Puerto Rico's Biodiversity:

In the Path of Progress

By Alvaro Calonje and Michael Calonje

▲ A majestic pair of *Sabal causiarum*.

◀ The authors find a spot in the sun to write up field notes on a *Zamia* population.

On a warm November afternoon in 1493, the men in Christopher Columbus' second expedition to the Americas became the first Europeans to discover the island of Puerto Rico. When they set foot on the white beaches of the island, they must have beheld a pristine forest inhabited by the native Taino Indians who generously greeted these strange visitors thinking them to be immortal gods. It is ironic that the Tainos showered the Spaniards with gold that, as colonization of the island began fifteen years later, they would be mining as slaves.

Centuries of agriculture and urbanization decimated the original forest cover until by the late 1940s only 6% remained. Agriculture yielded to industry and commerce as the main economic activity, and Puerto Rico gained back about a third of the original forest cover by 1990. However, urban areas began to encroach, and Puerto Rico is once again experiencing rapid forest loss.

One afternoon while visiting Dr. Terrence Walters at Montgomery Botanical Center, he mentioned that MBC had only a small number of Puerto Rican palm and cycad accessions. Because the rampant urbanization in Puerto Rico was resulting in a threat to biodiversity, we agreed that it would be advantageous to sample some of the native palm and cycad flora for MBC's *ex-situ* scientific collection as soon as possible. And so, a few months later, another kind of expedition set out towards Puerto Rico; this one seeking seeds rather than gold and sponsored, not by Spain, but by Montgomery Botanical Center—an expedition to preserve rather than exploit.

After Michael and I arrived in Puerto Rico for the three-week field expedition, we were soon joined by my other son Christopher, Sabra Turnbull from New York Botanical Garden (NYBG), and cycad enthusiasts Irvin McDaniels and Bruce Ironmonger. We met in the town of Coamo in the southern part of the island on the leeward, dry side. It was a perfect Caribbean day, the sky a deep blue and the breeze gentle and balmy.

Our main goal was to sample cycad populations on the island while possibly shedding some light on their confused taxonomy. In our preliminary investigations, we heard mentions of three different cycad species native to the island: *Zamia amblyphyllidia*, *Z. portoricensis* and *Z. pumila*. We were armed with a list of localities to explore that came from various sources, including some compiled by Sabra from the NYBG herbarium. Unfortunately, most of their vouchers were very old, some dating back to the late 1800s. A lot had changed in Puerto Rico since then. We came to the sad realization that most of the once-forested localities on the list were now covered by concrete.

We commenced our expedition seeking out populations of *Z. portoricensis*, an endemic species growing in the limestone soils of western Puerto Rico. Arnaldo Astacio from the Puerto Rico Department of Agriculture assisted us with permitting and served as our guide.

Our first stop was an area by a river where Arnaldo had seen a healthy population of *Z. portoricensis* 10 years ago. When we arrived there were no cycads in sight. After searching for over an hour with no luck, we decided it was a lost cause, and we headed down to the river for a picnic lunch. As we descended towards the river, we were astonished to see there was a single small *Z. portoricensis* plant growing on a sheer cliffside below us. The drop was over 100 feet and there was no way to get closer to the plant; we even got nervous as Bruce carefully leaned over the cliff to photograph it.

What was once a healthy population a decade ago was now represented by a single individual clinging to the side of an inaccessible cliff. With no other plants in the vicinity, its chances of reproducing were greatly diminished. Most likely, this cycad population was devastated by over collecting for commercial nurseries.

Not to be discouraged, we proceeded to visit a population of *Z. portoricensis* near Ponce, at a place we referred to as "The Dump." There were a few plants scattered about the understory of a beautiful dry forest that was situated next to enormous heaps of old couches, rusty cars, refrigerators, and you name it discarded by environmentally unconscious people.

Experiencing first-hand the region's heavy annual rainfall, the expedition team discovers an unusually large and healthy population of *Zamia portoricensis* growing within the protection of Puerto Rico's Susua Commonwealth Forest.

The *Zamia* population was not very dense nor the individuals very old. We suspected this site had fallen victim to some over-collecting as well. It took over two hours to find a single seed, but at least it indicated some pollination was occurring. The few coning plants showed little evidence of seedling regeneration. It had been a dry year so we hoped there were hidden seedlings covered by the abundance of leaf litter.

Nonetheless, we felt energized after seeing our first coning plants as we headed to Guanica International Biosphere Reserve in Puerto Rico's most arid zone. It holds the largest remaining tract of coastal dry forest in the world. We were deeply impressed by its wonderful feeling of austerity and simplicity.

We followed a map drawn by Dennis Stevenson of NYBG to the site to find very large plants but little evidence of seedling regeneration. Ancient herbarium vouchers from NYBG mentioned *Z. portoricensis* and *Z. pumila* occurring in the park, but the park rangers assured us only *Z. portoricensis* occurred there.

For our last search for *Z. portoricensis*, in the Susua Commonwealth Forest, we were joined by Brian Brunner, head of the Master's Program in Horticulture at the University of Puerto Rico.

The forest's ecosystem is similar to that of Guanica but differs substantially in its soil composition and climate. It receives twice as much annual rainfall (1400 mm), and consequently the trees are much taller and leafier. A great deal of the yearly rainfall must have decided to fall that day, soaking us completely through. Fortunately the rain was nicely warm.

We were happy to see that the conservation outlook for this population was much more promising. Before us were hundreds of plants at all stages of coning and very healthy seedling regeneration. We even found evidence of dispersal in small, scattered piles of seeds, often away from any possible mother plants. Many had telltale rodent bite marks on the seed's fleshy layer. We were fortunate to find enough mature seeds at this site to finally obtain a population sample of this species for MBC.

This experience marked the end of our *Z. portoricensis* itinerary, and we headed to a house we had rented in the mountains bordering Maricao State Forest. The deck had an amazing view of a highland forest where *Prestoea montana* palms were dominant. As night crept in, we had a lovely moonlit dinner while listening to the musical chants of coqui frogs.

The next morning, we started our quest to visit populations of *Zamia amblyphyllidia* in Puerto Rico's north coastal limestone hills (mogotes). Our first site was on a mogote marked by a stately *Gaussia attenuata* palm with an understory containing a young population of cycads. The plants exhibited extreme differences in leaflet width and arrangement. Close by, we found a cycad with leaflets so small, it could easily be mistaken for a *Zamia pumila*, the elusive species we never did find during our trip. It left us to wonder if it ever existed on the island, and if reported sightings had been a misidentified species.

For our next adventure, our group was joined by Papo Vives, an enthusiastic Puerto Rican chemist, talented amateur botanist, and expert on the island's flora.

Papo led us to a banana plantation by the Guajataca river where he knew of a *Z. amblyphyllidia* population. They were to be found two miles up and down a hot, dusty road. The effort proved worthwhile, as the population had many large plants with cones at all stages of maturity, including eight female plants with bright red ripe seeds. This was the healthiest cycad population we had seen to date, as well as the most successful collection.

But even this happy find did not prepare us for our next discovery in the moist forest of the Cambalache Natural Reserve. The *Zamia amblyphyllidia* population at Cambalache was the largest population most of us had ever seen, and had to be one of the most dense cycad populations in the world. We could hardly take three steps without running into another plant.

We sampled the population range for hours when a ranger offered to drive us to a site where *Gaussia attenuata* occurred. The Gaussias were interesting-looking palms, much taller than the surrounding canopy, albeit with a very sparse crown, supported by an incredible mass of thick roots tightly wrapped around coral rocks.

But sadly, our visit to the reserve was a case of saving the best for last because this, our most successful collection, marked the end of our trip. Driving back towards San Juan as the mogote and forest panorama changed to buildings and cars, we reflected on what we had seen that weighed heavily against the fate of Puerto Rico's biodiversity. Apart from the decimated and declining populations, we noted a proliferation of invasive species in many of the sites visited. We saw a population of *Sabal causiarum* living its last days surrounded by a golf course. A stately *Coccothrinax barbadensis* palm was bulldozed before our very eyes. How much of what we saw would be there if we returned in ten years' time?

On a more positive note, we were glad to see that many incredible ecosystems were preserved in Puerto Rico's national parks, and several concerned institutions and individuals were making efforts to salvage Puerto Rico's biodiversity for future generations.

Only by understanding the elements of biodiversity can we understand how to save it. We were content that the material we collected would be caringly nurtured at MBC—the germplasm preserved and as the plants grew in a living collection, they would play a role in increasing the understanding of the palms and cycads of Puerto Rico and the rest of the world. ■