



MBC AND USDA STUDY RARE CYCADS OF JAMAICA

The “Caribbean zamias” are a group of related plants occurring in Florida and Georgia, the Bahamas, Puerto Rico, Cuba, Hispaniola, the Cayman Islands, and Jamaica. They share several features including subterranean clumping stems, smooth petioles, and the same basic chromosome number. They are also taxonomically controversial. Over 40 scientific names have been published for Caribbean zamias, but currently between one to six species are accepted by experts. Included in this group is a zamia that grows wild on MBC’s property, commonly known as the “Coontie” but called many different names, including *Zamia pumila*, *Z. integrifolia*, and *Z. floridana*.

Caribbean zamias are a primary focus for Montgomery Botanical Center’s (MBC) *ex situ* research and conservation collection: they are poorly understood plants, highly threatened by habitat destruction and over-collection. As South Florida is within the Caribbean basin, MBC has the optimal environmental conditions to cultivate them. MBC has led expeditions to collect Caribbean zamias in The Bahamas (2002), Puerto Rico (2003), and Florida (2005).

From February 8-13, 2008, we had the unique opportunity to participate on collaborative research in Jamaica with botanist Andreas Oberli of the Plant Conservation Centre in Kingston, Jamaica. Along with Dr. Javier Francisco Ortega of Fairchild Tropical Botanic Garden and Dr. Dennis Stevenson of New York Botanical Garden (NYBG), we are conducting

DNA studies of the Caribbean zamias. Results of this research will increase understanding of genetic variation within the group and help develop conservation priorities.

FIELDWORK

During the Jamaica 2008 expedition, we visited five populations of *Zamia* comprising three different forms. One form

is a large plant with long narrow leaflets known in cultivation as the “Jamaican Giant.” The only population of this form known prior to this expedition was visited in 2003 by Sabra Turnbull for her Ph.D. research with NYBG. She reported that development was occurring throughout the population, and mature plants were being illegally harvested from the area. Exactly five years after her report, we found all large plants in the population had been removed. Only immature plants or small

male plants remained. Fortunately, we discovered another large, actively reproducing population of this form with several thousand plants.

We also visited two populations of *Zamia amblyphyllidia*, a clumping plant with wide leaflets. This species is probably the most threatened in Jamaica, as it is very sparse along the western coast of Jamaica and is highly threatened by tourism development. The few plants we found were far apart from each other and reproduction was very low, with many female cones failing to set seed.



Ripe cones of narrow-leaflet *Zamia* surrounded by seedlings

(continued on page 3)

Montgomery Botanical Center
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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 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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Masthead photo of *Veitchia arecina* (formerly *V. montgomeryana*) by Harvey Bernstein

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**From the
Executive Director**



Global conditions drive the mission and work of Montgomery Botanical Center. This year is a year of great concern.

Fuel and food costs have risen sharply; increased prices drive increased agriculture. Looking at current trends, we know that after a slowdown of forest clearing in recent years, deforestation is speeding up in 2008. Palm and cycad populations are imperiled by this trend—one crucial way that world economics relates directly to the work of MBC.

How does MBC make a difference? In these times, our work in conservation is critical. Michael's work in Jamaica (pages 1, 3) highlights diverse threats to native cycads. MBC fieldwork in Brazil (p. 4), China (p. 4), and Colombia (p. 5) advances conservation directly, by raising our understanding through basic botanical research. Articles by Tracy (p. 5) and John (p. 6) highlight the palm's role in biofuel production. Stella (p. 7) describes the intensive care sometimes necessary for individual cycads in our conservation collection.

Despite recent global uncertainties, the important work of MBC continues. Space limits what we can detail here, but you should anticipate further successes—as I write, Michael and I just returned from fieldwork in Belize, Chad is preparing for work in New Caledonia, and Larry is describing new palm discoveries. Planning for fieldwork in 2009 is underway. We are also excited to host the Organization for Tropical Studies here for their annual meeting, and we are eagerly preparing for MBC's own 50th anniversary next year.

I wish you and yours good fortune and health, and I look forward to seeing all of you here soon.

Pictured: Dr. Griffith with Colonel Montgomery's first *Microcycas calocoma*—the largest individual of its species in the United States.

JAMAICA 2008 *(continued from front page)*

The last form we visited had slightly narrower leaflets and longer leaves than *Z. amblyphyllidia* and was well separated geographically. Interestingly, these plants rarely clumped, and often produced aerial stems up to 50 cm tall. If this characteristic remains in cultivation, it would be unique among Caribbean zamias. This population is the only known population of this form, with fewer than 600 plants, too scattered for reproduction to be effective. Many seedlings from this population lack pigment, which may indicate inbreeding depression.



Narrow-leaflet zamia ("Jamaican Giant")
Alan Meerow (foreground) and Andreas Oberli

CONSERVATION AND RESEARCH

With the exception of the single, large population of the "Jamaican Giant", the *Zamia* populations we visited were small, sparse, and highly threatened by habitat destruction and illegal harvesting, which we witnessed first-hand. The Jamaica 2008 expedition extended our biogeographic knowledge and understanding of Jamaican zamias, and secured valuable germplasm and genetic samples for scientific research and *ex situ* conservation at MBC and the USDA National Germplasm Repository. We are grateful to the National Environment and Planning Agency of Jamaica for granting us permits. Genetic analysis will uncover more information about *Zamia* populations, how these populations are related to each other, and where they fit within the *Zamia pumila* complex. Seeds collected during this trip have sprouted and are now healthy one-leaf seedlings at MBC's nursery.



Andreas Oberli with
arborescent zamia

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MBC RESEARCH HIGHLIGHTS

• *Assembling the Tree of Life* (AToL), a large scale NSF-funded project, is making extensive use of the MBC collections. **Dr. Damon Little** and **Dr. Dennis Stevenson** of the New York Botanical Garden have collected cycad material from almost every species at MBC; **Dr. Sarah Matthews** of Harvard used many of the Tropical Conifer collections; Dr. Stevenson, **Dr. Wendy Zomlefer** of the University of Georgia, and **Dr. Jerry Davis** of Cornell collected from our palms.

• Recent M.S. graduate **Ian Cole** performed a phytochemical study on *Nypa*, investigating metabolic differences over time. Ian has begun doctoral study at The New York Botanical Garden this fall.

• **Dr. John Dowe**, Montgomery Botanical Research Fellow and Scientist at the Australian Centre for Tropical Freshwater Research studied biogeographic variation in palms, and collected data from *Sabal* populations in Florida, in collaboration with **Dr. Larry Noblick**.

• The *Attalea* collections were recently studied by **Jason Schonmann**, doctoral student at The University of Texas at Austin. Jason is investigating how *Attalea* species are related. UT graduates Lee (Marine Science, 1973) and Patrick (Botany, 1998) were happy to hear about how plant sciences are going in Austin.

• The MBC team also published a study on hurricanes and natural selection in palms. **Dr. Patrick Griffith**, **Dr. Larry Noblick**, **Dr. John Dowe**, **Chad Husby** and **Michael Calonje** authored the work, which appears in a recent issue of *Annals of Botany*. Among the conclusions: Caribbean palms are more tolerant of high winds than other palms.

EXPLORING FOR NEW PALM SPECIES IN BRAZIL

Over a decade has passed since my last palm collecting trip to Brazil. Henderson's *Palms of the Americas* and Harri Lorenzi's Brazilian palm book stimulated new interest in palms among Brazilians. I began receiving tantalizing images of possible new species. I also left behind undescribed new species of my own. Collections in neighboring Paraguay sparked more questions about Brazilian palms.

So when Harri invited me to take a trip with him to explore our questions together, the Montgomery Board gave their approval, and I started making plans.

The June trip was a marathon to see most of the new and existing *Syagrus* and *Butia* species in Brazil. We traveled nearly

5,000 kilometers through the states of São Paulo, Mato Grosso do Sul, Minas Gerais, Goiás, Espírito Santo and Bahia, where I left Harri and continued to Pernambuco.

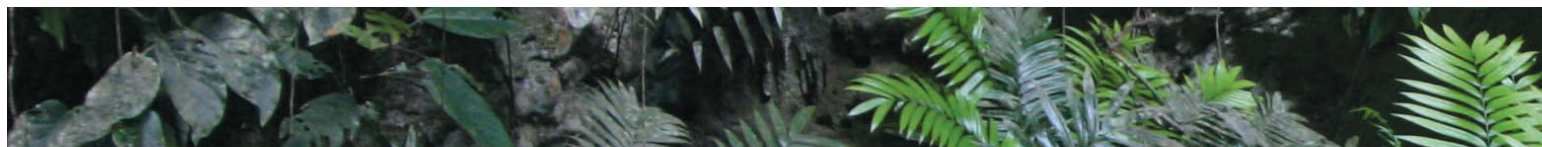
Harri is attempting to detail every species of palm for a new book, and he needs names. We speculate that there may still be seven possible new species of *Syagrus*, three new species of *Butia*, a new species of *Lytocaryum* and some new species of *Geonoma* to be described, plus some name changes. It was one of the most valuable palm trips I have taken to Brazil.



One of several new species of *Syagrus* currently being described.



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MONTGOMERY BOTANICAL COMPLETES SUCCESSFUL CYCAD FIELDWORK IN CHINA

Montgomery Botanical Center cycad biologist, Michael Calonje, traveled extensively in China, developing collaborative relationships with Chinese cycad researchers and students while attending the International Symposium on Cycad Conservation at Zhongkai University of Agriculture and Engineering, Guangzhou, and participating in a study tour organized by Willie and Limei Tang. Michael visited and studied native populations of *Cycas sexseminifera*, *C. ferruginea*, *C. segmentifida*, and *C. debaoensis*.

Because of his GIS expertise, Michael was called upon to assist in a GPS and data-collecting survey of *Cycas debaoensis* at the location of its discovery. Using the data collected, Michael prepared an accurate base map—as part of a cycad conservation

project—to aid the forestry department in managing the population.

During the symposium, Michael presented *Ex situ Cycad Conservation at Montgomery Botanical Center*, detailing the critical role MBC's *ex situ* conservation program plays in preserving cycads. Michael also presented his talk at Shenzhen Fairy Lake Botanical Garden.

Zhongkai University, the IUCN Cycad Specialist Group, the Cycad Society of China, Wutonsan Scenic Spot Administrative Office, and Shenzhen Fairy Lake Botanical Garden sponsored the symposium.

Michael visited the South China Botanical Garden, Dighushan Arboretum, the cycad garden at Qing Xiu Shan Park, and Shenzhen Fairy Lake Botanical Garden.



Cycas ferruginea with rust-colored tomentum on petiole and rachis of new leaves

RESEARCH ON TROPICAL ZAMIA IN COLOMBIA

As a Montgomery Botanical Research Fellow, I continue to work on native *Zamia* populations, as detailed in the Spring 2007 *Montgomery Botanical News*. After completing graduate study, I now teach plant ecology courses at Universidad de Antioquia, Medellín, and I am working on population biology research at Corporación para Investigaciones Biológicas (CIB).

Currently, I am developing a long-term research program for population biology of cycads in Colombia. With the IUCN Cycad Specialist Group, I am working to establish several sites for long-term population monitoring.

This research is also producing a population database of cycads in Colombia, for detailed documentation of species distribution and population conservation status. Our research team is initiating long-term population monitoring sites for two species of *Zamia*: *Z. obliqua*, in the Chocó region; and *Z. aff. muricata*,



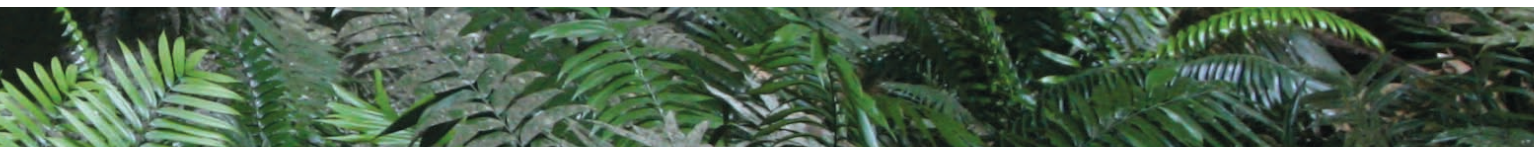
Dr. Cristina Lopez-Gallego conducting research in the Chocó region of Colombia.

in the Magdalena-Medio region.

The main goal of the monitoring program is to generate high-quality, detailed populational data. These data will help us understand conservation threats and develop conservation strategies.

With support from MBC and The Cycad Society, our research team at CIB is exploring the recruitment dynamics (i.e. the establishment of seedling and juveniles) of two populations of *Zamia obliqua* at a site in the Colombia Chocó. We are testing the hypothesis that a few adult individuals contribute disproportionately to the recruitment of the population. Additionally, we are quantifying genetic versus environmental effects on these disproportionate contributions. These initiatives could represent important contributions towards our common aim of advancing cycad conservation.

Cristina Lopez-Gallego, Ph.D.
Montgomery Botanical Research Fellow
Universidad de Antioquia, Medellín



BIODIESEL, PALM CONSERVATION, AND EX SITU COLLECTIONS

The African oil palm, *Elaeis guineensis*, has long been cultivated as a high calorie food source and a component in industrial oils. Its popularity is increasing via newfound interest in sustainable energy, renewable resources, and biodiesel production.

South American palms such as *Elaeis oleifera* and *Attalea speciosa* also produce industrial oil. Montgomery Botanical Center has 17 species and 213 individual oil palms on site. Agricultural plants tend towards loss of genetic variety; intensive breeding can remove useful genetic variation, such as disease resistance, from the population. *Ex situ* conservation collections like the ones housed at Montgomery Botanical Center are a great insurance for the genetic diversity of palms.

There is increasing controversy about biodiesel production and whether it is greenhouse gas positive, negative, or



One of the oldest *Attalea* collections at MBC

neutral. A recent study by Dr. Paul Crutzen and others suggests that biodiesel and fossil fuels may be equally detrimental in this regard.

The necessity of clearing land for planting oil palm is a primary concern for MBC. In many parts of the tropics, rainforests have been cut to plant *Elaeis guineensis*. New legislation encourages production of biodiesel on “degraded land”—but what is considered degraded and how is this enforced?

Increased demand for biofuels places palm and cycad populations at risk. *Ex situ* conservation has proven effective in saving rare plants prior to the destruction of their habitat. Making new additions to our collection is a top priority at MBC, especially with regard to retaining genetic diversity.

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NYPA FRUTICANS AT MONTGOMERY BOTANICAL

Although widespread in Southeast Asia and Indonesia, *Nypa fruticans* is poorly represented in the



Nypa fruticans infructescence

world's botanical gardens due to unique requirements for successful cultivation. Commonly known as the mangrove palm, *Nypa* is not a true mangrove as it is unable to tolerate undiluted sea water, but prefers estuarine habitat with regular

tidal exchange for the dissemination of its buoyant fruit.

The *Nypa* colony at Montgomery Botanical flourishes in a series of interconnected brackish lakes where fresh water springs lower the salinity to an acceptable level. In addition, the palm requires the fine silty mud of the estuarine habitat for its subterranean, dichotomously branched trunk to properly develop.

This primitive palm was once considered intermediate between palms and *Pandanus* because of the unusual form of its inflorescence and fruiting head. Occurring naturally from Sri Lanka to the Caroline Islands and south to Queensland, *Nypa* has been introduced in Nigeria, where it is considered invasive. Besides being used for thatch and fiber by native populations, the palm is tapped for its sugary sap which is used as a confection and fermented to make vinegar and alcohol. This little known palm is likely to become much better known as

large sums of money are being invested in Malaysia to develop refineries for the production of ethanol from *Nypa*. Stud-



Catkin-like male flowers surrounding globose female inflorescence

ies show that as much as 1,530 gallons per acre can be expected, which is twice the yield of sugar cane and six times the yield of corn.

John Harshaw, Assistant Curator
Montgomery Botanical Center

THE PALM WALK: EVOLUTION OF A LANDSCAPE

Our original Master Plan concept of “The Serpentine” as an essential element of the Palm Walk is alive and well, if not yet fully developed according to original plans.

MBC continues design concepts of Col. Montgomery's original landscape architect, William Lyman Phillips, often called the “Pioneer of Tropical Landscape Architecture.” Meandering pathways extend into the collections from the main vista, enticing aficionados and scientists to explore or study the groupings of palms, arranged to display interesting combinations of lines and planes, light and shadow, color and texture—elements Phillips felt were critical.

Although dozens of examples abound throughout the property, a few of the more spectacular ones can serve as a catalyst for more extensive discovery and study.

The northern terminus of the Palm Walk, anchored by the grove of Robert Montgomery's *Roystonea* collection is a relatively simple but elegant arrangement. Nell Montgomery felt that the royals made a good focal point for walking tour groups (as well as an ideal spot for her yoga classes).

Moving southward, populations of *Bismarkia*, *Washingtonia*, *Sabal*, *Hyphaene*, and *Livistona* are brought together to offer contrasts in size, color, texture, and shape, showing wide variation within a fan-leaved theme. Differing growth rates also vary this focal point over the span of years.

The multi-tiered arrangement at the southern end is more complex: low, blue-tinted *Serenoa repens*, backdropped by glossy dark-green *Arenga microcarpa* and all framed by towering *Quercus virginiana* displays distinctive color and texture contrasts.

Future plantings and maturing of existing specimens will enhance the subtle serpentine contours. In the interim the landscape team employs cultural strategies, and varied mowing heights and widths to enhance unified transitions, harmony and freedom of movement while avoiding inconsistency, interference and interruption, and the disruption evoked by such vagaries of design.

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Montgomery Botanical Center's Palm Walk

ADVANCING REAL CONSERVATION

Recent study by Dr. David Aplin raises a critical issue: botanic garden plants often have little conservation value. In one case, 90% of a “conservation collection” had no value. This finding prompts us to examine our own work.

For decades, Montgomery Botanical Center has incorporated a rigorous conservation strategy for plant collections. Recently, we tested our conservation strategy with modern scientific tools. Our findings – presented at the *Botany 2008* conference – show that MBC succeeds in conserving significant diversity.

Your support of MBC enables real conservation, grounded in solid botanical science – effective, efficient, direct conservation, with solid, long-term, tangible success. Please help us continue this vital work by contributing your financial gift. Contact me any time to discuss advancing plant conservation.

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MBC TEAM NEWS



John Harshaw has joined Montgomery Botanical Center as assistant curator, working with MBC's horticulture team. John brings a broad range of experience to MBC including working with many South Florida nurseries, work controlling invasive species, and working with the USGS as a hydro-biologist. He holds a Bachelor's Degree (Botany, University of Miami) and did post-graduate work in microbiology at their Institute of Marine Science.

Jesse Jones joined Montgomery Botanical Center this year as a landscaper with MBC's grounds team. Jesse brings more than 20 years experience with turf grass management in South Florida.

Marino Valcourt has moved into the position of assistant curator of cycads. Marino has been with Montgomery Botanical Center since 2000, starting as irrigation specialist with MBC's facilities team.

Ericka Witcher is now Montgomery Botanical Center's collections supervisor. Ericka joined MBC in 2005 as assistant curator and moved into the position of collections specialist in 2007. Ericka has two Bachelor's Degrees (Ecology and Plant & Microbial Biology, University of California Berkeley). While with the National Park and Forest Service, Ericka gained valuable experience with plant population data collection and GIS mapping.

Tracy Magellan is now working in Funding and Communications. Her Bachelor's Degree (Botany, University of Florida) and Master's (Environmental Science, Yale) provide a solid background in plant research and conservation work. Tracy has conducted field research through the OTS at La Selva, Costa Rica and has a variety of writing, funding, and website experience.

CYCAD REPAIR: CONSERVING RARE COLLECTIONS

All cycads are considered rare, and some species are represented by very few living individuals in botanic garden collections. In such cases, every single plant counts tremendously—so extra intensive care for an individual plant is needed.

The MBC cycad collections come from a wide variety of habitats, and in humid South Florida, trunk rot and root rot at times need to be addressed. Overwatering is a common cause of cycad rot, but excessive fertilizers and herbicides can also be a cause. When a cycad develops crown rot, leaves lose their color, turn brown, and eventually fall off completely. The apex below the cataphylls becomes soft from the rot. This rot can continue to spread throughout the entire plant if not dealt with immediately.

At MBC, the following procedure is used to treat crown rot: (1) The damaged area is removed with a sterile

cutting instrument, until healthy, white tissue is reached. (2) A diluted solution of ZeroTol (fungicide, bactericide, and algicide) is poured over the affected area to completely sterilize the wound. (3) The wound is allowed to dry completely. If rain is forecasted, the plant needs to be covered. (4) Once the wound

is completely dry, we apply insulating foam sealant*, which seals the wound from moisture but allows air circulation.

If the rot can be removed and stopped from spreading, cycads are able to produce offsets below the cut to replace the

damaged stem within six months.

Fungicide and foam treatment is time consuming, but an effective way to heal trunk rot. For rare cycads—whose hope lies in botanic garden collections—specialized care is the order of the day.

*Stella Cuestas, Curator of Cycads
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Cycas taitungensis showing new offsets following treatment. Insulating foam sealant on crown.

*Some experts shape and paint the sealer – see Greg Holzman's excellent articles in The Cycad Newsletter, Vol. 28 and Vol. 30.

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FROM THE MONTGOMERY ARCHIVE

In this 1938 photo, Colonel Robert Montgomery stands in front of the Arthur Montgomery Guesthouse and a *Syagrus romanzoffiana*. Montgomery Botanical Center's commitment to the genus *Syagrus* continues today.

Dr. Larry Noblick, Montgomery Botanical Center's palm biologist, has studied *Syagrus* for over 25 years. He has collected *Syagrus* on MBC expeditions since the early 1990s, primarily from Brazil, Venezuela, and Paraguay. Larry discusses new *Syagrus* discoveries on page 4.

Currently, 17 species of *Syagrus* are represented at Montgomery Botanical Center, totaling over 200 plants.

