend to produce only either male or female inflorescences, there are cases with plants producing both types of inflorescences or bisexual flowers. Pollination is carried out by birds, bats, and small terrestrial mammals. Fruits are sweet, juicy, pulpy berries and contain many seeds that are distributed by animals that are attracted to the fruits.

Freycinetia and David Fairchild

Like Pandanus, Freycinetia attracted Dr. Fairchild's attention during his explorations of the Asian tropics. He saw them as highly ornamental and as potential additions to the South Florida landscape:

"We missed the showy red airplants, the Bromiliads, so familiar to us in the trees around Coconut Grove. But taking their place in some measure are the great climbing Freycinetias, whose papery flowers make splashes of brilliant pink far up in the crotches of the forest trees. The flowers are followed by handsome red fruits resembling those of the pandanus. I can see Conicosa now as he climbed up after the fruits of Freycinetia multiflora [subsequently determined to be F. cumingiana] that hung over the stream from a huge tree forty feet above my head, and tossed them down on the bridge. From the way my plant in its box in the slat-house is growing, I predict that it will clamber up our live oaks among the bromiliads."
~ 'Garden Islands of the Great East'

One of the accessions from the Cheng Ho expedition that persists into the present day is Freycinetia cumingiana. The large specimen in the Conservatory was propagated from cuttings from a plant grown from the original seed collection Dr. Fairchild made in the Philippines on November 8, 1939 early in the Cheng Ho expedition. He noted the beauty and interest of the plant on a photo envelope:

"Narrow leaved species climbing into tall trees. Its fruits in clusters of four are only 2 in. long by 1 in. thick with coarse protuberances but of a brilliant scarlet color which give to the plant a very striking effect. Flowers striking salmon pink, last for many days. From shore of Lake Bulusan. Bulusan Nat. Park, Sorgoson, Luzon, P.I. Nov. 8, 1939. Germinated 1-15-40. Heuer 'Some growing not yet distributed' 4-7-41."

"This and the other Freycinetias deserve to be grown extensively in our oak trees, just as we grow Bromiliads."

This plant has been propagated and shared with other botanic gardens and with the public through Garden plant sales. There are a number of healthy specimens propagated from it in private gardens in Miami. Furthermore, it may be the source of specimens of this species in European botanic gardens. It continues to be a source of beauty and inspiration wherever it blooms and exemplifies Dr. Fairchild's feelings about the importance of sharing plants:

"What one collects in the shape of opinions, "data," "facts," and "figures," has a rather small chance of being passed on to others, a small chance of "doing some good," as the saying goes; whereas what one collects in the shape of seeds and plants has a very good chance of growing and becoming something worth while to somebody long after the shadows fall."
~ 'Garden Islands of the Geat East'

A Freycinetia Renaissance

Until the past few years, only Freycinetia cumingiana has persisted in the Garden's collection. In recent years, we have begun to actively introduce new species from this beautiful genus in hopes of realizing Dr. Fairchild's dream of exploring ornamental potential of this genus in South Florida and beyond. Beginning with our 2013 expedition to Hawaii and continuing through our expeditions to Southeast Asia in the past several years, the

Garden now has at least 10 species. However, because these were obtained from cultivation and there is little active taxonomic work in the genus, the identities of many remain to be determined. As more of them grow to maturity in the Garden and flower, we hope to learn more about their identities and their fascinating biology.

Highlights of recent Freycinetia introductions to the Garden include a species, perhaps originally from Sulawesi, that we obtained from a nursery in Thailand in 2015. This plant has lovely purple coloration on the leaf undersides. Although aside from F. cumingiana, Freycinetia have not been known to survive well outside long-term in Miami, which is far from their typical wet tropical forest habitat, this species has been growing well outdoors at the base of an oak tree near the Conservatory entrance, where it receives regular irrigation. Though it has not yet begun to climb, it has produced several vigorous shoots and flowered this spring, displaying impressive orange bracts.

Another new introduction, from the Singapore Botanic Gardens (SBG), has large and very dark green leaves with purple undersides. From SBG we also obtained a species with beautiful red coloration on the bases of the leaves along with a small species with purple stems. We also have species with strikingly different leaf arrangements from one from Malaysia (shared by the Prague Botanic Garden) with leaves arranged 120 degrees from each other and forming three columns to a small species from Papua New Guinea, Freycinetia elegantula, species that bends its leaves into a flat plane and hugs the surface on which it is climbing. We will continue to experiment with this fascinating genus and see whether the potential that Dr. Fairchild saw in them may one day be realized:

Other plants with showy bracts blooming in the Garden

Freycinetia inflorescences are dramatic examples of showy bracts. However, there are many other wonderful examples of plants with showy bracts blooming in the Garden now. Highlights include some dramatic gingers flowering in the Conservatory, such as the vibrant red 'rose petal-like' bracts of the ginger Etlingera corneri. Also in the Conservatory, the stunning red bracts of the 'Pride of Trinidad and Tobago,' Warszewiczia coccinea, are putting on a magnificent show. The reddish pink bracts of Heliconia bourgaena are gracing the Conservatory for the first time ever. Bracts also come in white as in a lovely Spathiphyllum blooming in the Conservatory and the ever-blooming Morinda latebractea growing just outside.

Laurel Wilt Update

By Georgia Tasker

The fungal disease called laurel wilt that has cost Miami-Dade County some 25,000 avocado trees—and it is still lurking around the 7,500 to 8,300 acres of South Florida's commercial avocado groves. A recent seminar on laurel wilt/ambrosia beetles at the UF/IFAS Extension's (University of Florida Institute of Food and Agricultural Sciences) Miami-Dade office updated avocado growers on what's being done to manage it.

Drones and GIS maps from Google Earth are new technological weapons now being added to the laurel wilt management arsenal, and horticultural techniques are evolving as well. Helicopters are used to track visual changes in the avocado groves every month, but on-ground scouting still is necessary.

Laurel Wilt Background

The foreign red bay ambrosia beetle probably arrived in Georgia in 2002 in packing material such as crates; it then spread south. The beetle, and the laurel wilt fungus it was carrying, were new to the United States. The disease made its way from Georgia to the avocado groves of South Florida by killing half a billion native bay trees in Georgia and natural areas in Florida such as the Everglades, explains Jeff Wasielewski, the commercial fruit crops extension agent for UF and Miami-Dade.

Here's how the disease spreads: Female beetles bore into the wood of members of the laurel family, such as red bay, swamp bay, sassafras and avocado, depositing fungal spores along the way as they create little passageways, often called galleries, for rearing their young. The eggs a female lays hatch, and the fungus becomes food for the brood. The young females mate, pick up the fungus and then fly on to other trees, or right back into the same tree to begin the process all over again. Only female ambrosia beetles can fly, and usually not far above the ground.

It's not the fungus itself that kills avocado trees and other members of the laurel family. Most woody trees try to combat the spread of a fungus by walling off the area that is infected. Many trees in the laurel family wall off their internal vascular system so efficiently that they essentially cut of their own water supply and die.

The red bay ambrosia beetle is no longer the only ambrosia beetle spreading laurel wilt in South Florida. There are 16 species of ambrosia beetles in South Florida, says Jonathan Crane, tropical fruit crops specialist with the University of Florida's Tropical Research and Education Center. Among the thousands of ambrosia beetles trapped within South Florida's commercial avocado groves, only a minute amount of red bay ambrosia beetles were found. Ten were contaminated with the laurel wilt fungus, but only two were able to transmit it. Therefore, the original vector of laurel wilt, the red bay

ambrosia beetle, does not seem to be attracted to avocados. In fact, once the laurel wilt fungus got to South Florida, at least two species of native ambrosia beetles began to carry enough of the fungus to cause an avocado tree to become infected and die.

Combating Laurel Wilt in Avocado Trees

The ambrosia beetles infecting avocado groves seem to prefer older, shady groves with larger trees. One management tool being used now is selective pruning or topping to increase the amount of light in groves, which the beetles don't like. Another is to top-work old-time varieties by grafting new or better varieties onto them. Top-working or pruning increases light in the grove and greatly reduces the amount of wood available for the beetles' tunnels.

Scouting groves to detect the early stages of the disease—leaves still green but wilting—is a must, says Crane, and immediate removal and destruction of infected trees should follow. Additionally, the removal of avocado trees around the infected tree prevents the spread of the fungus via root transmission. An avocado grove with larger trees may form root grafts, connecting trees with each other, which further allows the transmission of disease.

Drones can be employed to find dying trees from the air. They cost from $1,000 to $10,000, and operators must have remote pilot certification, passing tests for licensing. The licensing costs vary from $150 to $400. Fredy Ballen, economic analysis coordinator with UF's Tropical Research and Education Center, says additional costs include image processing, video review and ground verification. While this option may be costly for individual small grove owners, it may be offset by recent avocado prices, which have been quite good as demand has been high. Manual scouting of trees runs about $30 an acre, according to Ballen.

Remote sensing or geomatics is being conducted by Amr Abd-Elrahman, who is updating a Miami-Dade avocado GIS map using Google Earth historical and street images. He is comparing images from 2002 with those from 2014 to monitor changes in groves, and sharpening these tools to differentiate avocado groves from other fruit groves.

Once an infected tree is found, it costs about $100 to $150 to remove or destroy it. Lack of manpower and available machinery are management hindrances.

For commercial growers, there are some contact insecticides, fungicides and biological controls available. Fungicides can be infused or injected into the base of a tree and carried up through the trunk. The fungicide has an emergency label and cannot be used on avocado trees that are not being grown commercially. The Tropical Research and Education Center website has costs broken down for use of various products, as well as instructional videos on how to use them at http://agecon.centers.ufl.edu.

Rural residents as well as commercial growers should be on the lookout for signs of rapid wilting, dieback and insect boring in host trees and should report these symptoms to the Florida Division of Plant Industry (http://www.doacs.state.fl.us/pi/index.html or phone 1.888.397.1517) and Division of Forestry (http://www.fl-dof.com/). This information will help regulatory agencies and scientists track the movement of this pest.

A Hawk Tale

Told by Thad Foote and Jason Lopez

We interrupt Bug Beat to bring you this cautionary tale about a widespread South Florid problem that is widespread in South Florida, as rats are especially prevalent around bodies of water and canals.

Thad Foote: [In May] our resident pair of red shouldered hawks hatched three chicks. For that species, three is a noteworthy number in these parts. The male adult, while hunting rodents for his cast in the home oak tree, caught a winner. However, the furry meal was laced with rodenticide, having ingested it somewhere in the neighborhood. The fearless provider fell victim.

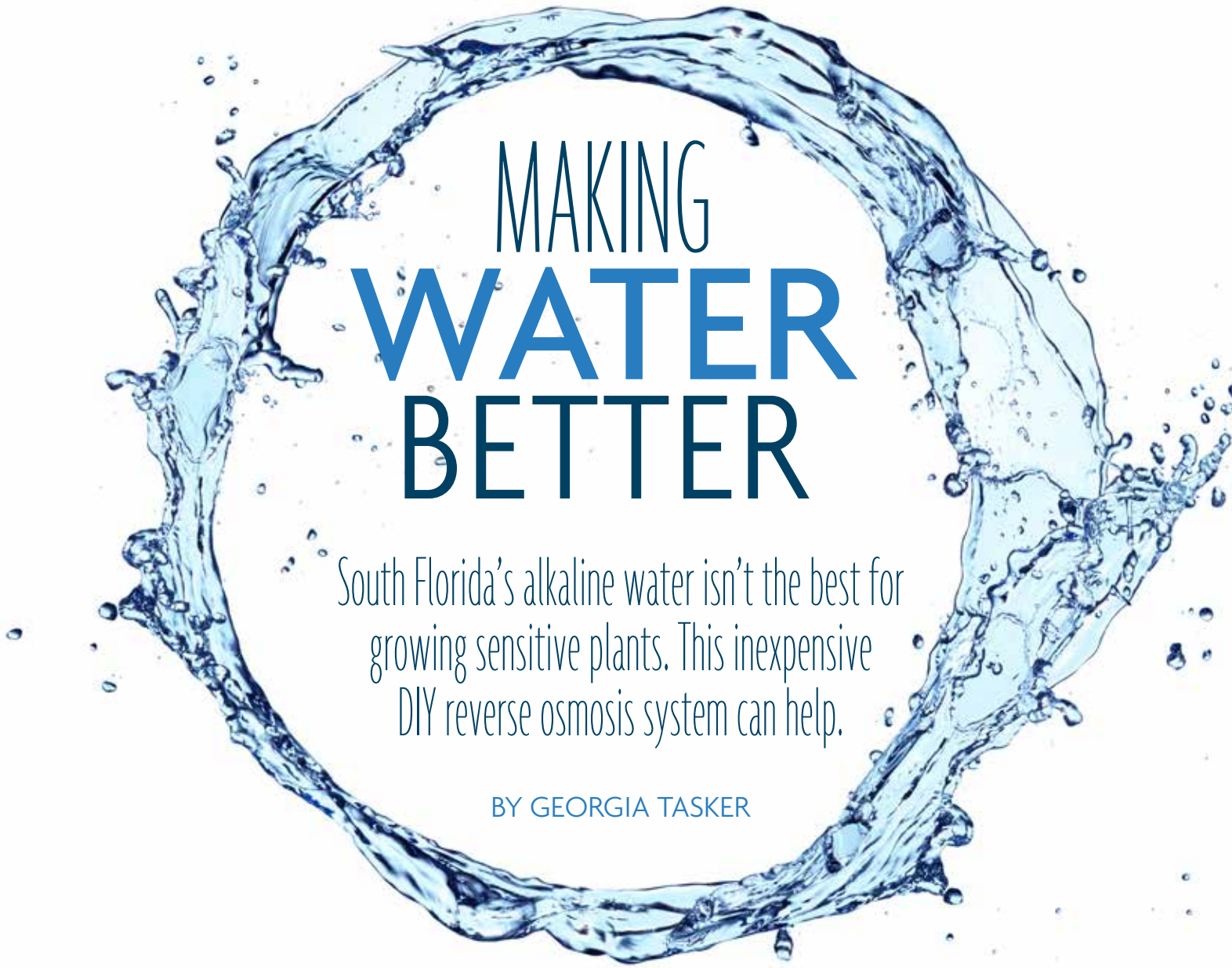
Jason Lopez: That morning my phone rang. It was Alvin at the front gate, saying a hawk needed help. A visitor found it early stumbling around on the lawn near the nest, removed his shirt and wrapped up the bird and Alvin found a box. Eyes half closed, full of liquid, the bird, although standing, was very wobbly. I took him directly to Pelican Harbor Seabird Station.

Thad Foote: While mama hawk screeched and called tirelessly, the good souls at Pelican Harbor pampered and fed our friend back to health. In [late May], papa came home and was released near Pandanus Lake. The chicks have flown on and time will tell whether mama's interest has.

According to the Center for Biological Diversity, "Super-toxic rodenticides are slow-acting substances that block the synthesis of vitamin K necessary for normal blood clotting, causing their consumers to bleed uncontrollably and die slow and agonizing deaths. There are four types of these silent, super-toxic killers (brodifacoum, bromadiolone, difethialone and difenacoum), all of which have long half-lives that allow rodents to ingest them multiple times before dying."

There are ways to prevent rats that the Center recommends:

- Don't leave pet food and water outdoors, especially overnight.
- Seal gaps around air vents to building sub-areas and attics.
- Keep compost piles as far away from structures as possible.
- If you have a birdfeeder, use a squirrel guard and keep the ground area clean of birdseed.
- Use city-issue plastic trash bins. If cracked or missing a lid, contact your department of sanitation for a free replacement.
- Clean up trash in garden areas to remove shelter for rodents.



MAKING WATER BETTER

South Florida's alkaline water isn't the best for growing sensitive plants. This inexpensive DIY reverse osmosis system can help.

BY GEORGIA TASKER

Anyone who has tried to grow orchids and other sensitive tropical plants in South Florida knows that our alkaline water is not ideal. Full of calcium, it deposits a chalky residue on leaves that is not only a nuisance, but also reduces photosynthesis and keeps certain micronutrients, such as iron and manganese, from being available to the plants.

A measure of alkalinity or acidity of water is the pH scale, which has a range of 0 to 14. Neutral is measured as 7. Tap water is generally 7, and most plants grow best in slightly acid conditions, 6 to 6.5. Our well water may be as high a 7.5 to 8.5 or greater.

Reverse osmosis (R/O), a process that creates pure water under pressure and eliminates contaminates, is one way to grow better plants. Ordinarily, the equipment for setting up an R/O system is expensive and out of reach for many backyard growers. But Dr. Paul Wetter, who grows orchids as a hobby in Southwest Miami-Dade, figured out how to make an R/O system using readily available materials and his ingenuity. "Over the years, I had visited collections of orchid growers who

had installed R/O systems and noticed how well their collections were thriving," he says. "I also noticed that the equipment was large, with large tanks and pumps. It was expensive and required maintenance and cleaning of the tanks and so forth. Wetter "put on my innovator's hat," he says, "to see if there was a simpler way" to construct an R/O systems for his orchids.
The founder and president of the Society of Laparoendoscopic Surgeons and a professor emeritus of the University of Miami's Miller School of Medicine, Wetter is a gynecologist who has devised new medical instruments for minimally invasive surgery. He has lectured around the world on laparoscopic techniques and founded ORReady to improve surgical outcomes involving organizations on five continents. Devising a way to improve his orchid-growing techniques was a small challenge.

Wetter's result involves a heavy-duty garbage can to contain the filtered water, an aquarium R/O filter, a submersible pump, a float, some quick-connect fittings and a few other parts that cost a total of $200. He tried several ideas, he says, which evolved into the current system. When run overnight, it produces 30 gallons of filtered water for the orchids in his 30-foot-by-30-foot greenhouse. To this, he adds a small amount of Jack's Classic 20-20-20 fertilizer plus magnesium. On a daily basis, he uses a hose-end sprayer connected to the pump in the container and waters and fertilizes his vanda orchids. He constructed a second system, with pure R/O water and no fertilizer, to water his phalaenopsis orchids and to rinse the vandas of any salts left by the fertilizer. Once a week, the phalaenopsis orchids are watered from the R/O plus fertilizer system.

Follow these steps to set up this remarkable little system:

1 Assemble the parts and make sure you have everything you need (see list).

2 Drill a 3/8-inch hole about 5 or 6 inches from the top of the garbage container and insert the brass fitting that will hold the float. You will need about 3 feet of ¼-inch black irrigation tubing, onto which a brass crimp ring (comes with float) and threaded brass nut are attached. Then insert the tubing into the float valve. Tighten the fitting with a wrench to prevent leaks

3 Next, the three-part aquarium reverse osmosis kit requires more tubing. Connect one end of the ¼-inch irrigation tubing fitted with a female hose connector (1/4-inch quick-connect-to-female; often comes with aquarium R/O system—see parts list) to the hose bib. The other end of the tubing will go to the first small cartridge of the filter bundle, where solids and particulates will be removed. Next, the water flows into the central filtering membrane.

4 Water from the R/O membrane will flow to the garbage container via tubing connected with the float.

5 A third section of the aquarium kit is a post-filter for removing carbon. For every gallon of filtered water made, four extra gallons of water are lost. So attach the ¼-inch tubing here to direct this excess water to the lawn or a planting bed.

6 At the end of the excess water line is an anti-siphon tube, which prevents backflow of excess water into pure water. This part is not necessary for this setup, since water is not used for drinking or an aquarium. But you can leave the tube, as a weight, at the end of the excess water line that goes to your lawn or plant bed.

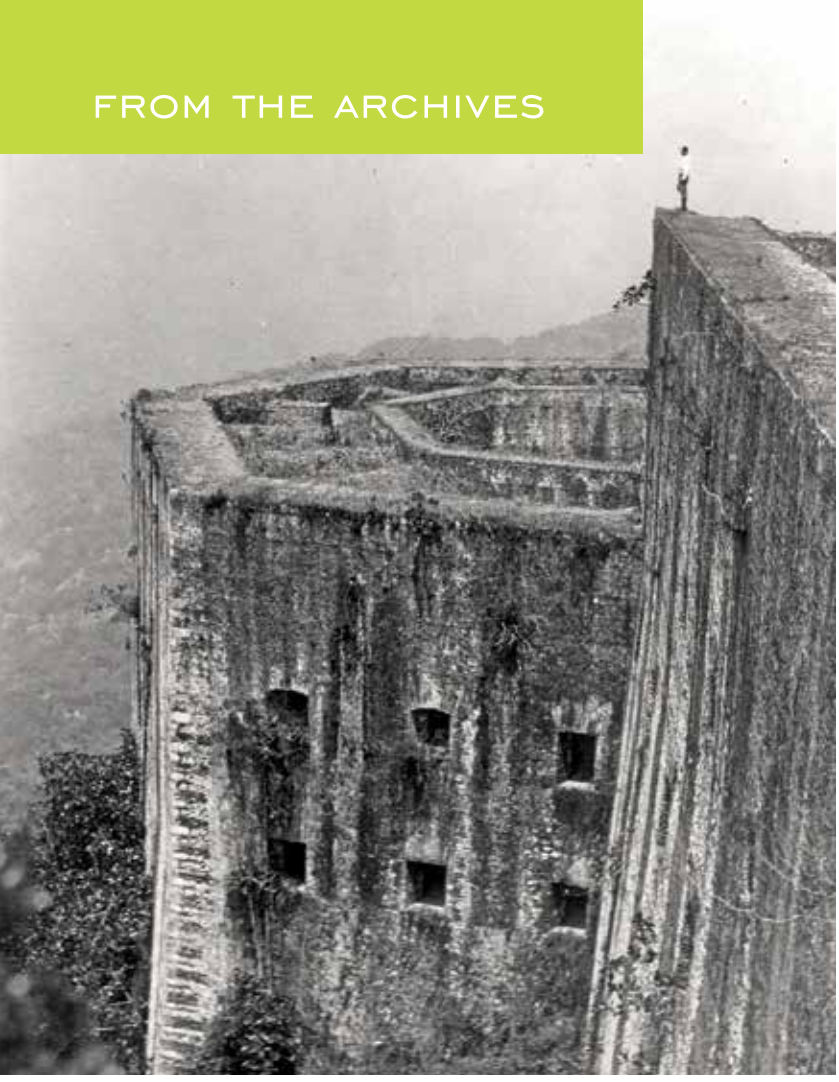
7 On the back of the filter cartridges are mounting brackets. These can be attached to a mount or you may thread wire or string through the brackets and bend the ends to hang the system on a wall, on the side of the container or under an orchid bench.

8 Fit the 1/8 horsepower submersible pump with a 50-foot length of 3/8-inch coil hose, again using (male & female) hose connectors. Attach a Melnor, or similar, nozzle to the working end and use the "flat" setting when spraying your plants. The flat setting seems to work best to provide a good watering stream for this type of pump. A regular hose or nozzle would not work well to create a watering stream. The coil hose and nozzle setting are suited to the output of the small pump.

Dr. Wetter has found that ½ cup of Jack's Classic 20-20-20 plus ½ cup of magnesium sulfate (Epsom salts) in the 30 gallons of R/O water work well for him. This also adjusts the pH to slightly acidic, a good level for absorption of fertilizer and elements. It provides a weak solution of fertilizer with each watering, which many orchids love. During the summer, he doubles this amount on vandas, which areheavy feeders.

Supplies and Sources

- ☑ **Least-expensive three-stage 50-gallon-a-day reverse osmosis filter:** These are usually used for aquariums. This piece of equipment can be the most expensive part of the homemade system. Commercial products can run hundreds of dollars, but the least-expensive ones work just as well and last just as long for this purpose. Wetter likes the Aquatic Life RO Buddie Three Stage Reverse Osmosis System, 50-Gallon (available from Amazon for around $50).
- ☑ **¼-inch irrigation tubing in 3-foot lengths:** You can purchase this from a hardware or home supply store.
- ☑ **Submersible pump:** A good option is the Ironton Submersible Water Pump, 1268 GPH, 1/8 HP, 1in. port (available online from Northern Tool for $49.99).
- ☑ **32-gallon heavy-duty garbage container:** Wetter used the Rubbermaid Commercial Brute (available from Amazon for around $22).
- ☑ **Lid for 32-gallon garbage container:** Wetter used the Rubbermaid Commercial Round Brute Container Lid (available from Amazon for around $11).
- ☑ **Valve:** Use the B&K Heavy Duty Brass Float Valve (available on Amazon for around $11).
- ☑ **Pattern Nozzle:** Melnor makes a variety of pattern nozzles. You need one that includes a "Flat Pattern" as one of the options ($9-$13).
- ☑ **50 feet of 3/8-inch coil hose:** Ace Hardware #91250 is the correct diameter needed to work with pressures of the submersible pump above ($22). Other companies make these coil type lightweight hoses as well.
- ☑ **Small ¼-inch plastic quick connect fittings:** You can purchase these at home supply stores. Assembly requires drilling one hole in the garbage container, and several small fittings to make the parts attach to each other.
- ☑ **¼-inch quick-connect-to-female hose connector:** You may need one of these to attach to hose bib, but these often come with the aquarium reverse osmosis filter.



David Fairchild's trips to Haiti

Researchers examine two extensive trips to the Caribbean nation.

By Javier Francisco-Ortega, Ph.D.; Marianne Swan; Janet Mosely; Nancy Korber; and Brett Jestrow, Ph.D.

TOP
View of the ruins of the Citadelle with Leonard R. Toy standing on top of one of the fortress walls, March 27, 1932.
Photo: Archives/FTBG

ABOVE
Fred C. Baker (see text) posing with an individual of *Agave brevispina* Trel. (Asparagaceae). on road to Keskoff, March 2 1933.
Photo: Archives/FTBG

NEXT PAGE
View of a market in Port-au-Prince, March 4 1933.
Photo: Archives/FTBG

Between 1931 and 1933, Dr. David Fairchild made two extensive trips to the Caribbean Islands. These were the last voyages that he made on *Utowana*, a famous research yacht that was owned by philanthropist and businessman Allison V. Armour. The latter was a long-time friend of Dr. Fairchild who also joined these two Caribbean expeditions. The first voyage (1931–1932) included Panama. The second one (1933) also targeted the British and Dutch Guyanas. Haiti was explored during both voyages.

Through our research, we have catalogued and interpreted all of the documents and photographs found in the Garden archive and library pertinent to Fairchild's visits to Haiti. Furthermore, we have found relevant documents in the U.S. National Archives and in the U.S. National Agriculture Library Special Collections (both in Maryland) that provide extra details about these trips. Unfortunately Dr. Fairchild did not publish any account about these visits, and to reconstruct his itineraries and accomplishments we needed to rely mostly on archival research.

Fairchild's first stay in Haiti occurred during March 26–27, 1932, during his return trip to Miami, en route from Guantanamo, Cuba, to the Bahamas. Expedition members included USDA scientists Harold Loomis

and Pamelon Howard Dorsett; David Fairchild´s wife and daughter; and Leonard R. Toy of the Florida State Experimental Station at Homestead. This short visit focused on northern Haiti, where *Utowana* called at the port of Cap-Haïtien. In the U.S. National Archives, we located Dorsett's travelogue, which provided us with insights about this visit. Expedition members were hosted by F. C. Barker, who was a USDA agriculturist working on a major program focused on the rubber tree. Dorsett´s travelogue has 27 photographs from Haiti, five of which are also found in the Garden archives. All told, the Garden's archives contain 21 photos taken by Dr. Fairchild during this visit. The expedition resulted in 13 plant samples and four herbarium specimens for the USDA collections and the U.S. National Herbarium (Smithsonian Institution), respectively. During this short stay, Fairchild and his colleagues visited two of the most relevant historical sites in Haiti: the *Citadelle Laferriére* fortress and the palace of *Sans-Souci*. Both buildings were made under the rule of King Henri Christophe—one of the leaders of Haitian independence. These buildings have received international recognition as a UNESCO World Heritage site.

Dr. Fairchild's second visit to Haiti took place between February 28 and March 4, 1933, and it focused on Port-au-Prince and Jérémie. Other members of this expedition included Dorsett and two zoologists from Harvard University: herpetologist Thomas Barbour and ornithologist James C. Greenway. On this visit, *Utowana* called first at Port-au-Prince and subsequently Jérémie, en route from the Bahamas to Jamaica and Panama.

The Garden's archives contain 30 photos taken in Haiti by Fairchild during this second visit. He collected a total of 15 accessions for the USDA, and we have located nine herbarium specimens—most of them in the U.S. National Herbarium. In addition, Fairchild´s unpublished travelogue for this voyage devotes two pages to Haiti. The people he met during this second visit included F. C. Barker (who hosted Fairchild during his first visit to Haiti) and Henry D. Barker (author, with William S. Dardeau, of the first comprehensive flora of Haiti). Fairchild's visit happened during carnival, and he took photos of this festival of parades. During this visit, the USDA had a very active presence in Haiti, and Fairchild met with scientists from the department who were working on cotton and banana diseases. We also know that Barker worked primarily with the rubber tree, as Haiti and the U.S. were interested in developing this as a cash crop to target U.S. markets.

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wish list

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To fully fund a wish, donate a portion of the cost or donate the actual item, please contact Leslie Bowe at 305.667.1651, ext. 3338, lbowe@fairchildgarden.org, or please visit www.fairchildgarden.org/Donate

REMEMBERING
Dr. James Vaughn

By Amy Padolf

Fairchild mourns the passing of Dr. James Vaughn, a proud supporter of the Garden's education mission.

Because of his passion and dedication to encouraging students to pursue careers in the sciences, Dr. James Vaughn, South Miami Hospital's first chief of staff and a longtime Fairchild member, established the Lewis Vaughn Memorial Scholarship program. Since 2012 this program, named in honor of Dr. Vaughn's late uncle Lewis, has provided college scholarships for two deserving high school seniors who have actively participated in Fairchild's award-winning environmental science program, The Fairchild Challenge. Through Dr. Vaughn's generosity, 10 deserving students have been awarded $5,000 each to attend either Florida International University or the University of Miami to study biology, ecology or environmental science. Unfortunately, Dr. Vaughn passed away before being able to meet this year's recipients, Myles Covington (from Cutler Bay Senior High School) and Layla Claure (from Miami Killian Senior High School).

Everyone in the Fairchild community is grateful to Dr. Vaughn for helping us to inspire the next generation of scientists. We will truly miss his contagious laugh, dry wit and unwavering support.

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About The Legacy Society

The Legacy Society is a dedicated group of Fairchild supporters who have made a lasting commitment to the Garden by making a planned or life-income gift with Fairchild or by naming Fairchild as a beneficiary in their estate plans.

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For more than 80 years, bequests and planned gifts have provided vital support to Fairchild's collections, exhibits and programs. Today, you can help continue this tradition by making a lasting commitment to the Garden. When you join The Legacy Society, you help ensure that the programs we pioneer today will continue long into the future. And, the expression of your individual values will provide hope, inspire others and have a real and lasting impact.

Ways to join Fairchild's Legacy Society

Membership in The Legacy Society is open to those who wish to join the tradition of making a lasting gift. It is our way of recognizing a remarkable commitment to Fairchild. You can become a member of The Legacy Society by naming Fairchild in your will or estate plan or by making a life-income gift. As a member of The Legacy Society, we recognize your profound contribution and dedication to preserving the Garden.

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