Building living plant collections to support conservation:

A guide for public gardens

The rare Sinkhole Cycad, **Zamia decumbens** *in the wild in Belize*

The foundation of public gardens is built on the amazing diversity of the world's plants, yet today more than 20% of plant species are in danger of extinction.

Your garden has the power to ensure extinction isn't an option by strategically building and using your collection to support conservation of threatened species. In doing so, you contribute to the **Global Strategy for Plant Conservation** and support global efforts to halt the continuing loss of plant diversity.

This guide provides a general blueprint to help you strategically build your collection for conservation.

Define your purpose and scope, and then choose your species wisely.

Many living plant collections at public gardens can *indirectly* support conservation by providing opportunities to advance research, horticulture, and education. Some living plant collections can also *directly* support conservation by providing seeds or plants needed to reintroduce extirpated or declining populations. Building high quality and genetically diverse collections to support reintroduction efforts requires a significant investment in time, expertise, and resources. However, it can be difficult to know where to start, and how to strategically maximize conservation potential while minimizing costs. We recommend identifying a single species with the greatest need where your efforts can make a real difference. Here are some ways to do this:

the rare Key Thatch Palm, **Leucothrinax morrisii** *in the wild in Florida, USA*

- **Focus on threatened species**. Threatened plants have the greatest need for protection. You can quickly identify species globally threatened with extinction in the wild by uploading a list of your collections to BGCI's PlantSearch database. Regional threatened plant lists can be useful, too.
- **Focus on long-lived 'exceptional species'**. 'Exceptional species' cannot be seed banked, so living collections may be their last line of defense against extinction. Living collections of 'exceptional species' can also support needed research on cryopreservation and micropropagation techniques. For more information, visit www.bgci.org/usa/ExceptionalSpecies.
- **Build on your strengths and location**. Select a species that matches your mission, expertise and climate to ensure they will thrive under your care and be available for conservation purposes when needed.
- **Build partnerships**. Partner with researchers, land managers, and other conservation organizations to integrate your collection with broader efforts, and provide an outlet for using your collection to encourage and support research, conservation and education activities in countries where the species occurs.
- **Tell a story**. The plants in your collection are important tools to engage the public on important conservation issues. Species that meet all of the above requirements and have a memorable economic, ecological, or cultural story are always a good choice. For free interpretation resources for threatened plants, check out the Care for the Rare program: www.bgci.org/usa/CareForTheRare

Build your living plant collection thoughtfully.

Once you select a species to conserve, how you create and curate your collection will directly impact the conservation value it can provide. Here are some rules of thumb for building your living collection to maximize its conservation value for restoration and reintroduction:

- **Curate first generation, wild-collected material from well-documented sources**. This is often the most challenging (but necessary) part of establishing a collection for conservation. If you don't know where your plants came from (or if they are many generations removed from the original wild collection) they will be less useful for conservation and research efforts.

Montgomery Botanical Center researchers work with in-country partners from Belize Botanic Gardens to collect seed of threatened cycads like **Zamia decumbens** *for* **ex situ** *conservation and research*

Collaborative research and conservation projects benefit all organizations involved

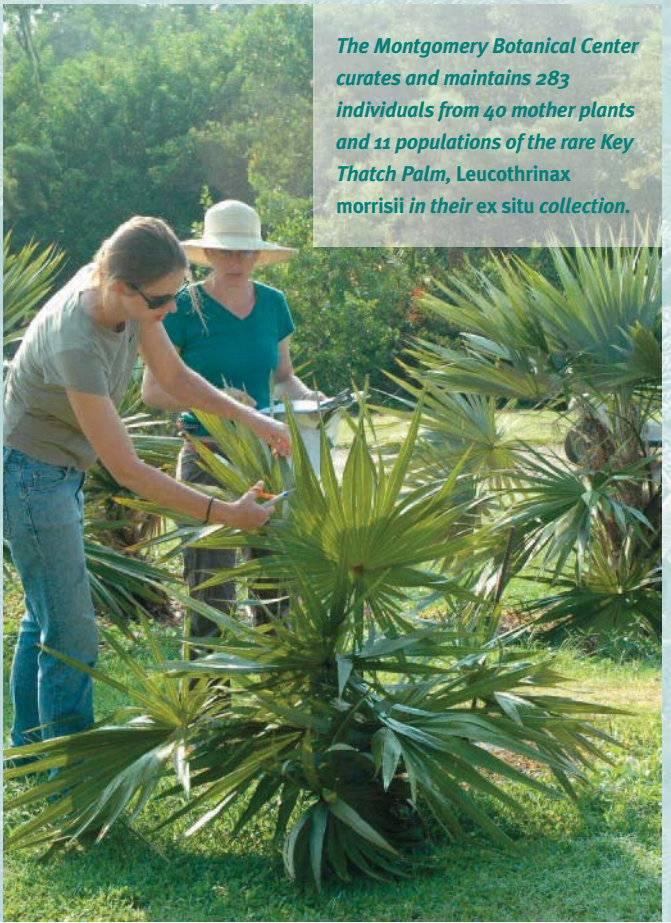
- **Keep good records**. Maintaining the associations between living plants in your collection and information about their wild origins is an ongoing process and vital for conservation. Documenting their biology (including growth rate, habit, phenological events, pests and diseases) can also provide valuable information to guide conservation efforts.

- **Curate genetic diversity**. For most species, the more individuals you curate the greater the genetic diversity you can conserve, and the greater the conservation value of your collection. Curating a genetically diverse collection is relatively easy and affordable for seed bank collections, but much more challenging for living plant collections. This is why it is best for living plant collections to focus on conserving 'exceptional species' that can't be seed banked. Balancing space and cost limitations while maximizing the number of individuals your institution can sustainably curate in its living plant collection is critical.

Why is genetic diversity important?

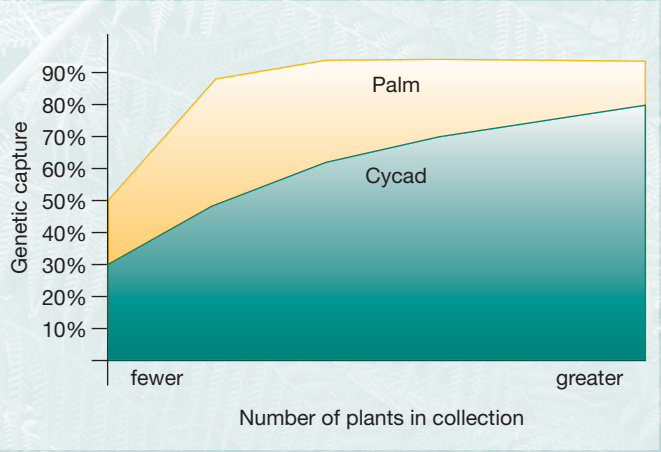
Genetic diversity provides options for species to survive new pressures (like pest and pathogen attacks or environmental disasters) without going extinct. Species with high genetic diversity are more likely to survive these pressures, while too little genetic diversity increases the risk that no individuals will have the right genetic makeup to survive new conditions.

How many plants is 'enough' to conserve genetic diversity?



The Montgomery Botanical Center curates and maintains 283 individuals from 40 mother plants and 11 populations of the rare Key Thatch Palm, Leucothrinax morrisii *in their* ex situ *collection.*

Unfortunately, the answer is different for every species, as illustrated by recent work on palms and cycads at the Montgomery Botanical Center (MBC) in Coral Gables, Florida. For the rare Key Thatch Palm, *Leucothrinax morrisii*, curating 10 plants can conserve as much as 80% of a population's genetic diversity (measured using one type of genetic marker called ISSR). However, for the rare Sinkhole Cycad, *Zamia decumbens*, curating 30 plants only conserves about 35% of the cycad's genetic diversity (measured using microsatellite markers). It may take more than 300 individuals to capture 80% of known genetic diversity for this cycad.



So how do you decide how many plants to curate? Collections representing many mother plants and populations will capture more genetic diversity than collections representing only one mother plant from one population. But knowing exactly how many plants and populations are appropriate is challenging and species-specific. Partnering with researchers and conservation organizations can help to answer these questions for the species you work with (see resources below for additional information).

The Montgomery Botanical Center maintains 364 individuals from 13 mother plants and 3 populations of the rare Sinkhole Cycad, Zamia decumbens *(each tracked individually in their plant records database) to capture genetic diversity for* ex situ *conservation and research*

For additional resources on this topic, including detailed protocols for collecting genetic diversity from wild populations for *ex situ* conservation, visit: www.montgomerybotanical.org/Pages/Collection_Genetics.htm.

Acknowledgements:
This guide has been made possible through a federal grant from the U.S. Institute of Museum and Library Services (IMLS) to the Montgomery Botanical Center (MBC) to support collections stewardship (award number MA-05-12-0336-12). MBC partnered with the USDA Agricultural Research Service Subtropical Horticulture Research Station and Botanic Gardens Conservation International U.S. (BGCI U.S.) to conduct research to assess the genetic diversity of their cycad collections and develop management guidelines for MBC and other living plant collections.

Funders:
IMLS, AZH, Mohamed bin Zayed Species Conservation Fund, SOS, International Palm Society

Partners:
BGCI U.S., Montgomery Botanical Center, Belize Botanic Gardens, Green Hills Botanical Collections, Ya'axché Conservation Trust

Photos:
All photos and images were generously provided by the Montgomery Botanical Center.