Montgomery Botanical News

Advancing research, conservation, and education through scientific plant collections.

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Lessons Learned: Weathering 2005's Hurricanes

The increased hurricane activity predicted for future decades has serious implications for the important work of Montgomery Botanical Center (MBC). Hurricanes Katrina and Wilma were the worst weather events at MBC since 1992's Hurricane Andrew.

THE STORMS

Hurricane Katrina struck south Florida on August 25th. The damage far exceeded expectations for the Category One hurricane; the combination of exceptional rains with a slow-moving eye led to extensive uprooting and damage to many of MBC's collections. The loss of valuable shade trees threatened delicate tropical *Chamaedorea* and *Zamia* collections with scorching rays.

In less than two months, the far more powerful Category Three Hurricane Wilma struck, causing much more extensive damage. Many important scientific collections lay uprooted, damaged, and—worse still—some were instantly, unsalvageably destroyed. The garden lay in seeming ruin, with branches piled over roadways and collections heaped upon other collections. Roof tiles were scattered and shade cloth was whipped mercilessly about.

The effects of Katrina and Wilma far overshadow those of last year's other hurricanes, Dennis and Rita, but we prepared for those storms as well. The effects here were, thankfully, limited to enhanced rainfall and loud (but tame) winds.

RECOVERY & ASSESSMENT

The recovery process at Montgomery Botanical began immediately following each hurricane. Although the grounds currently look well-groomed, this job is still underway. Montgomery Botanical Center's commitment to scientific collections mandates that thorough, complete data collection runs concurrently with the immense task of debris clearing and removal. That assessment adds much time and effort to recovery, but those data are vital to the research and conservation value of MBC's collections.

Following storms, biologists and curators inspect every individual plant for damage. This evaluation begins with immediate triage of the collections, much like the initial emergency work in a human crisis. Coordinating the assessment with crucial road clearing and hazard removal is not an easy task! Careful organization and communication ensure no valuable specimens are lost by hasty removal.

A *Corypha umbraculifera*, felled in Hurricane Katrina, is raised with a 70-ton crane.

A large portion of our collections sustained damage *(see table on page 3)*. These data also demonstrate that many specimens were unharmed, and for that we are deeply thankful. One way to estimate the total damage from both storms is in the amount of ground debris; these storms resulted in over 4,000 cubic yards of mulch for MBC.

SUPPORT

Following Hurricane Wilma, many of Montgomery Botanical's team were unable to make it in, due to blocked roads and myriad concerns at home. Ultimately, we were without utility power for over two weeks. Undaunted by those conditions, two-thirds of the team showed up on that first day, and worked exceptionally hard on assessment and

(continued on page 3)

To advance science, education, conservation and horticultural knowledge of tropical plants, emphasizing palms and cycads, Montgomery Botanical Center collects seeds from wild plant populations around the world and grows the resulting plants in population-based, documented, scientific collections, for use by botanists, scientists, and educators, in a 120-acre botanical garden exemplifying excellent design.

Montgomery Botanical Center (originally The Montgomery Foundation) is a tax-exempt, nonprofit, private institution established by Nell Montgomery Jennings in memory of her husband, Colonel Robert H. Montgomery, and his love of palms and cycads.

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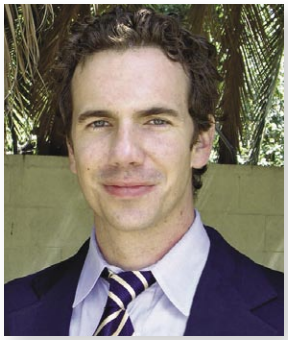
From the Executive Director



As I write this letter, it's been almost one year since I arrived to assume my responsibilities at Montgomery Botanical Center. And what a year it has been! 2005's two major and—as some forget—two minor hurricanes have literally reshaped our garden. Nevertheless, I am thrilled to report that we are recovering nicely thanks to solid teamwork—and lots of heavy lifting. The Montgomery Botanical team is a great group!

Although storms are certainly the major story of the year, we shouldn't ignore all of the other great things happening at MBC. In the past year, we have had eight major expeditions, resulting in a huge number of research and conservation collections. MBC brought back vital material from Argentina, Costa Rica, Panama, Paraguay, Uruguay, and our home state of Florida.

2005 was also the inaugural year for the Montgomery Fellows program. With generous funding from the Kelly Foundation, we were able to bring four palm and cycad scholars to MBC; our collaborative efforts are advancing our knowledge of those two plant groups.

My prime goal at Montgomery Botanical Center is integrating collections and research. Connecting our plant collections with plant scientists will fulfill our mission in the most efficient, direct way. Indeed, through the dedicated scientific rigor in MBC's collections, connecting our efforts to offsite scholars will "cultivate discoveries" in a way few institutions can.

You may notice a few changes in the newsletter this year. As executive director, I am committed to MBC's core mission of advancing science, conservation, and education. Collecting, maintaining, and tracking live scientific collections is what we do; making sure our resources stay focused on our mission is my job. Remember, it's all about the plants!

I wholeheartedly thank each of you for your support and friendship over the last year. I have enjoyed meeting many of you, and I look forward to speaking with you again soon. This looks to be a great year!

Weathering 2005's Hurricanes *(continued from front page)*

clearing work. Nick Kelly, MBC Director and CEO of Kelly Tractor, generously loaned a 10,000 watt diesel generator to power the main irrigation pump, and the kitchen and offices at Nell's House.

In the aftermath of both storms, FEMA funding was rumored to be minimal, nonexistent, difficult to attain, or entirely spoken for. Regardless, we pursued claims for physical damage, debris removal, equipment usage, contractors, and for loss of valuable specimens and vital shade canopy. Although rumors of no support for south Florida proved unfounded, limitations on FEMA prevented funding for any damage to plants. MBC, however, did collect over $74,000 from FEMA, which largely covered the cost of debris removal, but fell short of MBC's total losses.

Generous donations of service by longtime partners greatly mitigated this catastrophe's cost. We are especially grateful for donated and discounted work from Dave Atkins of Banyan Tree Service, Keith Lane of Signature Tree Service, Gold Coast Crane, Angel Ramos and Ramos Enterprises, and Evergreen Sprinkler.

Most of all, I am especially grateful for the immense show of support from the community in response to our plight. Our appeal following the hurricanes was met with a tremendous outpouring of generosity, with many new contributors and increased gifts from longtime friends. All in all, we saw a 40 percent increase in contributions last year! We are extremely grateful for your support. Montgomery Botanical Center is based on collections, and I am committed to ensuring our funds support that purpose.

LESSONS LEARNED

Unfortunately, hurricanes are increasingly a fact of life for botanic gardens in our region. On the bright side, a number of lessons were learned, and more are being studied.

Katrina, the worst hurricane to hit since Montgomery Botanical Center began developing the scientific collections, provided a serious test of our hurricane response protocol. Although high standards for communication, safety, and thoroughness were met with enthusiasm, there was still room for improvement. Our hurricane response protocol was found to be nearly perfect for low- to moderate-levels of damage. MBC responded to Hurricanes Frances (in 2004) and Dennis without difficulty or snag.

But Katrina's scale of damage far outmatched the conditions that shaped our protocol; although the assessment and recovery went well, the scale of the work dwarfed the time allowed for its completion. Our old protocol required completion of assessment before beginning debris removal and plant recovery. In most cases, assessment could be completed by three people in a half-day. But Katrina's assessment work took 10 of us 3 1/2 days to complete.

Based on that experience, we worked hard to tune our hurricane response to achieve vital, urgent recovery concurrent with initial triage and emergency salvage of the collections. Lessons learned from Katrina were put in place just in time for Hurricane Wilma, a far more intense test. Using the new protocol, the response to Wilma maximized collections survival, data collection, and debris removal, while keeping safety in focus.

One of the points in our practical planting plan is to "plant specimens that have a reasonable chance of growing on our property". In previous discussions, that largely meant considering cold tolerance, precipitation, or soil properties. Now, the long-term climatic regime is also considered. For example, we have noted for canopy plantings, a specific group of tree species performs admirably, especially when growing together as a stand. Specifically, a mixed stand of *Bursera simarouba* (gumbo limbo) and *Quercus virginiana* (live oak) forms a very resistant matrix of vegetation. *Lysiloma sabicu* is another species that seems unaffected by the recent storms. *Bucida buceras* (black olive) is a tree that we will not use due to its propensity to uproot.

2005 Collections	Hurricane Katrina		Hurricane Wilma	
	Damaged	Destroyed	Damaged	Destroyed
Palms	15%	0.80%	24.40%	2.40%
Cycads	1.23%	0%	6.40%	0%
Other trees	12.80%	3.70%	2.85%	1.65%

On the botanical side of things, the world's palm flora has evolved with hurricanes since time immemorial, and much can be learned about hurricane adaptation in these plants. Dr. Larry Noblick, Dr. John Dowe, and I are currently investigating patterns of hurricane tolerance in palms, using data from our assessments. In a sense, you could say 2005 gave us two pseudoreplicates on a long-term common garden study, testing hurricane effects on a broad cross-section of worldwide palm diversity. Those data may illuminate biogeographic patterns of adaptation. The study will also help steer local planting choices towards species that are less prone to damage and loss in future events.

CURRENT STATUS

Every day, the effects of last year's hurricanes are less evident. Much aerial lift work has been done on damaged palms and hardwoods; the debris has all been carted out and ground; and the grounds are, once again, being mowed and edged. Looking closely, you will see some shade cloth protecting valuable tropicals, and you may note an overall transparency of view. But the 2006 growing season is here and, due to hard work and generous support, Montgomery Botanical Center's collection is looking great, and keeps getting better.

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Developing Our Collections

The Zamias of Costa Rica's Pacific Slope

by Michael Calonje

Costa Rica is a destination of choice for botanical exploration. It is rich in biodiversity with an extraordinary range of habitats that are safely accessible and protected by an extensive national park system and many private reserves. Costa Rica is also researcher-friendly, and many international institutions (e.g., the Organization for Tropical Studies) have field stations with lodging, equipment, and contacts that help visiting researchers. Although Costa Rica has been heavily collected, there remains great confusion regarding the taxonomy of its native cycads.

A review of cycad books, websites, and herbarium specimens supports four species of *Zamia* in Costa Rica: *Z. neurophyllidia* and *Z. acuminata* on the Atlantic slope, and *Z. fairchildiana* and *Z. pseudomonticola* on the Pacific slope. The type localities for *Z. neurophyllidia* and *Z. acuminata* are both in Panama, and the relationships of these taxa with those in Costa Rica are not well understood. Some authors consider *Z. pseudomonticola* synonymous with *Z. fairchildiana* (Whitelock 2002, Schutzman *et al*. 2004).

In November 2004, with the kind support of Montgomery Botanical Center (MBC) and the assistance of my brother, Christopher Calonje, and ecologist Heather Hendrixson, I set out on a 30-day expedition to take a closer look at cycad populations on Costa Rica's Pacific slope and collect cycad and palm seeds for MBC's *ex-situ* collection. Our search began on the Osa Peninsula, about 20 km away from the type locality for *Zamia fairchildiana* within Corcovado National Park. A park ranger led us to a *Zamia* population slightly outside the park perimeter but within the same primary forest. After a few minutes walking up a steep slope, we began to see several zamias. This was what we had hoped to find: a large, plentiful population! There were hundreds of zamias of all sizes growing on the steep mountain slope on both sides of the trail. There were not many coning plants, but we saw a few with male cones and finally spotted a female plant with a broken-up cone.

As I excitedly approached the cone, I suddenly noticed something odd. Wrapped around the plant was a conspicuous aluminum tag that read "P1-9". The ranger explained that this population and others in the immediate vicinity were part of a conservation biology study being conducted by Cristina Lopez-Gallego, a University of New Orleans graduate student and MBC collaborator *(see page 9).* So, in searching for *Zamia*, we encountered the work of another MBC associate! We were not about to interfere in her important research, so we limited ourselves to taking photographs and notes. Encouraged to realize that there were, indeed, large *Z. fairchildiana* populations on the Osa Peninsula, we headed back to the hotel, hoping that our remaining two days in the region would yield seed for collection.

The next morning we tried a different strategy. Our uploaded GPS coordinates from *Zamia fairchildiana* vouchers in Costa Rican herbaria appeared closer to the coast than the road that traversed the peninsula. We therefore arranged with a fisherman to pilot us along the shore toward some of these points. As we embarked in his motorized canoe, he suggested a diversion for snorkeling at a group of tiny islands. As we approached the larger of the islands and began putting on our snorkeling gear, we noticed an enormous *Zamia* with over two meters of trunk right at the edge of the forest! We quickly replaced our snorkeling gear with notepads, a tape measure, and a camera, and hopped onto the tiny island to take a closer look. We found a total of five adult plants growing close together. Luckily, one of the plants was a female with a few seeds left in a broken-up cone. We wondered how long these large plants had been growing on the island and how the seeds might have made it there from the mainland 300 meters away.

Leaflets and female cones from three *Zamia* populations collected during MBC's 2005 Costa Rica expedition: Left, *Z.* sp. (San Vito type); center, *Z.* aff. *pseudomonticola*; right, *Z. fairchildiana*

As we left the island and headed back to the mainland, we found several populations growing right by the water. Several plants had branching trunks, probably the result of wind and wave damage from this harsh marine environment. The proximity of the plants to the ocean suggested they may prove to be somewhat salt-tolerant under cultivation. They seemed to thrive in this harsh but sunny environment, as many plants were reproductively active.

Next, we headed to the cool, mountainous region around San Vito, near the Panama border. This very different environment was said to house *Zamia fairchildiana* populations with the type locality for *Z. pseudomonticola* nearby. We were welcomed at the Organization for Tropical Studies' Las Cruces Field Station by the director, Luis Diego Gomez, who originally described *Z. pseudomonticola* and *Z. fairchildiana.* Gomez (1982) described the diagnosis between *Z. pseudomonticola* and *Z. fairchildiana* as unarmed versus armed petioles. Also according to Luis Diego, *Z. pseudomonticola* was very rare in its type locality, and a team sent by Loran Whitelock in 2003 found only specimens of what they considered typical *Z. fairchildiana*.

The following morning we set out to find *Zamia fairchildiana* plants in the premontane rainforests near San Vito. We followed a path deep into the cool, moist forest and after about 20 minutes of walking, we began finding zamias with arborescent trunks up to two meters tall. However, the female cones were remarkably different compared to those of *Z. fairchildiana* from the Osa Peninsula. The cones were dark green rather than light tan; had short, rounded tips instead of long, sharp tips; and were generally wider with bigger seeds. These plants have been known and cultivated for years as *Z. fairchildiana*, but these cool-weather, premontane wet-forest dwellers were clearly distinct from the warm-weather, tropical wet-forest dwellers of the Osa Peninsula.

After admiring the unique plants at San Vito, Luis Diego told us about a population of *Zamia pseudomonticola* he had located 10 km away from the type locality. We were excited at the prospect of clearing up some of the controversy surrounding this species. The plants we found had trunks to one meter tall, about half as tall as the plants we had seen near San Vito. The leaflets were variable, some obviously acuminate and matching the original description for *Z. pseudomonticola*. The female cones were about half the size of the San Vito cones but were also dark green when mature and had blunt, short tips. These plants and the San Vito plants are obviously closely related to each other yet distinct from *Z. fairchildiana* or any other described *Zamia* species. One detail prevented us from assuming this was the long lost *Z. pseudomonticola*: these plants had heavily armed petioles, unlike the unarmed petioles described for *Z. pseudomonticola*. So, *Z. pseudomonticola* apparently remained unseen, yet a very similar plant remains undescribed. Since few specimens with unarmed petioles were ever observed near the type locality, we wonder if the lone specimen examined in the original description was an aberrant individual of the same cool-growing *Zamia* we were observing.

Zamia sp. (San Vito) from a population near the *Z. pseudomonticola* type locality

The opportunity to visit several *Zamia* populations on the Pacific slope of Costa Rica revealed many as-yet undocumented differences among populations. I expected a few minor differences between populations of *Z. fairchildiana*, but certainly did not expect to find plants that do not fit any published description. It is apparent that the taxonomy of Costa Rican cycads is anything but clear, and that further field work and phylogenetic studies are urgently needed to sort out the native species and their relationships within the genus *Zamia*. At least we departed knowing that the carefully documented seed and voucher collections, data, and photographs we collected during our trip may help clarify the situation in the future.

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Developing Our Collections

Several of the *Oncosperma* along Duck Lake at Montgomery Botanical Center

TACKLING SALTY SOILS

As curator of palms at Montgomery Botanical Center (MBC), I am often challenged to provide suitable growing environments for unique palm species collected throughout the world. Frequently, this task involves modifying the condition of a planting site to better suit the horticultural demands of a particular palm.

It is not uncommon to find the palm team working diligently to transform a sunny, dry, and exposed planting area into a dark, moist, and highly protected site suitable for planting sensitive baby palms. So, I was happily surprised when MBC's landscape architect sited *Oncosperma tigillarium* along the edge of Duck Lake in the lowland Palmetum. There seemed to be no better site, as this species thrives in coastal swamps and on the fringe of mangroves in Southeast Asia and Indonesia.

Oncosperma tigillarium is a very large, clustering, beautiful (but foreboding) palm. It sports masses of deep-green, drooping fronds with stems covered in long, sharp, black spines. It is easy to understand why this particular palm was selected to form the highly visible backdrop behind the lake. Both visually and horticulturally the site seemed to be perfect… or so I thought.

Soon after installation, the healthy baby palms began to decline rapidly. Despite regular watering and supplemental micronutrient feedings, the palms showed no improvement and were, in fact, dangerously close to death. Once deep-green leaflets now had necrotic tips; new growth was grossly stunted and chlorotic. Those symptoms are characteristic of salt damage. I knew the soils in MBC's lowlands were slightly salty, but not at levels that would damage our plant collections. We decided to run a few tests.

A saturated soil analysis was conducted at the *Oncosperma* site. Soluble salt levels in the soil were 9760 ppm (parts per million); levels below 1280 ppm are normal. With salt levels that high, the chances of the young palms surviving in this soil seemed bleak. We needed to amend the soil with products that would reduce the sodium levels significantly. Our treatment plan: add gypsum directly to the soil and begin drenching the young palms with a sodium reducer.

Gypsum (calcium sulfate) helps leach harmful salts from the soil. At the same time, it improves soil structure allowing for better air and water penetration and root development. Products that are sodium reducers work by displacing salts in the root zone, rendering them unavailable to the plant. They also coat the roots, protecting them from salt damage and enhancing nutrient uptake.

After adding gypsum to the soil, the sodium-reducing drench was applied to the palms every two weeks for the next 60 days. A second soil analysis showed the soluble salts had fallen to 3987 ppm—a great improvement but still at a toxic level. We continued the biweekly drench treatments throughout the summer. As the salt levels continued to fall, the oncospermas began to recover and put on new growth. To support their recovery, a biweekly micronutrient drench was added to the treatment plan. With the salty soil problem now in check, the plants were able to take up the much-needed fertilizer and the palms began to thrive.

Now, looking across Duck Lake, the *Oncosperma tigillarium* are beginning to fill in and form the striking backdrop first envisioned. The perfect site? It could have been a horticultural disaster but, after some patience, it turned out to be fine after all.

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Roystonea Palms at Montgomery Botanical

Roystonea is a New World genus consisting of 10-12 species of solitary, columnar palms. Five species grow at Montgomery Botanical Center (MBC), consisting of 124 accessions and 231 plants. They are frequently used as dramatic landscape design elements and are commonly known as "royals". Fortunately, there is sufficient space at MBC to maintain *Roystonea* in groups of populational plantings.

Our database contains extensive, up-to-date, on-site information gathered from our population-based collections of *Roystonea*. MBC also sponsors expeditions to obtain seed and herbarium specimens and to observe palm populations in habitat.

Photographic documentation is a crucial part of the data tracked at Montgomery Botanical Center. Seeds are given accession numbers and photographed upon arrival in the nursery. Upon germination, an image is taken of the first seedling leaves. After the young palm is planted in the landscape, MBC accumulates monthly phenology data, biannual growth and development data, and horticultural observations. As imaging specialist, I digitally capture images of plants, including visual documentation of their height, for MBC's Growth and Development program. One representative plant from each accession is photographed biannually.

Images from Growth & Development database: *Roystonea oleracea* in 2004 (above); the same plant in 2002 (below)

A towering "royal" from the original Robert Montgomery Collection

The physical differences between various species of *Roystonea* appear as the trees develop in the landscape. *Roystonea regia*, perhaps the best-known species, often displays a bulge along the mid-trunk. *Roystonea altissima* has particularly attractive inflorescences *(see image lower left)*. Plants growing at MBC exhibit interesting details related to their growing conditions and localized microclimate, such as splitting from excessive water uptake *(see image lower right)*.

Roystonea are native to various islands in the Caribbean Basin and adjacent areas of North, Central, and South America. Growing primarily in moist lowlands, many locations where *Roystonea* were previously found have now been cleared and altered for agricultural use.

In Florida, the range of the native *Roystonea regia* historically extended along the Saint Johns River into the northern third of the state. The largest extant wild stands of royal palms are in the globally unique Fakahatchee Strand State Preserve and Collier-Seminole State Park. Plants grown at Montgomery Botanical Center from wild-collected seed have been returned to the Fakahatchee Strand and the adjacent Florida Panther National Wildlife Refuge for habitat restoration.

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Talking Palms in London

London might seem an odd place to talk about palms, but it is actually the center of much of today's palm research. Last year's International Symposium on the Biology of the Palm Family was held at the Royal Botanic Gardens, Kew, and at the Linnean Society in the Royal Academy of the Arts, downtown London. The Linnean Society's meeting room is an awe-inspiring room where many of the world's most prestigious scientists have delivered talks. The small room with its church-like benches has high ceilings, dark walls, and life-size portraits of such legendary greats as Charles Darwin, with his long gray beard and critical stare, glaring down on the proceedings.

Most of the world's palm experts and palm students gathered at the symposium to honor the retirement of Dr. John Dransfield, Kew Gardens'—and the world's—most notable and congenial palm scientist. In honor of Dr. Dransfield's retirement, a new genus of palm was named after him, *Dransfieldiana* (New Guinea).

It was encouraging to hear Drs. John Dransfield, Sophie Nadot, Julie Sannier, and others pressing their colleagues to visit Montgomery Botanical Center (MBC). Dr. Dransfield paid a special compliment to MBC for aiding his work during the revision of "Genera Palmarum".

The London symposium was a spectacular opportunity to showcase Montgomery Botanical Center's work to our most valuable clients—the palm scientific community. During the poster session, I presented my research on the palm genus, *Butia.* The symposium was also a great opportunity to confer with some of the world's foremost authorities on the palm family.

HIGHLIGHTS OF THE TALKS

•Dr. Barry Tomlinson described the uniqueness of palms: the longest leaf, the biggest seed, the largest inflorescence, and the oldest living tissues—just to name a few features.

•Dr. Sophie Nadot and her French colleagues are studying developing pollen grains from material collected at Montgomery Botanical Center and elsewhere. This developmental information will be useful in understanding palm evolution.

•Aaron Pan, a graduate student from Texas, presented evidence from the fossil record that Africa's palm flora was devastated by at least two major extinction events, 65.5 and 33.9 million years ago.

•Dr. Connie Asmussen of Denmark discovered that the Calamoid, or rattan palms, are the most primitive of all of the palm groups. Others have since confirmed this.

•Dr. William Baker spoke of his efforts to combine all of the various datasets into one large matrix. He estimates palms are indeed older than anyone has yet published. His current estimation—palms are 92 million years old.

•Dr. Carl Lewis, from Fairchild, presented his findings of the West Indian palms using various nuclear gene sequences. His findings will result in the renaming of at least four Caribbean palms.

•Hugh Harris, a leading coconut expert, described two groups of coconuts, a wild type and a domestic type. He believes that the wild type group is Indo-African in origin, having its beginnings on an ancient Gondwanaland coastline, evolving thicker husks to survive the floating distances between the two ancient separating coastlines of Africa and India. Experiments show coconuts can survive 200 days floating in saltwater (travelling a possible distance of 3,000 miles) and remain viable.

•Dr. John Dransfield spoke about the publication of the second edition of "Genera Palmarum", aided by material examined at Montgomery Botanical Center. Some of the changes include: five newly described genera, four resurrected genera, two or more rediscovered genera, and 24 genera that have been lost.

•Dr. Marie-Charlotte Anstett described how palms attract pollinators with perfumes. To date she has identified 398 odors produced by palms. However, flowers do not necessarily produce those odors. The European fan palm attracts beetles with odors produced from shiny structures located in the sinuses of the leaf segments.

Growing palms under glass in the Palm House at Royal Botanic Gardens, Kew

•Dr. Terry Sunderland spoke on the utilization, management, and conservation of African palms of which there are only 60 species. He spoke in particular about the 22 species of African rattans. Terry recently donated wild-collected seed of some of these rare and poorly known rattan species to MBC.

Montgomery Botanical Center was acknowledged by several scientists who have used our material and facilities; no one left the symposium without hearing about our work. Without a doubt, Montgomery Botanical is building a reputation in the scientific world for quality collections, quality data, and a quality team. We look forward to collaborating with the palm scientific community on their upcoming research projects.

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Geophysical Explorations in a Botanic Garden

While Montgomery Botanical Center's (MBC) main focus is tropical botany, our unique, unspoiled "outdoor laboratory" provides a wide range of natural resources for other scientific disciplines. University of Miami undergraduates practice their field investigation techniques along Silver Bluff. Postdoctoral students from the Rosenstiel School of Marine and Atmospheric Sciences used the escarpment to develop prototype core-sampling equipment, working out the glitches on land before making the resource-intense commitment required for offshore expeditions.

However, a long-term project in progress marks the first time geological studies at MBC are directly related to tropical botany. Florida International University graduate student Jeremy Stalker is attempting to quantify the amount of fresh water entering Biscayne Bay via rainwater, surficial runoff, and groundwater which results in considerably lower salinity in the vast Bay waters compared with the open ocean seaward of the reef tract.

The two test wells on MBC's main tract, along with data from the main irrigation well located one-half mile west of the property, provide readily accessible groundwater data that would be almost impossible to gather from waterfront sites on private property north and south of MBC. The fresh well water has an isotope signature very close to that of rainwater, most likely because the Silver Bluff escarpment running through MBC is over a local recharge zone for the Biscayne aquifer allowing fresh rainwater to quickly infiltrate into the ground.

Mr. Stalker's monthly observations of the three wells provide a summary of the ionic constituents of the irrigation water and—more important for Montgomery Botanical Center—also include pH and salinity data. Those data, collected with the FIU students' sophisticated instrumentation, are then compared with the weekly readings taken by MBC.

In a related project, Mr. Stalker is also attempting to track the precise location of the saltwater interface at MBC—the same saltwater interface plaguing much of south Florida's coastline. He and his associates use a rather unique device called an "EM-31" that is towed along predetermined north-south tracks on the property. The device emits and receives electromagnetic pulses. By timing the return velocity of the pulses, salinity percentages can be determined. Increased salinity results in increased conductivity and, therefore, a faster return of the electromagnetic pulses. Conversely, lower rates of chlorides decrease conductivity and result in slower return pulses.

Although the USGS has been doing this sort of evaluation for years all across Miami-Dade County, the location of the agency's test wells (the closest one to MBC being several hundred feet north of the northwest corner of the property) cannot provide the localized accuracy of Mr. Stalker's on-site investigations.

With those two projects well underway, Mr. Stalker plans to continue increasing the sophistication and accuracy of the resultant data. For example, he is devising a tracer test to develop a hydrologic model which would show preferential flow paths—caves and conduits through the limestone substrate—that would be invaluable in FIU's research into karst coastal processes and would ultimately help MBC identify viable sites for new irrigation wells. Mr. Stalker believes the tracer tests, combined with ground penetrating radar surveys, could locate sinkholes and cavities in the substrate as well as determine the depths of the saltwater interface.

Just as Montgomery Botanical Center is recognized as a leading contributor in tropical botany, Montgomery Botanical's geographical location, accessibility, and relatively undeveloped topographical resources offer an incomparable "laboratory" for long-term coastal hydrogeologic studies.

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Montgomery Botanical Names First Research Associate

Cristina Lopez-Gallego, a cycad researcher from Colombia, was recently inducted as Montgomery Botanical Center's first research associate in acknowledgment of her valuable contribution to the Montgomery Botanical Center mission.

Cristina is a doctoral candidate at the University of New Orleans, where she is investigating genetic diversity in *Zamia fairchildiana* populations growing in primary rainforest and disturbed habitats on Costa Rica's Osa Peninsula.

Cristina recently returned from an MBC-sponsored collecting and research expedition with plant material for her continuing investigations. While at MBC in January, she initiated seed germination experiments. Once the experiments are completed, the wild-collected material will be accessioned into Montgomery Botanical Center's collections. The enormous amount of quality data associated with these plants make them uniquely valuable for research.

MBC Team News

Steve Chickillo *joined MBC in February as the newest member of the grounds team. After a short period volunteering, the curators found him indispensable. Steve brings a lifelong enthusiasm for and knowledge of palms to Montgomery Botanical, as well as a deep appreciation of nature.*

Christina Dupuy *is a talented arborist with experience caring for prominent plant collections; she is also active in many local botanical groups. Christina cared for the University of Miami's Gifford Arboretum for many years before joining MBC as the curator of dicots.*

Charmaine Kappler *joined MBC this year working in funding and communications. Her experience as a writer, brand manager, and marketing consultant made her an ideal fit for MBC's needs. And, she has also been a volunteer assistant for* Zamia *research projects.*

Sandra Rigotti *is MBC's newest field specialist. A native of Brazil, Sandra has an extensive background in sustainable agriculture and agronomy research, and a deep appreciation of conservation work.*

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Zane B. Carothers Memorial Fund Supports Crucial Conservation Efforts

Dr. Zane B. Carothers (1924-2005) was Professor Emeritus of Plant Biology at the University of Illinois. Dr. Carothers' professorial career spanned 34 years and he guided many undergraduate, graduate, and postdoctoral students in botanical studies. An expert on bryophytes and stem and root anatomy, he was known for meticulous interpretations of microstructure based on electron micrographs. His work illuminated many features of reproductive cells in bryophytes. Dr. Carothers was an avid botanist with a love of all plants, but was especially fascinated with cycads and their unique anatomical features.

In honor of her longtime collaboration and colleagueship with Dr. Carothers, Dr. Anne E. Rushing, with a generous donation, established the Zane B. Carothers Memorial Fund at Montgomery Botanical Center. Early in her academic career, Dr. Rushing, Professor and Associate Chair of Biology at Baylor University in Waco, Texas, was a postdoctoral researcher in the laboratory of Dr. Carothers, studying the anatomy of bryophytes. Drs. Rushing and Carothers remained longtime colleagues, coauthoring numerous important studies of plant anatomy.

In keeping with Dr. Rushing's wishes, this fund supports vital international collecting activities to obtain cycad research and conservation material. The Zane B. Carothers Memorial Fund directly and effectively sustains Montgomery Botanical's mission by enabling scientific, population-based seed collection for research and conservation. The Fund has supported MBC's upcoming expedition in Swaziland to recover seed from rare, imperiled *Encephalartos* species.

Since its establishment, the Zane B. Carothers Memorial Fund has been augmented by a generous donation from Dr. Robert R. Ireland.

Please consider supporting Montgomery Botanical Center's vital conservation efforts. This fund goes a long way toward palm and cycad conservation, but there is still an urgent need for your help in this area. Your gift will enable Montgomery Botanical to collect palm and cycad populations for future research.

Facilitating long-term conservation of unique, rare, and imperiled plants is a singularly noble way to honor or commemorate a respected colleague or loved one. Please call anytime if you would like more information.

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ACCOMPLISHING BOTANY AT MONTGOMERY BOTANICAL CENTER

Montgomery Botanical Center is committed to providing plant material for research, educational, and conservation purposes. In 2005, we provided 5,067 specimens—bark, leaves, pollen, seeds, wood specimens, flowers, and whole plants—to our colleagues.

Montgomery Botanical directly promotes conservation by working with the Florida Nursery, Growers and Landscape Association (FNGLA). In 2005, MBC seedbank coordinator, Judy Kay, and MBC's volunteers distributed an additional 775,599 seeds through the FNGLA. This ensures the survival of otherwise endangered plants, while diversifying the landscaper's palette and, ultimately, our public and private gardens.

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FROM THE MONTGOMERY ARCHIVE

Shortly after the famous Cuban botanist Brother Leon discovered a new population of *Microcycas calocoma* in western Cuba, Colonel Montgomery obtained several plants through Brother Leon at great effort and expense. The Colonel added these to his collection at the Montgomery estate and donated one plant to Fairchild Tropical Garden after establishing that garden in 1938.

In the photograph, above left, from the Montgomery estate (circa 1933), the Colonel's foreman stands next to one of the first specimens of *Microcycas calocoma* brought to the United States. Dr. Barry Tomlinson stands next to the same plant 30 years later (center photo, 1965) and 70 years later (right photo, 2006), illustrating the slow growth rate of cycads.

Botanic gardens are well-suited for long-term, collection-based studies, but vigorous record-keeping is essential. Montgomery Botanical Center is committed to data stewardship, a curatorial tradition in practice at the Montgomery estate since 1932.