



# Fronds and Folioles

News from the Conservatory & Botanical Collection at the College of Biological Sciences



*The number of university collections like ours, which play a key role in collecting and preserving plants, is in sharp decline.*

– Lisa Philander

## Biodiversity on display

The College's new Conservatory & Botanical Collection on the University's campus in St. Paul highlights rare plants from places far from Minnesota.

**W**hen you walk into the Antarctic Forest, one of four biome rooms in the College's new Conservatory & Botanical Collection, the first thing you notice is the smell. The air is filled with an earthy scent that signals a shift from the outside world into a more vegetal realm. Antarctic forest may sound like an oxymoron, but it's a nod to the now-icy continent's distant tree-covered past.

Each room elicits a different response inviting flights of floral fancy and offers a unique lesson. With its soaring glass canopy and abundance of light, the new Conservatory brings new life – literally – to campus with rare plants from around the world.

"The Conservatory is all about bringing the plants of the world to the people of Minnesota, and the new facility delivers on that promise in a big way," says Valery

Forbes, dean of the College of Biological Sciences. "At the heart of this endeavor is a desire to inspire appreciation for plants in people of all ages."

Visitors to the new Conservatory will encounter the direct descendants of the first flowering plants from New Caledonia, an island in the southern Pacific. They will cross paths with caudiciform plants with large succulent bases found living in cliff cracks on the island of Socotra near the Arabian Sea. They'll experience warty pebble-like plants that camouflage themselves into the surrounding rock from the Somali desert in the Horn of Africa.

The new Conservatory highlights floristic regions around the world with high plant biodiversity, including many plants that are rare and even extinct in the wild. It's a repository of genetic information

unlike anything else in the region.

"It's estimated that 20 percent of plant species globally are threatened," says Lisa Philander, the curator of the Conservatory. "At the same time, the number of university collections like ours, which play a key role in collecting and preserving plants, is in sharp decline."

As visitors pass through the entryway into the Conservatory, they might notice a quote: "In the end, we will conserve only what we love; we will love only what we understand; and we will understand only what we have been taught."

For Philander, this speaks to the purpose of the place. "We are guardians of that incredible inheritance," says Philander, "and our mission is to inspire and educate the next generation of conservationists."

– STEPHANIE XENOS

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## CURATOR'S NOTE

### Work in progress

As we welcome the warm weather and begin to watch plants grow, I am regularly reminded of just how lucky me and my staff are to spend our days taking care of this incredible collection. We have a front-row seat to the incredible transformation of the plants as they bloom and thrive in their new setting.

When I am on watering duty, my kids love to help and I love to observe the joy it brings them and how absorbed they are in the flora. For me, being with the plants is an exercise in mindfulness since caring for them requires me to be present to the conditions in the greenhouse.

I've observed great changes over the past few months. In-ground plantings in our four biome rooms are growing vigorously. Some areas are beginning to fill in. At the same time, we continue to add new plants and look forward to a future when we'll be able to share the space with the community.

In the meantime, we are ramping up our virtual presence on Twitter (@cb-conservatory), Facebook and Instagram (cbsconservatory). We also plan to offer virtual tours in coming months. If you are interested in organizing a tour for a group, please get in touch!

I am hoping you all keep well, stay safe, and notice the plants coming to life around you this summer.

**Lisa Philander, Curator**  
CBS Conservatory & Botanical Collection

*Brighamia insignis* is extinct in the wild, but alive and well in the Conservatory's collection. Conservatory staff successfully cultivated the plant and now share its offspring with other academic greenhouses. Learn more at [z.umn.edu/conservatoryconservation](https://z.umn.edu/conservatoryconservation)



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## Four biomes, 1,800+ plant species.

The new Conservatory includes four distinct biomes, which correlate to climates: arid, tropical, subtropical and maritime. The plants in each room showcase the incredible diversity of flora in those regions. "Being able to see, up close and in person, the shape of a leaf or the curl of a flower petal gives you a real appreciation for how plants adapt to their unique environments and of the incredible diversity of flora," says Philander.

Here's a little background on each of the biomes in the new Conservatory:



### ANTARCTIC FOREST

**Climate: Maritime**

Vast forests once spanned a region now known for icebergs and penguins. Antarctic forests still exist in small pockets today in New Zealand, Tasmania and Chile. In these cool, temperate environments, mosses and ferns thrive in the wet conditions. Every available surface in this shaded landscape is covered in a mat of spongy green vegetation. Once part of a supercontinent, similar plants growing in these far-flung locations are biological evidence of continental drift.



### DIVERSE DESERTS

**Climate: Arid**

Desert environments characterized by a lack of water and bright light can be harsh for plants. Yet, these severe conditions also lead to adaptations that allow plants to flourish even in the most challenging environments. Many adaptations evolve independently in multiple plant lineages, something known as convergent evolution. Examples of convergent evolution, including spines and succulence, can be seen in the plants.



### MEDITERRANEAN SCRUBLAND

**Climate: Subtropical**

The Mediterranean region is known for its almost perfect climate. Did you know it's also a type of climate that occurs in spots around the world, including South Africa and southwestern Australia. Mediterranean Scrubland hosts a wide range of endemic plants that grow only in those regions. These climate regions – with their wet winters and dry summers – are hot spots of diversity outside of the tropics.



### ANCIENT RAINFOREST

**Climate: Tropical**

The sudden appearance of flowering plants in the geological record confounded Charles Darwin because it challenged the notion that evolution happened gradually. Before flowering plants, gymnosperms (think pine and fir trees) dominated the landscape. New Caledonia is home to the last remaining tropical rainforests where gymnosperms still reign. It is also home to the sister species of all flowering plants.

# Making connections

Botanical Horticulturalist Angie Koebler loves sharing her passion for plants with people.

Angie Koebler spent more than two decades as lead landscaper for the City of St. Paul. Three years ago, she made the move to the Conservatory & Botanical Collection.

## What do you most enjoy about working at the Conservatory & Botanical Collection?

As a life-long learner, my joy comes from being surrounded by amazing science-minded colleagues, faculty, students and researchers, and to be entrusted to share what I learn with our Conservatory audience. To me, outreach is the most enjoyable part of our mission. We are entrusted to share the wonders of the plant kingdom with a spectacular living showcase of examples.

## What is your favorite biome or plant and why?

My favorite plant currently is a small ball cactus, *Escobaria vivipara*, one of Minnesota's rarest plant species. They only occur within a 2-3 square mile area in the west-central part of the state in the Minnesota River Valley on granite outcrops. I am fortunate to be in a position to help coordinate efforts here at the Conservatory to preserve this unique species in partnership with the University Landscape Arboretum and other organizations.

## What does a typical day look like for you?

A typical morning begins with a walk through to check



Koebler in the Antarctic Forest biome room in the new Conservatory.

on the health of the plants and the working parts of the greenhouse. Every once in a while this may involve a life-saving dose of water, chemical or re-plant. Next, I check on the daily class or lab planting and delivery schedule for several semester courses put in place at the beginning of each semester. A typical day also includes coordinating and assisting with undergraduate and graduate student projects or research, and leading conservatory tours and visits with faculty, lab coordinators, researchers and partners.



## An artist's take

The Catherine and Ford Nicholson Conservatory Commons features an installation of four ceramic tiles depicting each of the Conservatory's four biomes. The tiles were created by award-winning artist-in-residence Ursula Hargens. "These pieces give visitors another way to experience the environments and plants they'll encounter in the Conservatory," says Conservatory Curator Lisa Philander. Learn more about the past and current artists in residence at [cbs.umn.edu/conservatory](https://cbs.umn.edu/conservatory).

A detail from a ceramic tile depicting a plant in the desert biome room in the new Conservatory.

# Gecko magnet

The tiny lizards are drawn to this flower's unusual red nectar, which has yielded new insights into nectar chemistry.

It's unusual to make an abrupt change in the direction of your research as a graduate student, but that's what happened to me several years ago following a visit to the College of Biological Sciences Conservatory.

At the time, I was a YEAR graduate student advised by Dr. Clay Carter and Dr. Adrian Hegeman. Clay and I were on a tour of the Conservatory with a group of middle school students as part of an outreach program we were coordinating. The Conservatory's Botanical Horticulturalist Angie Koebler led the tour.

At one point in the tour, we walked into the maritime cloud forest room. Angie pointed out a flowering species from Mauritius (an island in the Indian ocean) that produces red nectar. I study nectar, so as you can imagine my attention was immediately drawn to this beautiful anomaly. One look and I knew I had to learn more about this unusual plant.

The flower of *Nesocodon mauritianus* is a cool blue bell-shaped flower that at the center produces huge drops of blood-red nectar, which then trickles down the edges of the flower petals. The nectar is consumed by geckos that then presumably pollinate this species in the wild. I remember asking the Conservatory staff whether I could collect the nectar and running back to the lab that same afternoon to start experimenting with it.

Since then, this unusual red nectar has been the focus of my research. Working with Clay and Adrian, our inquiries have revealed fascinating secrets and expanded our understanding of how nectar chemistry works. I'll give you an example of what I mean.

Nectar produced by flowers is usually colorless and clear. Coloration in nectar helps pollinators such as birds and geckos visualize the nectar better. Our research helped identify a novel pigment in the nectar of *Nesocodon mauritianus* and the University of Minnesota now patents its chemical synthesis. Interestingly the nectar starts off yellow in color in the flower and then as the pH of the nectar increases, the nectar turns red. We also identified novel enzymes in the nectar that help catalyze these fascinating color-changing reactions.



*Nesocodon mauritianus* produces blood-red nectar, which attracts geckos that pollinate the plant.

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*“Our inquiries have revealed fascinating secrets and expanded our understanding of how nectar chemistry works.”*

– Rahul Roy

Our research has now inspired us to look into the colorful nectar of more non-model species from around the world, something that I intend to continue as an incoming assistant professor at St. Catherine University starting fall 2020. We hope to be able to access these species in the Conservatory year-round and keep asking questions. Places such as the Conservatory are a critical resource for plant biology research and outreach to the public. Here in Minnesota, we are fortunate to have access to one of the best. – RAHUL ROY



Ford and Catherine Nicholson at Kenya's Lewa Wildlife Conservancy.

## A living legacy

Catherine and Ford Nicholson's passion for preserving plants has taken them around the world. Now, they're bringing it home through support for the new Conservatory.

Catherine and Ford Nicholson have traveled around the world pursuing their passion for nature. Now they are bringing it home through their family's support for the new College of Biological Sciences Conservatory & Botanical Collection.

It's no surprise that Catherine was drawn to plants coming from a family of agronomists, artists, and nature lovers. Her earliest memory is as a toddler, standing beside her father, observing the miracle of the emerging feathery carrot seedlings they had planted. A life-long gardener and environmentalist, this appreciation blossomed into a passion for plants used in our everyday lives and a desire to protect rare and endangered plant species from around the world. In turn, Catherine and Ford have shared this interest with their children by exploring the world's diversity of plants, animals and cultures.

Catherine's involvement in teaching school children about plants, volunteering with garden clubs and participating in conservation activities spans decades. As a past president of the Saint Paul Garden Club, Catherine discovered her affinity for the new Conservatory & Botanical Collection on a visit to the old facility with her club. "It was amazing to open a door and be transported to the chilly cloud forest with blooming orchids and bromeliads and then to open another door and enter the warm, swampy cypress forest."

Catherine and Ford found their passions mirrored in the mission of the Conservatory, "to bring the plants of the world to the people of Minnesota." With a keen understanding of the importance of protecting rare plants and their genetic material, Catherine states "It's important to save all plants because you never know when

“It was amazing to open a door and be transported to the chilly clour forest with blooming orchids and bromeliads and then to open another door and enter the warm, swampy cypress forest.”

- Catherine Nicholson

a particular chemical quality is found in a previously unanalyzed plant will contribute to a new medicine or food.” She points to countries such as Somalia, where political strife threatens rare plants unique to the area, and values the Conservatory & Botanical Collection for its role in protecting this incalculably valuable genetic material while at the same time, teaching Minnesotans of the great value and diversity of plants.

As seasoned travelers, the Nicholson’s have firsthand knowledge from their travels of some of the rare flora in the new Conservatory. Ford celebrates being able to visit the four biomes displayed in the new facility. “In just a few minutes, we can visit the cloud forests of Chile, the deserts of Somalia, the tropical Norfolk Island pines from New Caledonia in the South Pacific and the succulents of the Karoo desert in South Africa.”

With the brand new Conservatory & Botanical Collection set to open it’s doors in 2021, the Nicholson family pledged \$100,000 as the first major gift to the \$2.2 million capital campaign.

“The Conservatory & Botanical Collection is providing an incredibly important resource to our Minnesota community and the world”, says Catherine Nicholson. “It’s something that we, as a family, are thrilled to have the opportunity to support.” – KEEGAN CARDA



Learn more about how you can support the Campaign for the Conservatory & Botanical Collection at [z.umn.edu/newconservatory](https://z.umn.edu/newconservatory)



## BOTANY BRIEF

### Source material

As the impact of COVID-19 is felt around the world, traditional healers have turned to plants with medicinal properties for treatments. For example, the BBC recently reported that *Artemisia afra*\* is the main ingredient in an herbal remedy being marketed in parts of Africa as a cure for the virus. In parts of southern Africa, *Artemisia afra* has long been used to treat cold, cough and flu.

The Conservatory & Botanical Collection has a robust collection of plants from South Africa including *Artemisia afra*. A common garden plant in South Africa, it has silvery aromatic fern-like leaves with trichomes that produce camphor, terpenes and essential oils. Currently a seedling in our Mediterranean biome, our *Artemisia afra* will eventually grow into a three-foot shrub.

There are over 400 *Artemisia* species worldwide and some are well known for specific properties. In 2015, two scientists received the Nobel prize for isolating a compound artemisinin from *Artemisia annua*, which has been used by Traditional Chinese Medicine to treat fever and malaria for thousands of years. The Eurasian species *Artemisia absinthium*, or wormwood, is used to create the famous liquor absinthe, while the semi-arid American species *Artemisia tridentata*, or sagebrush, is used by several Native American groups as a smudge, topically to prevent wound infections and in a tea to treat cough.

Part of our mission at the Conservatory & Botanical Collection is to preserve plant species and provide researchers with access to raw source material for their studies. There’s much left to discover!

\* There are currently no studies on the efficacy of *Artemisia afra* as a treatment for COVID-19 or other illnesses. The above information about traditional uses of varieties of the *Artemisia* plant should in no way be taken as medical advice or relied on in lieu of medical treatment.

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