Winter 2021

Fronds and Folioles

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

Life on the edge

Hitting the road to preserve rare plants close to home.

A hundred acres of granite outcroppings dot the grasslands like ancient horizontal monoliths nestled among 11,000 acres of wetland, remnant prairie and floodplain forest along the Minnesota River just upstream from where it begins its journey to the Mississippi. It's the location of Big Stone National Wildlife Refuge. Surrounded by privately owned land, the refuge is located in western Minnesota near the South Dakota border. It's also home to *Escobaria vivipara*, a small cactus whose native range dips into Minnesota where it occurs as a single population of less than 200 plants.

The diminutive cactus grows west of the Mississippi from southern Canada south to Mexico. In Minnesota – its eastern most range in North America – it lives on thin soils on and around exposed granite on the refuge and on two large private properties nearby. These properties hold the majority of the genetic variability for this species in the state. Unfortunately, these pockets of diversity are threatened due to habitat loss.

In my role as botanical horticulturalist for the College of Biological Sciences Conservatory & Botanical Collection, I work with all types of plants. But, as it turns out, I first learned about this cactus at the Minnesota State Fair.

A summer downpour brought in a surge of people seeking a dry spot, among them a U.S. Fish and Wildlife refuge supervisor who told me about the small Minnesota cactus population and wondered

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CURATOR'S NOTE

Conserving what we love

Our mission at the CBS Conservatory & Botanical Collection is to cultivate plants from around the world as well as inspire, educate and advance research and conservation. Like the University, our mission includes teaching, research and outreach, but also collections and conservation.

Each year, we reach over 4,000 University students. They come from the College of Biological Sciences, other colleges here at the U, and other universities in Minnesota and even Wisconsin. We serve up to 40 classes a year in the sciences, arts and humanities, and continue to add new classes each year.

You will learn more about how we support research in this newsletter. While there have been some restrictions on research due to the pandemic, the Conservatory has been able to assist researchers who are unable to travel to their research sites and we routinely house exemplar plants of past or ongoing research at the University.

Sharing our unique collection is a top priority, which is why we engage in a variety of outreach activities. We introduce hundreds of K-12 students to plants they might otherwise never see and provide them with opportunities to get their hands dirty through on-site tours and off-site with our Botany Bus. We participate in events out in the community such as Art in Bloom at the Minneapolis Institute of Art and even develop exhibitions designed to inspire interest in plants and our relationship with them.

Growing our plant collections is also central to our mission and we are proud to host the largest collection of plant species in the upper Midwest with almost 2,000 plant species and over 200 plant families out of a total of 452 families.

Finally, the focus of this newsletter and the last leaf of our mission represents our commitment to conservation. You'll read about our work on the Hawaiian plant *Brighamia insignis*, which is extinct in the wild, and an endangered cold-hardy Minnesota cactus, both of which demonstrate our commitment to collaborating with other research institutions with the intention of preserving plant genetic diversity. We also recently became members of Botanic Gardens Conservation International, the only institution that links the plant catalogs of greenhouses and botanical gardens worldwide to help gain a better understanding of where targeted efforts need to be made with regards to plant conservation.

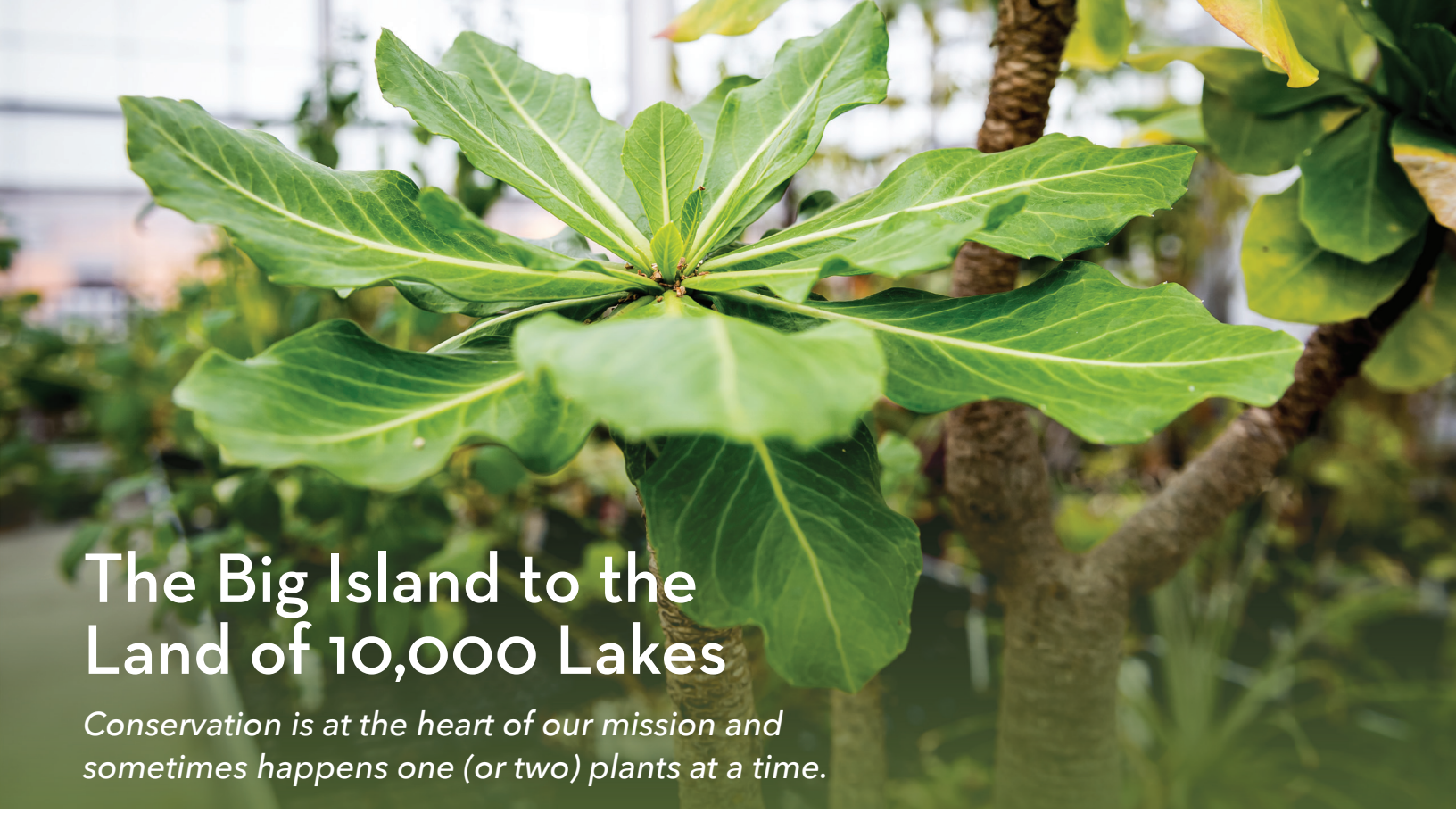
On the wall in the lobby of the new Conservatory is a quote by Senegalese forestry engineer Babab Dioum that speaks eloquently to our mission. At the International Union for Conservation of Nature and Natural Resources in 1968, he said: "In the end we will conserve only what we love; we will love only what we understand; and we will understand only what we have been taught." Just as we hope the Conservatory inspires students and the public to learn more about plants, we hope that this knowledge grows into a passion for their preservation and cultivation.

Lisa Philander, Curator
CBS Conservatory & Botanical Collection

The leaves of the Conservatory logo represent its five-pronged mission, which encompasses research, education, outreach, conservation and collections.

Fronds and Folioles Winter 2021

Fronds and Folioles is published biannually by the Conservatory & Botanical Collection at the University of Minnesota. The University of Minnesota is an equal opportunity educator and employer.



The Big Island to the Land of 10,000 Lakes

Conservation is at the heart of our mission and sometimes happens one (or two) plants at a time.

The Conservatory & Botanical Collections is a storehouse of plant biodiversity. Most of our incredible botanical diversity is used to instruct students and reach out to Minnesotans with living examples of the often-unexpected world of unique and rare plants. We like to say we grow it all from succulents to aquatics, from trees to ground covers, and from benign to toxic. You can find the spectrum of botanical diversity within our collection. However, core to our appreciation of biodiversity is its preservation.

Though we are not positioned to head major conservation efforts ourselves, that doesn't prevent us from being meaningfully involved in preserving the plants we love so much. We are involved with a number of projects that seek to aid in the preservation of threatened and endangered species right here at home in Minnesota and around the world.

Case in point, our work on *Brighamia insignis*. Through a longstanding partnership with the Chicago Botanical Garden and the National Tropical Botanical Gardens, we are helping researchers both preserve and reintroduce this odd and incredible plant back to its original habitat on the Hawaiian island of Kaua'i. Often called "cabbage-on-a-stick" for their clusters of leaves growing on top of chubby stems, this species is one of only two in the genus; the other, also from Hawai'i, *Brighamia rockii,* is critically endangered as well. *B. insignis* is extinct in the wild, which means that the remaining genetic diversity in collections like ours will prove critical to its long-term survival.

The two specimens in our collection were screened for their relatedness and were found to be genetically distinct from each other. This means we are able to provide seed to bolster the reintroduction program on their native island.

This year, we provided pollen from our plants to researchers investigating the species' pollen storage techniques. Understanding how the plants store pollen boosts conservation efforts since it makes it possible to use pollen reserves to propagate plants. Pollen banking can serve as a last ditch effort at maintaining genetic diversity in a species, especially for species where seed storage is challenging. Knowing if it is possible to apply pollen in this way and having the raw material available to do so provide another tool to prevent the loss of this incredible plant.

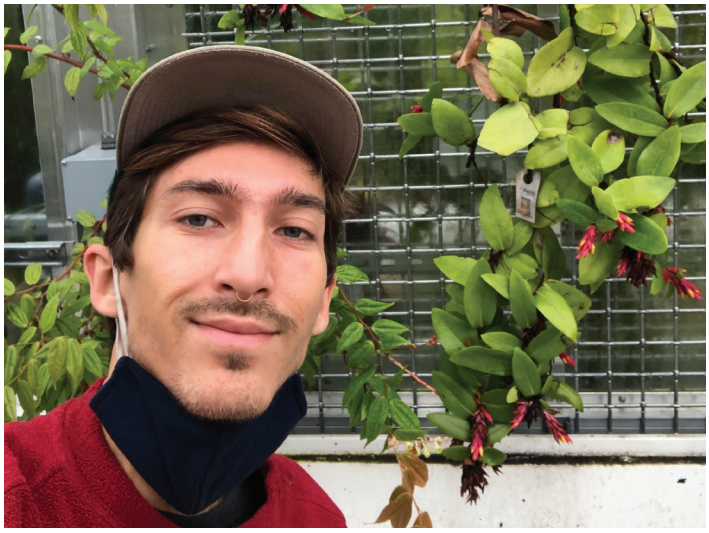
This project has been an incredible learning opportunity for us to discover where we can be useful to researchers across the country as well as right here at the University of Minnesota. We continue to apply what we learned as we connect with other projects where our plants and expertise can assist conservation efforts. As we look to the future of our collection, we continue to seek further opportunities where our plants can fulfill multiple roles as educators, ambassadors, and to support the survival of their own kind, much like our *Brighamia insignis* have already done. – ALEX EILTS

In his role as research associate, Alex Eilts assists in procuring plants for the collection as well as helping determine the conditions the plants need to succeed..

A labor of love

Davis Redmond started working at the Conservatory as an undergraduate and continues to volunteer as a recent graduate.

Although he studied engineering as an undergraduate at the University of Minnesota, Davis Redmond was drawn to the College of Biological Sciences Conservatory & Botanical Collection. Volunteering as a student offered a welcome escape from the stresses of school. Since graduating in 2019, he's continued to volunteer. Redmond shared what led him to the Conservatory and why he keeps coming back.



What do you enjoy the most about working at the Conservatory?

Getting my hands dirty and my feet wet in the warm Conservatory is such a stress reliever for me. It hardly feels like work at all. I love the diversity of plants, the ever-changing display of flowers, the ability to work with plants that are rare or even extinct, and the wonderful people I have met there.

Do you have a favorite plant or biome?

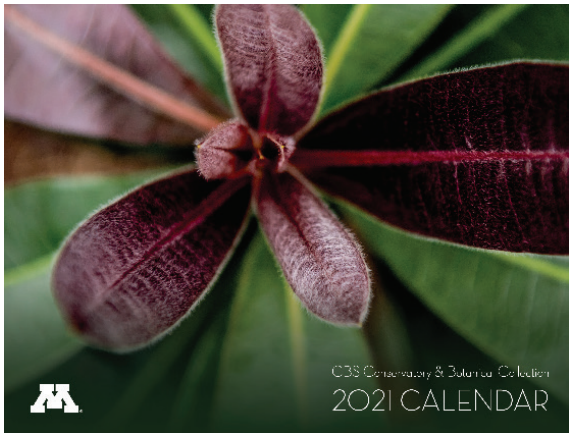
I am partial to the cloud forest collection, and I especially love the epiphytic ericoids (neotropical blueberries). I'm also very keen on some of the ferns and lycophytes in the tropical rainforest room, as well as all of the carnivorous plants throughout the collection.

How did you become interested in working with plants?

I think I've always been interested in plants and horticulture. One of my earliest memories of plants was the large lemon tree that my family had in our house in frigid North Dakota. I took over caring for it when I was about 7 or 8, and since then I have been crazy about working with plants.

Do you have plans to combine your engineering degree and your love of plants?

My degree is in bioproducts and biosystems engineering, but I'm not sure if that's my passion. I would like to either work at a conservatory, in conservation or in habitat restoration. Graduate school will likely be in my future. I hope to keep volunteering with the CBS Conservatory for as long as they'll let me, though!



Enjoy a year of fantastic flora!

Order your 2021 CBS Conservatory & Botanical Collection calendar at **z.umn.edu/conservatory2021**.

FIRST PERSON

A change of plans

When the pandemic halted field work, the CBS Conservatory offered an alternative to catching a plane to Madagascar.

Madagascar is a biodiversity hotspot and, consequently, a high priority for conservation. High rates of endemicity and deforestation are contributing to rapid biodiversity loss, and Madagascar's dry forests are among the most threatened on the island.

During the first two years of my Ph.D. under the supervision of Dr. Jennifer Powers, I studied the vegetation of this ecosystem in Berenty, a forest reserve located in southeastern Madagascar. My primary goal in focusing on these forests is restoration and conservation. Unfortunately, due to travel restrictions related to the pandemic, my research plans changed dramatically. I was not able to travel to Madagascar as planned and many protected areas, including the Berenty Reserve, are closed because of the pandemic.

Like many other graduate students, I had to reimagine my research project. Fortunately, with the help of the CBS Conservatory & Botanical Collection, I was able to access a little piece of Madagascar right here in Minnesota. As it turns out, the Conservatory has some individuals of the plant *Cissus quadrangularis* in its collection. This succulent vine, a member of the grape family, is invading the forests at Berenty Reserve and is a potential threat to the forests in the rest of the island. With the support from the Conservatory, we are multiplying the plant and studying it to learn more about its biology and physiology.

Studying this problematic vine will allow me to formulate a management strategy to stop the spread of this plant in Madagascar, and hopefully continue working for the conservation of the dry forests on the island. I am glad that my research did not come to an end, but above all, I am extremely grateful to everyone at the CBS Conservatory for supporting researchers and students alike during these unprecedented times.

— ARIADNA MONDRAGON BOTERO

Cissus quadrangularis, an invasive vine that grows on trees, is a particular problem in the dry forests of Madagascar.

"Studying this problematic vine will allow me to formulate a management strategy to stop the spread of this plant in Madagascar."

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if there was anyone at the University who would be interested in this endangered plant. This chance encounter was the impetus for a collaboration that will protect the genetic diversity of this rare plant in perpetuity.

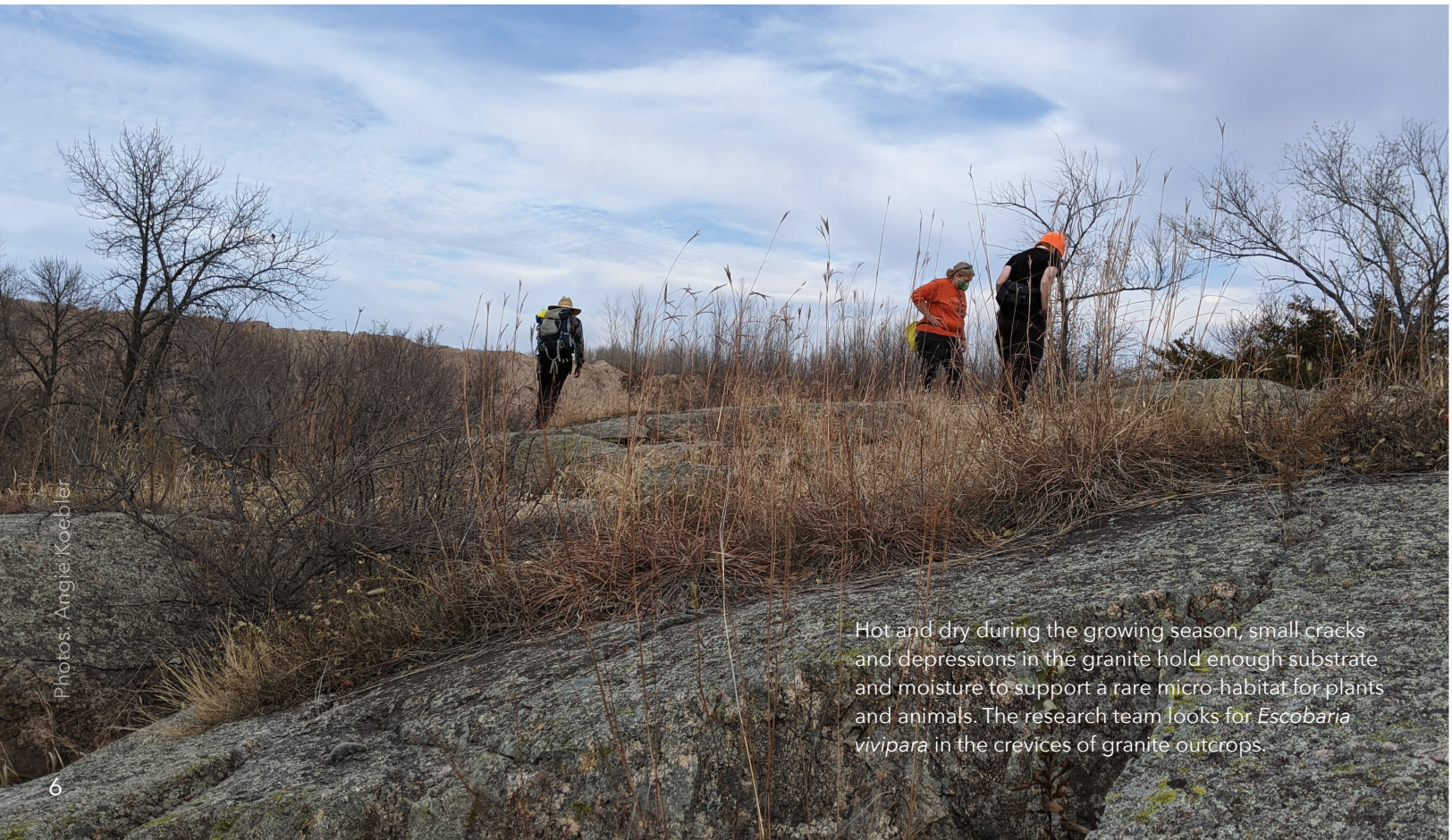
I contacted University of Minnesota's Landscape Arboretum Curator of Endangered Plants Dr. David Remucal, who proposed and secured a Land and Legacy Grant (LCCMR) in collaboration with the Conservatory to ensure the preservation of this edge-of-range population. Late last year, a small team made the drive to Odessa, Minnesota, to collect specimens last fall.

A special permit allowed us to harvest 10 percent of the seed population, which are currently being cataloged and stored at the Arboretum. We will work together to preserve and propagate them with an eye to developing reserve populations of the plant at Big Stone, the Arboretum and Plover Prairie, a Nature Conservancy preserve. In addition, two separate living genetic banks of plant material will be propagated and curated at the Arboretum and the Conservatory & Botanical Collection. Genetic banks serve as a failsafe to ensure protection of the genetic material and provide the source material for future augmentation at the wildlife preserves.

Moving plants to the CBS Conservatory and other protected off-site locations serves an important role in conservation but also in education. Students are able to study *Escobaria vivipara* and other rare and endangered plants and work directly on projects that support real-life conservation horticulture, field biology and research.

The Conservatory is committed to preserving and cultivating knowledge of rare plant species of our region and beyond, and *Escobaria vivipara* is one example of many. – ANGIE KOEBLER

Angie Koebler synchronizes Escobaria *propagation and care at the Conservatory and beyond.*



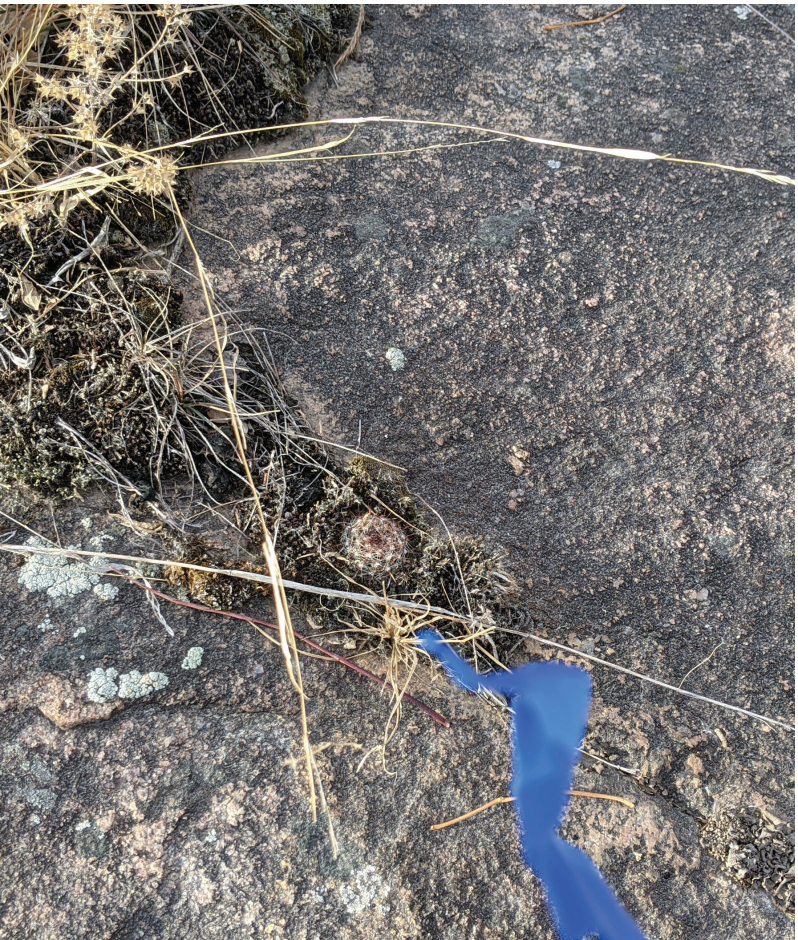
Photos: Angie Koebler

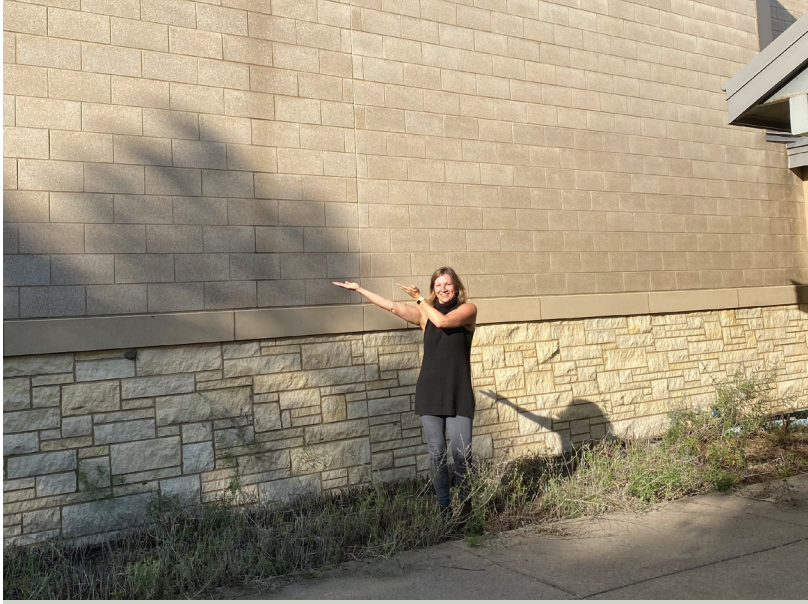
Hot and dry during the growing season, small cracks and depressions in the granite hold enough substrate and moisture to support a rare micro-habitat for plants and animals. The research team looks for *Escobaria vivipara* in the crevices of granite outcrops.

Escobaria vivipara occurs as a single population of less than 200 plants, most on two private properties, in western Minnesota near the South Dakota border.

The bigger picture

There are several varieties of *Escobaria* throughout the United States, all of which are rare and protected by state laws. The species *Escobaria deserti* with humble honey-colored flowers, might be spotted by lucky cactus enthusiasts while hiking through the Mojave Desert below the majestic limestone cliffs. Another pink flowered species, *Escobaria rosea*, is known from only 20 occurrences in California.





An artful take

Jodi Reeb tapped to create a public art piece inspired by the new Conservatory.

The last piece of the new Conservatory is taking shape! Artist Jodi Reeb was awarded a public art commission to create a sculpture to be installed on the north wall outside the CBS Conservatory & Botanical Collection lobby.

The large aluminum sculpture will take the shape of a world map made up of plant cells. The four biomes of the Southern Hemisphere represented in the Conservatory collections will be represented with different metallic patterns. Reeb's inspiration? A lifelong fascination with nature and science, and especially with the patterns that emerge in the organic world.

"My thoughts on making this sculpture are to speak to a relevancy of these times and the evolution of biomorphic forms," says Reeb. "I'm hoping it will speak to visitors at the Conservatory with its pushing-pulling, folding-opening and evolving forms, its parts beginning to take form into something new, connected yet still organic."

Reeb's artwork has been shown nationally. She's received numerous awards and her work is in many private and corporate collections.

The sculpture will be installed later this spring. Follow its progress on the Conservatory's Instagram account (@cbsconservatory)!

You can learn more about Reeb and view her work at www.jodireeb.com.

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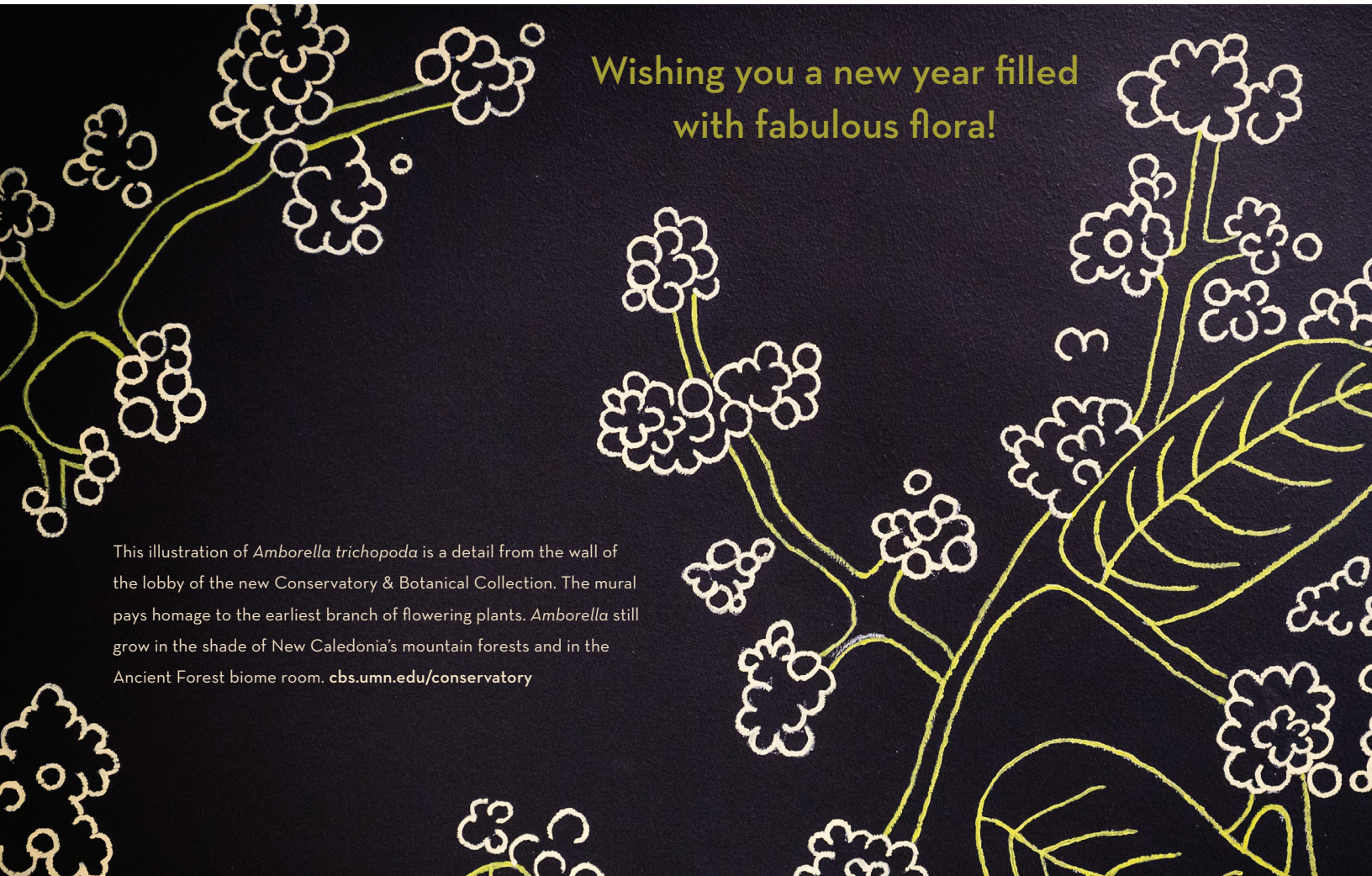

This illustration of *Amborella trichopoda* is a detail from the wall of the lobby of the new Conservatory & Botanical Collection. The mural pays homage to the earliest branch of flowering plants. *Amborella* still grow in the shade of New Caledonia's mountain forests and in the Ancient Forest biome room. **cbs.umn.edu/conservatory**