LEFT
Sinkhole cycad *(Zamia decumbens)* grows at the bottom of a sinkhole in Belize.

BOTTOM
A team collects DNA samples from a remote stand of Cacheo de Oviedo *(Pseudophoenix ekmanii)* in the Dominican Republic.

STOCKING UP

NEW PROTOCOLS WILL ENSURE THE GENETIC DIVERSITY OF THREATENED TREES.

BY JEFF LINK

In what may be one of the largest tree conservation efforts in recent history, a team of environmental scientists from nine botanic gardens, arboretums, and environmental conservation agencies, as well as international collaborators in the Dominican Republic and Belize, is working to preserve and increase the genetic diversity of the country's living tree collections. Launched in October 2016, the ambitious, three-year project is a form of insurance for endangered species.

"Zoos often have to exchange animals to maintain good genetic diversity across the population. Gardens are just starting to realize they have to manage plant collections in the same way," says Patrick Griffith, the executive director of the Montgomery Botanical Center in Coral Gables, Florida, who is leading the effort. "We want to know what is the right number of plants to grow in botanic gardens if you want to maintain the genetic diversity of these plant populations."

With support from a $439,000 grant from the Institute of Museum and Library Services, researchers are collecting and analyzing DNA samples of endangered or threatened woody plants across a broad phylogenetic spectrum, including oaks, magnolias, palms, cycads, and Hawaiian alula *(Brighamia insignis)*. From Puerto Rican forests where magnolias are routinely poached to eroding Hawaiian cliffsides only accessible by helicopter, a total of 1,600 specimens will be collected in the wild, says Sean Hoban, a conservation biologist at the Morton Arboretum outside Chicago, who is involved in the study. These will be compared with samples from curated living collections to determine the number of species that botanic gardens need to maintain, individually and collectively, to capture the full range of a species's diversity.

Many of the trees being studied, such as the buccaneer palm, are attractive, charismatic species whose ornamental value has contributed to their threatened or endangered status, Griffith says. "Many of these wild plants were dug up and used in landscaping throughout the Caribbean. When you pull these plants out of the wild and grow them in isolated locations, you don't contribute to reproductive populations," he says.

Even popular house plants such as the alula can have high conservation value because they are so genetically similar, often grown through trade cuttings and clones, says Murphy Westwood, the director of Global Tree Conservation and a scientist at the Morton Arboretum, who is involved in the project. That's one of the reasons this research is so vital for tree conservation. Current living collection protocols, lacking scientific rigor, capture only about 40 percent of the genetic diversity found in each species, leaving these populations vulnerable to threats such as climate change, drought, and insect predation.

Westwood says she is particularly excited about plans to develop an online portal, similar to those used by zoos, through which reproductive and geographic data about seeds, leaf cuttings, and pollen exchanged among gardens can be carefully tracked. These plant specimens then can be shared among botanic gardens and grown in captive breeding programs before being reintroduced into the wild. "We need to prioritize plants that aren't backed up and know where there are genetic gaps," Westwood says, "to inform collecting in the future."

MONTGOMERY BOTANICAL CENTER/MICHAEL CALONJE. TOP: MONTGOMERY BOTANICAL CENTER/PATRICK GRIFFITH. BOTTOM