Quarterly

NORTH AMERICAN ROCK GARDEN SOCIETY

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SPECIAL ISSUE

ALPINE PLANT CONSERVATION

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All illustrations are by the authors of articles unless otherwise stated.

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Front cover: Nanette Kuich looks at *Salix calcicola*, with a colleague from the Colorado Natural Heritage Program; Photo by Emily Griffoul

The Rock Garden

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The Rock Garden

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FROM THE EDITOR

I have wanted to include more information on the conservation of alpine plants and landscapes in the *Quarterly* for quite some time. These beautiful, high-elevation landscapes that we rock gardeners love so much are uniquely vulnerable to threats like climate change, and I think conserving them is a cause that every rock gardener can get behind. So, when Mike Kintgen approached me about doing a special issue on alpine conservation efforts he's involved with, I was delighted to agree.

This special issue details a specific effort towards alpine conservation headed up by a consortium of public gardens in Colorado, but the information that follows will be useful and interesting to rock gardeners in every climate and part of the horticultural world. The articles detail ways that we, individual plant lovers, can contribute to these projects. They also provide a framework that organizations, from other public gardens to local NARGS chapters, can use to start similar projects focused on vulnerable native plant populations in each of our own local landscapes and ecosystems. So many of the things that we gardeners do – from collecting and sharing seeds, to figuring out how to cultivate plants in environments different from what they're used to – can be applied directly to the cause of understanding and preserving our planet's precious biodiversity.

I also have to add that these articles are not just important, they're also a lot of fun, taking us along on the many adventures involved in studying these beautiful plants, with some spectacular photographs of incredible alpine flora.

So thank you, Mike, for collaborating to produce this issue, and I hope we all take from these articles a renewed commitment to understand and preserve precious alpine habitats.

ALPINE PLANT CONSERVATION

Nicola Ripley

I HAVE ALWAYS loved the North American alpine ecosystem, areas above the limit of tree growth, which extends from the northern sea-level tundra of Canada and Alaska, at 11,000 feet (3350 m) and above on the peaks in Colorado and the southern Sierra Nevada, to the southern mountains of Mexico, and west from the coastal volcanic Cascades to the top of Mt. Washington in the east. While many regard these vast ecosystems as largely conserved because they are beyond the reach of man-made disturbance, they are extremely susceptible to change, and climatic change is happening on a global scale.

The alpine plants that inhabit these ecosystems are loved for their beauty but also admired for their toughness and resilience. Who wouldn't be moved by the image of alpine spring beauty (*Claytonia megarhiza*) or dwarf clover (*Trifolium nanum*) clinging to the rocks on top of the Continental Divide. With the expected impacts of climate change on their alpine environment, understanding these remarkable plants and their adaptation to their native habitat has become paramount.

According to a 2019 special report by the United Nations Intergovernmental Panel on Climate Change and Land, anthropogenic warming is projected to shift climate zones poleward and upward into regions of higher elevation.

Opposite: *Penstemon hallii* on Horseshoe Mountain. Photo by Alex Seglias.

Claytonia megarhiza, photo by Gerhard Assenmacher.

The challenges for alpine plants from a warming climate are unique because in many isolated mountain areas upward movement is impossible. Particularly threatened are those plants that are rare and endangered, including those that are highly adapted such as the well-known alpine forget-me-not, *Eritrichium argenteum*. The same reasons that make these types of plants so hard to grow is a clue to their probable inability to adapt to warmer conditions.

Scientific data is also showing that the rate of warming is greater at higher elevations. At two high elevation sites in Colorado, temperatures increased an average of 1.2°C (2.1°F) per decade from 1983 to 2007 (Clow, D.W. 2010). This data is supported in many other scientific studies, some of which are referenced in support of these articles.

To play a role in understanding the risk of a changing climate to alpine plants and to project the impact it may have, we have to thoroughly understand their ecology. To this end, educating the public is a critical role for scientific

organizations like botanical gardens, but also plant societies like the North American Rock Garden Society (NARGS). NARGS does an excellent job of relating the plants that members grow and nurture back to the ecology of their native habitats, fostering an appreciation of the conditions in which the plants thrive and the habitats in which they have evolved and then using that information as a guide to how they might be grown in captivity. This appreciation is building a community of plantspeoples that could play a critical role in the future of these plants.

Botanical gardens in the modern world are also challenged with being more than a refuge from day-to-day life for gardening enthusiasts and now embrace issues such as sustainability awareness, conservation advocacy, and education. In the United States, increased public interest in conserving natural resources provides a much-needed opportunity to raise awareness about the effect climate change is having on alpine ecosystems. With some 140 million visitors annually, botanical gardens in the U.S. and Canada host nearly as many people as all professional sporting events combined. Gardens have an enormous opportunity to advocate on behalf of threatened ecosystems, and a substantial opportunity to influence public opinion in favor of conserving them.

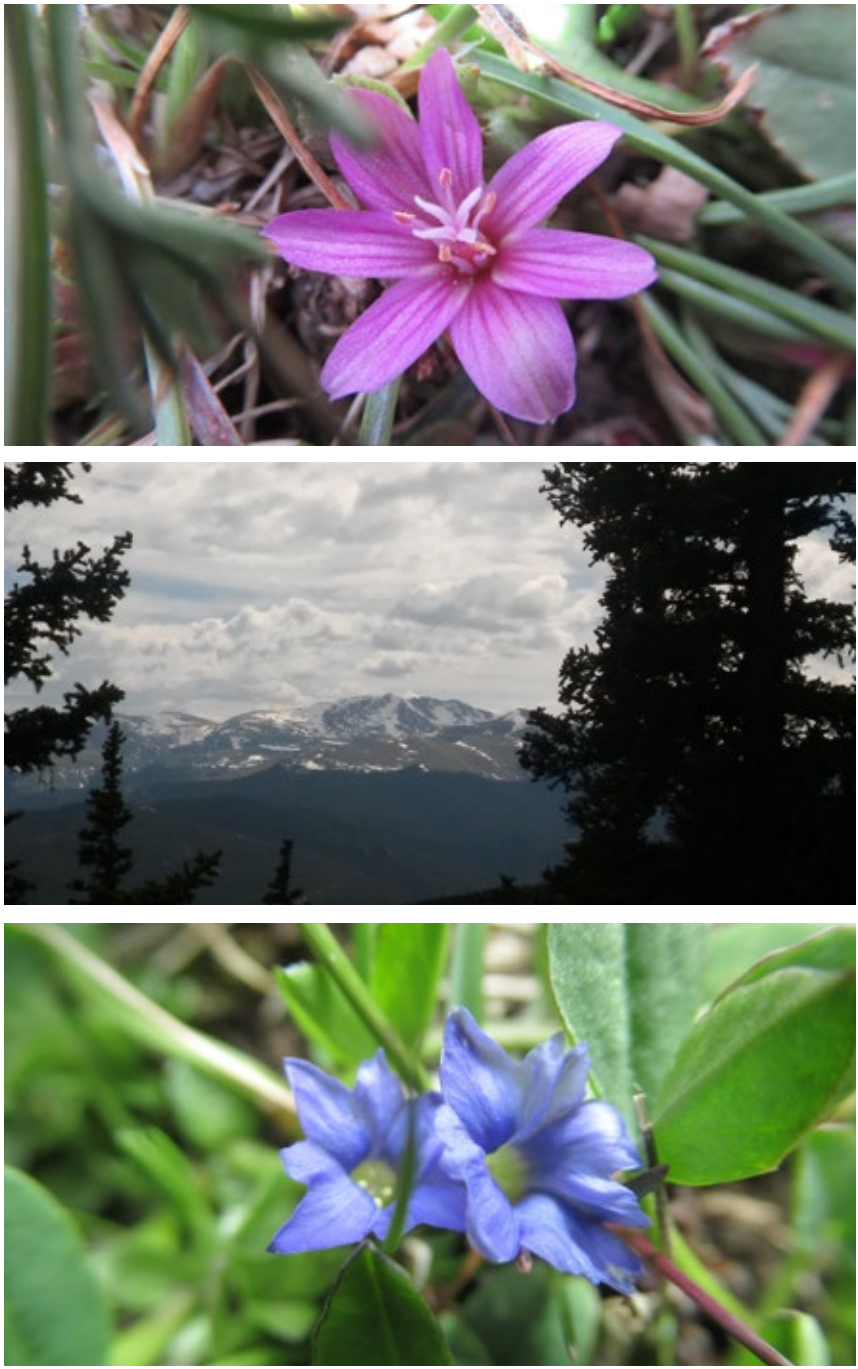
At 8,200 feet (2500 m) in the ski town of Vail in the southern Rocky Mountains, Betty Ford Alpine Gardens (BFAG) is uniquely positioned to take on the role of advocating for the alpine environment and the strategic initiative in these articles will explain and examine that role. In 2010, while building its 30-year foundation on its collection of world alpine species, Betty Ford was accredited with the National Collection of Colorado's alpine flora by the American Public Gardens Association (APGA). With over 200 species represented, this is the only North American botanical garden with a collection devoted to Colorado alpine plants specifically, mainly with wild origins. Facilitated by federal seed collecting permits issued by the United States Forest Service and Bureau of Land Management, we have made the development and understanding of this collection a top priority.

Betty Ford Alpine Gardens, in partnership with Denver Botanic Gardens, has created a framework designed to ensure the future of alpine plants and their habitats. The framework is based on two documents: the 'Global Strategy for Plant Conservation' first adopted by the Conference of the Parties for the Convention on Biological Diversity in 2002; and the North American Botanic Garden Strategy for Alpine Plant Conservation (2006, updated in 2016). From these templates, we created the North American Botanic Garden Strategy for Alpine Plant Conservation in 2020 with a series of four objectives and associated targets to work towards. First, understand and document alpine plant diversity. Second, conserve alpine species and their habitats. Third, promote awareness of the alpine ecosystem and plant diversity through education and outreach. And fourth, build capacity for the conservation of alpine plant species and associated habitats

The articles in this special issue detail the work being done as part of this effort, not only to directly conserve these plants, but to better understand them and to build the network of both professional scientists and amateur enthusiasts advocating for them. We hope that through the course of these articles readers will feel a call to action and find a way to join us in this important work.

The following articles will discuss the work being done toward the targets in the Strategy at Betty Ford in Vail and how we are working towards some of the basic understandings required, such as a complete list of alpine plants of North America; some of the specialized work on the challenges of banking alpine plant seeds being done at Denver Botanic Gardens; the role of alpine plant collections in botanic gardens and the opportunities for educational outreach. The well-known phrase by Barbara Dioum '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' reiterates the value of learning that gardens can provide. Encouraging a global perspective on the importance of this special and fragile environment is a key strategic objective for the twenty-first century (Sarah Chase Shaw, 2021)

Clow D.W. *Changes in the Timing of Snowmelt and Streamflow in Colorado*. A response to recent warming. Journal of Climate. 2010;23:2293-2306



Lewisia pygmaea (top), Mount Evans (middle), and *Gentiana prostrata* (bottom).

Photos by Amy Schneider

PROGRESS ON ALPINE CONSERVATION

at the Betty Ford Alpine Gardens

Emily Griffoul

IT'S BEEN AN exciting and productive couple of years for our alpine conservation efforts here at Betty Ford Alpine Gardens. The recently published Alpine Strategy (officially, the North American Botanic Garden Strategy for Alpine Plant Conservation) has been getting attention from other gardens and organizations interested in participating, and we are looking forward to engaging these partners as we develop the Alpine Strategy Network. I joined the Betty Ford Alpine Gardens team in June 2020 as the gardens' first conservation scientist with the primary purpose of my position to implement the Alpine Strategy. My job is not only to coordinate the project but also to work on our conservation goals in the field.

These past two summer field seasons, we've focused on seed collecting, which is part of our goal to "Conserve 60% of all identified alpine plant species in North America ex-situ by 2030." Ex-situ refers to conservation work that happens off-site, like back in the lab or an herbarium. Seed collecting and banking is an important component of ex-situ conservation

Opposite: Old-Man-of-the-Mountain (*Hymenoxys grandiflora*).

Emily Griffoul collecting seed from Silky Phacelia (*Phacelia sericea*)
Photo: Dominique Taylor

because it allows us to preserve a portion of the species' genetics and to study the germination strategies of these alpine species. Don't miss Alex Seglias' article about the exciting experimental seed banking and propagation work she does later in this issue. Throughout the summer season, we document the alpine plant diversity at each site we visit, using a dichotomous key (our favorites are *Flora of Colorado* by Jennifer Ackerfield and *Alpine Flower Finder, the Key to Rocky Mountain Wildflowers Found Above Treeline* by Janet L. Wingate and Loraine Yeatts) to ensure correct species identification. These records are called floristic inventories and are one way that we can track how species composition changes over time when we revisit these sites in five or ten years.

We also record any population of alpine plants that could support a seed collection and revisit it throughout the season to check how the seeds are developing. Last year, many populations of alpine plants did not produce or aborted seeds due to a couple of dry weeks in the middle of the season; and while this isn't unusual, it can be disappointing. The goal is to collect enough seeds to send to a seed bank for long-term storage, usually about 3,000 seeds, representing genetic diversity from the population, and most

importantly, not impacting the population's reproductive chances. We adhere to the Center for Plant Conservation's Best Plant Conservation Practices to Support Species Survival in the Wild. The seeds we collect are cleaned, counted, and the bulk of each collection is sent to the National Lab for Genetic Resource Preservation in Fort Collins, a world-renowned seed vault and research institution that is part of the USDA (United States Department of Agriculture). A small portion of each collection is kept to be stored here at Betty Ford Alpine Gardens, where it will be used in the Gardens as a living collection, another way to preserve these species ex-situ. And a very small amount of seed was sent to some of our collaborators at other botanical gardens to be grown in their collections as additional backup populations.

Seed cleaning. Photo: Dominique Taylor

Preparing an herbarium specimen of *Primula parryi* in the field.
Photo: Dominique Taylor

We also collect herbarium specimens. These are dried plant samples for study and can include plant materials, seeds, pollen, wood sections, and more. We collect a plant specimen by digging one individual up, taking care to include the root and as many identifiable features as possible. We also record where it was found and other data points. Then we lay it flat in a field press for transport back to the lab, where we use newsprint and blotter paper to help suck out all the moisture in a plant press. The result is a two-dimensional representation of the plant, hopefully with most of its characteristics intact.

The amazing thing about herbarium specimens is that once they are dried, they can last many years. There are herbarium specimens from some of the first expeditions to the Rockies that showcase the first scientifically named specimen of our common alpine species! These herbarium specimens are another way to document plant diversity and distribution, and we often check the herbarium records for any new areas we plan to visit to see what taxa have been found there previously. For any population of plants that we plan to collect seed from, we take an herbarium specimen early in the season when it is flowering rather than when it is in seed, as it can

Papaver radicatum subsp. *kluanense*, the only native poppy in the state of Colorado.

be harder to identify when it's all dried out and crunchy. These herbarium specimens serve as a "voucher" or proof of the species from which seeds were collected, and they are housed at the Kathryn Kalmbach Herbarium at Denver Botanic Gardens (DBG). Our permits through the U.S. Forest Service require us to have a voucher specimen for each seed collection we make, and we also submit a record of everything we collect so that collecting can be monitored.

As part of the objectives laid out in the Alpine Strategy, we aim to document biodiversity in alpine environments, especially in areas of high biological value. These areas are designated as Important Plant Areas, or IPAs: places of exceptional botanical richness or that support an outstanding assemblage of rare and endemic plant species. Here in Colorado, the Colorado Natural Heritage Program has identified about 200 IPAs rated B1: "Outstanding Biodiversity Significance", and B2: "Very High Biodiversity Significance." And around 30 of these highly-

ranked sites are in the alpine. This leads us to our goal to protect 50% of the most important plant areas for alpine plant conservation in North America by 2030. The goal is to not only identify the most significant IPAs, but to also work with land managers to make sure these sites are well protected. In the two field seasons since we began the targeted work on the strategy, our conservation team visited three highly ranked IPAs, including the Mosquito Range which is home to six fourteeners (mountains over 14,000 feet/4200 m) and is ranked B1 because of the concentration of rare and endemic plants. Some of these plants include Penland's eutrema (*Eutrema penlandii*), the only federally listed alpine plant species; sea-pink (*Armeria maritima* subsp. *sibirica*), which is globally common but state-rare and found in only Summit and Park counties in Colorado; globe gilia (*Ipomopsis globularis*), a gorgeous and fragrant plant endemic to the Mosquito Range; shortflower Indian paintbrush (*Castilleja puberula*), a

Left: Globe Gilia (*Ipomopsis globularis*)
Right: Sea-Pink *(Armeria maritima* subsp. *sibirica),*

small, yellow paintbrush species; Colorado sleepy-daisy (*Xanthisma coloradoense*), a purply-pink flower with bristled, toothed leaves; clawless draba (*Draba exunguiculata*), a tiny, yellow-flowered plant in the whitlow grass genus; Weber's saw-wort (*Saussurea weberi*), another highly ranked alpine species with fuzzy, grey-purple buds; and more. At each of these IPAs, we made floristic inventories, as well as a photo library of the plants we observed that will be a learning tool for future interns and volunteers as well as a record of what we saw in the field. We were joined several times by our partners at DBG, who shared their valuable botanical and natural history knowledge.

Our conservation team has also been working on Target Three: "Assess Land Management Designations for All North American Alpine Habitats by 2023". Why do we care about land designation? Natural areas are managed by a variety of people and organizations, and some are much better protected than others from threats to the flora and fauna. Have you ever been to a natural area to find it full of ATV tracks, or with social trails crisscrossing the landscape? A lot of this is due to the kind of land management. We want to find out where alpine areas fall within these protection mosaics to determine if some sites need a higher level of protection. Wilderness areas are places within public lands that are set aside with a higher level of protection to ensure that America's wild lands will not disappear. These protections include regulations such as barring mechanized recreation. Colorado has more than 40 wilderness areas, most of which are within the eleven National Forests in our state. We also have four National Parks, four National Monuments, and two National Historic Sites. The International Union for Conservation of Nature (IUCN) has created criteria to measure the protection level of land designations, with strict nature preserves as the highest, followed by wilderness areas, national parks, and on down the list. We are working with a Regis University graduate student this spring using Geographic Information Systems (GIS) to map these management areas. Stay tuned on our website for updates on this exciting project!

Ranunculus adoneus

This year, the team expanded to include both a conservation scientist and intern, a new position made possible by the generosity of a local family foundation. We surveyed new areas and continued collecting alpine seeds for seed banking and study, as well as working closely with partners at DBG, CNHP, and the Center for Plant Conservation to increase the value of our collections. We are also recruiting other organizations, such as botanic gardens, research organizations, and land managers, to collaborate on achieving the objectives laid out in the Alpine Strategy. These include a professor at California Polytechnic State University who runs a summer research program in the alpine areas of the Sierra Nevada mountains and is going to collect seed from some of the alpine species occurring in both our states. We also participated this year in Project Budburst, a worldwide citizen science initiative to study phenology, or the timing of plant phases. Our goal is to observe these species over the course of the growing season, as well as the same species in different areas, to better understand how climate and environment affect patterns in plant growth and reproduction of our alpine species in a changing world.

If you are interested in alpine ecology, be sure to visit our website this summer to participate in our upcoming EcoFlora Project. This citizen-botany project is powered by iNaturalist and will provide us with valuable information about the distribution of alpine plants while also building a network of engaged citizen-botanists who are excited about the wonderful world of alpine plants. We also have a forthcoming Alpine Wildflower Finder App featuring over 200 beautiful, high-quality images of alpine plants in their habitats captured by a local photographer. Additionally, we have two summer exhibits at the Gardens and Education Center featuring some of the unique and charismatic alpine plants in our collections and our work to conserve them and their habitats: "Celebrate the Alpine," and "Be an Alpine Conservationist!" We are also leading a Native Plant Master Class for Colorado State University Extension program, and we are excited to talk about identifying alpine plants with new people in the beautiful alpine areas here in Colorado. I encourage you to continue reading to discover the work our partners are engaged in to conserve the alpine.

A full version of the Strategy can be found on our website www.bettyfordalpinegardens.org along with other virtual presentations and initiatives in support of our goal to engage people in the alpine environment.

Xanthisma coloradoense Photo: Nicola Ripley

PROGRESS ON ALPINE CONSERVATION

at Denver Botanic Gardens

MIKE KINTGEN and JEN TOEWS

WHAT'S NOT TO LIKE about the alpine? In the Rocky Mountains, alpine vistas showcase snow-speckled peaks above mixed coniferous forests and lush mountain meadows, and rarefied air offers a delightful relief from summer's heat and humidity. Charismatic flora including sky blue alpine forget-me-nots (*Eritrichium argenteum*), blue and white columbines, (*Aquilegia* spp.) pink moss campion (*Silene acaulis*), and a host of yellow composites (*Hymenoxys* spp., *Senecio* spp., *Tonestus* spp.) dot rocky slopes, while adorable pikas call out from boulders before disappearing into their dens and camouflaged ptarmigan munch on willow buds, flowers, and berries.

Far below is the bustling metropolis of Denver. While often thought of as a mountain city, Denver is situated at the base of the Rockies in the western Great Plains. In the heart of the mile-high city, Denver Botanic Gardens, with its extensive living collections at three sites (York Street, Chatfield Farms, and Mt. Goliath), a large alpine collection, herbaria, research and conservation department, and educational outreach, offers visitors a taste

Opposite: Pink moss campion (*Silene acaulis*).

American Pika (*Ochotona princeps*), one of the most charismatic alpine animals.
Photo: Emily Griffoul

of flora they will encounter high up in the Rockies. Founded in 1951, the Gardens has worked with the flora of Colorado including alpine species for decades. In fact, prior to its formal founding, Denver Botanic Gardens and the U.S. Forest Service partnered to preserve the flora, fauna, and ecosystems on a site above 11,540 feet (3517 m) on Mount Goliath, which is located 43 miles (69 km) west of Denver on the Mount Evans Scenic Byway. Today, visitors from around the world stroll the paths, learning about alpine floral diversity and the harsh but fragile life zone these plants call home.

Committed to the conservation of alpine flora, Denver Botanic Gardens partnered with Betty Ford Alpine Gardens in 2018 to build on foundational work done by Betty Ford. Since the publication of the Alpine Strategy in 2021, Denver Botanic Gardens' staff and volunteers have focused on the following two targets as described in objective one of the Alpine Strategy: Understand and document alpine plant diversity.

Target One: Develop a working map of all North American alpine areas. While it seems that a comprehensive map of alpine areas in North America should exist, a usable one has not been found. Rising to the challenge, a volunteer in the Research and Conservation department at Denver Botanic Gardens set out to generate a map delineating all alpine areas of the U.S. and Canada. Work to refine this map is ongoing.

Such a map is crucial to furthering the alpine strategy. First, as the strategy uses IUCN protection designation categories (Ia, Ib, II, III, IV, V, and VI), this map will allow partners to assess the protection level of each alpine area. For example, the map will highlight alpine areas with high levels of protection, such as wilderness areas, national parks, and habitat/species management areas, and those with less protection, including mining districts and ski resorts. Second, the map will include Important Plant Areas (IPAs), which have been designated by organizations such as the Colorado Natural Heritage Program as areas with exceptional botanical richness or that support rare, threatened, and endemic plants. This will allow partners to evaluate progress in our goal of protecting 50 percent of each IPA for alpine plants by 2030. Finally, this map will identify understudied alpine areas and where further botanical surveys are needed to provide more up-to-date species lists as well as habitat assessments.

Delphinium alpestre Photo: Alex Seglias

Target two: Create a list of all known alpine plants of North America. Staff, interns, and volunteers from Betty Ford Alpine Gardens and Denver Botanic Gardens are collaborating to compile a list of North American alpine taxa. This list draws from regional lists created by NARGS member Todd Boland of MUN Botanical Garden (Newfoundland and Labrador), Curtis Björk (western Canada and Alaska), Robert Fowler (Southern Rockies), regional floras including *Flora of Colorado* (Ackerfield, 2015), and various floristic surveys conducted in alpine areas. To date, the list includes around 2,500 taxa.

When complete, this list will be the most comprehensive list of North American alpine plants, enabling partners to meet other targets of the Alpine Strategy, specifically Target Six: Conserve at least 25% of all identified North American alpine flora in-situ; and Target Eight: Conserve at least 60% of all identified North American alpine flora ex-situ. Stored in BG-BASE, a database used by botanic gardens, arboreta, and similar institutions to document their collections, the taxa will be searchable by state/province, global and state conservation statuses, and endemism, which will inform which taxa to prioritize for field and conservation work. Ultimately, this list will be publicly available, allowing other stakeholders to benefit including botanists, land and resource managers, horticulturists, herbaria curators, university professors and students, natural heritage programs, citizen scientists, outdoor recreation groups, and even rock garden enthusiasts! For example, rock gardeners will be able to consult the alpine list to preview special plants they might encounter when visiting a specific area, and if these taxa have state or federal protection or are considered plentiful and secure. The list could also help highlight what noteworthy taxa rock gardeners are cultivating in their own gardens.

Objectives two, three, and four:
In addition to focusing on the above targets, Denver Botanic Gardens continues to contribute to other objectives of the Alpine Strategy. Specific to objective two (conserve alpine plants and their habitats), the Research & Conservation Department at Denver Botanic Gardens has a long history of

plant conservation stretching back more than forty years. In the following article in this issue, Alex Segalis, the seed conservation research associate at the Gardens, outlines ex-situ and in-situ studies she is working on.

Also, while still early in the implementation of the strategy, Denver Botanic Gardens has used its international and national reach to address objective three: promote awareness of the alpine ecosystem and plant diversity through education and engage in outreach; and objective four: build capacity for the conservation of alpine plant species and associated habitats. Following the publication of the Strategy, Denver Botanic Gardens distributed it to other botanic gardens across the U.S. and Canada with notable alpine collections. The Gardens has also shared the strategy with

Ranunculus adoneus blooming on Loveland Pass.
Photo : Alex Seglias

Eritrichium argenteum

Photo courtesy of Betty Ford Alpine Gardens

local and regional forest service personnel. It will take many public gardens, land managers, and concerned members of the public to conduct outreach and build the capacity to conserve and safeguard alpine habitats.

Finally, for objectives three and four which deal with awareness and engaging partners and the public, few methods promote plant conservation like the plants themselves. Living plants are the panda bears and elephants that put a living representation of what is at stake in front of the audience we are hoping to inspire into action. The Gardens' plant collections across three sites show visitors living representatives of the strategy and also allow us to work with alpine plants with different growing conditions. At the heart of the living collection is the Rock Alpine Garden. With over 4,000 plant taxa and covering one acre of Denver Botanic Gardens' 23-acre (9.3-hectare) York Street location, this garden has been inspiring visitors since the early 1980s with the beauty and delicacy of high elevation flora from around the world. As the climate has continued to warm over the past decade, the Gardens have added interpretational signage to educate visitors on why these beautiful plants are in peril. Additional interpretation discusses specific alpine habitats replicated in the gardens and the importance of using microclimates to grow these plants at 5,300 feet (16,150 m) in elevation, where temperatures have reached 105°F (40°C) several times since 2004. Taxa that tolerate Denver's warming climate may offer clues as to which taxa might weather climate change more successfully in-situ.

Finally, rock gardeners have also been inspired by the alpine life zone and its plants. Over the past several centuries, private rock gardens and troughs have brought a taste of alpine into our yards and neighborhoods. These beautiful gardens can educate and inspire our communities of the beauty, diversity, and fragility of alpine ecosystems. Please continue to share your enthusiasm for and knowledge of alpine plants. Also, stay tuned for opportunities to become involved with the Alpine Strategy itself. Specifically, we are looking for help refining state and province lists of alpine taxa. Emily Griffoul's article in this issue has information about upcoming citizen science projects. Let's use our combined knowledge and love of alpine plants to work together to help safeguard these plants and their precious habitats forever.

BANKING ALPINE SEEDS

ALEX SEGLIAS

PLANT BIODIVERSITY IS being lost at an accelerated rate as a result of climate change, habitat degradation, and multiple other factors. To conserve native plant species, many institutions are turning towards ex-situ methods, such as storage in seed banks. Seed banks store seeds at low moisture (3-7% moisture content) and temperature conditions (-20 °C/-4 °F or below), which slow the rate of deterioration and the loss of viability, allowing for the preservation of some seeds for up to hundreds of years. Importantly, seed collections are not established as a replacement for conserving populations in the wild, but rather to serve as a precautionary measure in the case of species extinction or population destruction. If a species or population were to become extinct in the wild, the stored seeds would allow for its reintroduction or restoration.

The most well-known seed bank in the world is likely the Svalbard Global Seed Vault, which was built into a mountainside on an island off the northern coast of Norway in the early 2000s. However, the origin of the modern seed bank begins almost one hundred years earlier in what was then the Soviet Union. Nikolai Vavilov was a Russian botanist and geneticist in the 1920s, a period when many people in eastern Europe were dying of starvation. Vavilov was interested in studying the origin of plant cultivation and crop diversity around the world in the hopes that he could find a solution to crop failures. During his expeditions around the globe, he and his team collected hundreds of thousands of seeds from 64 countries and brought them back to his home base in Leningrad, creating what was then

the largest seed bank in the world. The seed collections became a target in the Siege of Leningrad during World War II. For over two years, a group of scientists preserved and protected the seed collections in the basement of a building as they starved and fell victim to disease. In total, twelve of the scientists died of starvation while protecting the seeds, but the seeds survived. Svalbard and so many other seed banks are direct descendants of the Leningrad seed bank and the scientists who collected and protected those seeds.

Until somewhat recently, most of the research in the world's seed banks had been primarily focused on seed collections and storage longevity of crop species. Alternatively, collections of rare species too often went into frozen storage with little data collected on the viability change of those collections during storage. But a few decades ago, scientists began strategically thinking about using seed banks to conserve rare native plant species in case of extinction or population destruction.

Collecting seed on Horseshoe Mountain, Colorado.

Denver Botanic Gardens has been collecting seeds of rare native Colorado species since the late 1980s when it became one of the first partnering institutions with the Center for Plant Conservation (CPC). Over the past thirty years, partnering institutions with CPC have been making seed collections of rare species across the United States and preserving those seeds in frozen storage. Seeds of some species can survive for hundreds of years in a seed bank with no reported ill effects on germination, growth, or survival. However, many species can't survive for extended periods, or even at all, in a seed bank. The Gardens collect seeds of native Colorado flora to conserve species outside of the wild (ex-situ) and in recent years have made a concerted effort to include alpine species in our seed collections.

However, recent studies from Italy and Australia have shown that alpine species are short-lived in seed banks compared to low elevation species. Through an Institute of Museum and Library Services grant, I used accelerated aging experiments to determine if alpine species in Colorado exhibit this same behavior. Seeds are placed in an airtight box with a lithium chloride solution, which is used to raise the relative humidity of the seeds at a high temperature (113°F/45°C). This process accelerates the loss of viability of the seeds, simulating storage time in a seed bank. Seeds are taken out at regular intervals over the course of 100 days and placed in previously determined germination conditions. I found that four alpine species from Colorado – *Castilleja puberula, Heterotheca pumila, Physaria alpina*, and *Saussurea weberi* – were short-lived in accelerated aging conditions. Although the study found that alpine species from Colorado are short-lived through artificial aging, seeds may survive for years to decades in ex-situ seed bank conditions where temperature and relative humidity are kept low. The standard protocol for seeds stored in ex-situ seed banks is to test the viability every five to ten years. At Denver Botanic Gardens, we test viability of our seed collections every five years. However, given the results of this study, we will amend our protocols to test the viability of stored alpine seeds every three years.

Top: *Saussurea weberi* in habitat.
Bottom: Testing viability of *Saussurea weberi* seed..

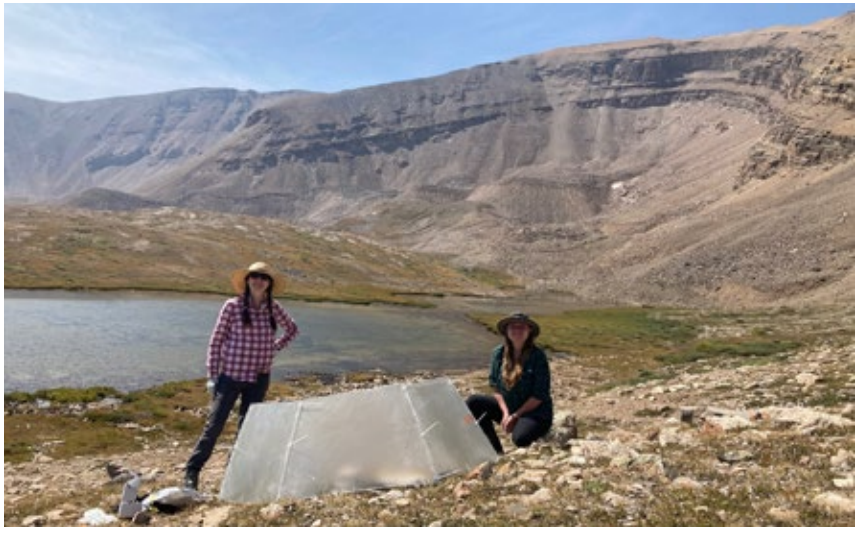
The North American Botanic Garden Strategy for Alpine Plant Conservation has advocated for the conservation of alpine plants and ecosystems, as alpine areas are particularly threatened by climate change. Two targets within the Strategy call for the ex-situ conservation of alpine plants – 60% of all alpine plants and 75% of threatened alpine plants – by 2030. These targets involve important actions towards alpine plant conservation; however, if seeds go into storage with little understanding of longevity, time and resources may be wasted if viability is lost prior to utilizing the seeds. As such, seeds should not be collected haphazardly with no plans for use in the subsequent decade. Seed conservation measures for alpine plants should involve viability testing every three years, grow-outs in greenhouses, and reintroduction and/or recollection of the seeds if a decline in viability is becoming evident.

In thinking about restoring populations of native alpine species using stored seeds, it is important to consider the role of climate change and how the climate may have drastically changed since seed collection. Furthermore, how might a restored population adapt to a continually changing climate?

Physaria alpina on Weston Pass

Through a grant from the Colorado Native Plant Society, I am using open-top chambers to experimentally raise temperatures in the alpine to study the effects of increased temperature on a rare Colorado alpine endemic, *Physaria alpina*. The chambers increase the temperature by about 1.5°C (2.7°F) in a three-foot (0.9 m) diameter area within a population of the study species. Fitness measurements such as height, flower and fruit production, and survival are recorded and compared to plants in control plots without warming. Seeds will also be collected from the plants inside the warming chambers each year to understand how offspring may adjust germination requirements to match changes in temperature. This study will be in place for at least five years and will allow us to understand the impacts of increased temperature on rare alpine plants of Colorado and be better able to prioritize species and populations for in-situ and ex-situ conservation.

Climate change can be daunting to think about, and sometimes it feels like there may not be any hope. But we need to remember that alpine plants are resilient, and various organizations are working toward their conservation so that we don't lose our beloved alpine treasures.



Open-top chambers raise the temperure to study possible effects of a warming climate on the alpine plant *Physaria alpina*.

Eritrichium argenteum

A PERFECT PARTNERSHIP: DENVER BOTANIC, BETTY FORD, GLOBAL GENOME INITIATIVE AND... ICE CREAM

NICK COURTENS and AMY SCHNEIDER

DON'T YOU LOVE it when you have a mountain of work to get done on alpines? Doesn't everybody in the rock garden community feel this way? We love it even more when we work on a project for years, then suddenly and luckily meet people doing the same thing, and a group project is born! Nick Courtens and Colin Lee of Betty Ford Alpine Gardens in Vail, Colorado, had this very experience one cold May morning in 2018 when Amy Schneider from Denver Botanic Gardens showed up, just as they were busy building their new Silk Road garden. It was the first day we all met to start a collaborative gardens project for alpine species documentation. We went on to do field work in the Colorado alpine together and continue making contributions to both the Global Genome Initiative and the North American Botanic Garden Strategy for Alpine Plant Conservation to this day. Little did we realize how our separate projects would start coming together that morning, and how years of collaboration were about to begin.

It all started with the former director of the Denver Botanic Gardens (DBG) Kathryn Kalmbach Herbarium, Dr. Melissa Islam. Melissa first taught Amy how to create alpine plant herbarium collections for species occurrence

Amy Schneider and Colin Lee on Hoosier Pass.

documentation and seed collection on Mount Evans in 2010. Melissa spent time discussing the qualities that make a valuable alpine herbarium specimen with Amy, instilling a philosophy of collecting to create preserved "moments in time." These have been and will be used in the future for research on topics, such as plant phenology, genetics, climate change, and more. Amy collected over the years with different DBG interns, seasonal employees, and volunteers.

Meanwhile, the Betty Ford team had been working in collaboration with the Bureau of Land Management to monitor, collect small amounts of seed from, and propagate wild populations of *Penstemon debilis*. This imperiled species grows in a remote area of the Roan Plateau on steep oil shale cliffs and is under threat from natural gas production and development. Betty Ford has been able to grow several flats of *P. debilis* for their collections and distribute these plants to other regional botanic gardens to conserve this threatened species.

Penstemon debilis growing at Betty Ford Alpine Gardens.

A few years later, all DBG field collectors were expected to make an additional leaf tissue collection for each specimen they vouchered. The preserved leaves would become part of the data collection done for the Global Genome Initiative (GGI). The leaf tissue collections would be used for DNA extraction, available to researchers all over the world. Another branch of the GGI project takes place at various botanic gardens, where curated ex-situ species and leaf tissue are collected. DBG had already begun participating and interns were supervised in collecting for the GGI Gardens Project at the York Street campus.

Melissa talked with Amy about doing this project at another botanic garden in Colorado. Amy decided on Betty Ford Alpine Gardens in Vail, mainly because they have a huge number of curated alpine plants from around the world and Amy adores alpines. Nick gave Amy permission to start collecting from their garden for the GGI Gardens Project, and we have been working together on this project ever since.

GGI Gardens Project

The three of us gather several times throughout each season at Betty Ford Alpine Gardens to collect herbarium vouchers and leaf samples, documenting the curated alpines making up their beautiful garden displays. The leaf sample specimen is taken from each voucher for the GGI Gardens Project. We work with Betty Ford's horticulture interns each summer to practice making scientifically valuable and useful collections and learning how these are preserved for future use by the research community. This hands-on experience for interns also teaches them about the diverse collection of plants that grow at 8,200 feet (2,500 m) above sea level. Interns assist with inventory checks, label needs, plant conditions, and photographs for the plant database and SEINet. Sometimes a label goes missing, and although Nick and Colin know which species it is, they challenge the interns to ID and key the plant out for homework.

Androsace chamaejasme

Hymenoxys grandiflora

Field Days in the Alpine

After working together in the garden at Betty Ford and learning how much fun we have together, we decided to join forces as often as possible. We began to meet a few times each summer to work in the field, exploring our beautiful backyard, the Colorado Rocky Mountains. Our exciting and danger-filled adventures commenced.

There is no doubt that if you asked us what our favorite part of summer is, it would be doing field work. Getting away from the hustle and bustle of Denver or Vail connects us to the reasons we love alpine plants. The time we spend collecting together is almost always the most productive and thought-provoking time, sharing and discussing all things plant or gardening related. Seeing plants grow in-situ helps us to grow them ex-situ, which may help to conserve rare or threatened plants in the future.

We hike together at different field sites throughout the Colorado alpine, botanizing and taking field data on which alpine species we find for future

Asa Gray in the field with *Caltha leptosepala*

seed collection as part of our work with the Alpine Strategy. Typically, we go on at least eight to ten trips throughout the season. In the past few years, the number of successful seed collecting trips was limited due to extreme drought conditions and the difficulties of navigating COVID-19 protocols.

We have learned that friends who don't share this passion may find it to be pretty boring. We hike slowly and stop every ten feet to crawl around on the ground. Nick's puppy, Asa Gray, is also a regular on hikes and is often photographed more than the plants themselves (the guilty party here is Amy).

The extreme conditions can make field work challenging in the alpine. Being prepared with a backpack full of gear such as layers, rain jackets, gloves, Snickers bars, and a big bag of peanut M&Ms is essential for the

intense sun, high winds, and unpredictable weather. We have managed to survive some alarming and crazy weather events such as freak snowstorms, close lightning strikes, and poor air quality from wildfires. There have been times we had to huddle under whatever shelter we can find from willows or rocks and wait it out (rule for bad Colorado weather? Wait 15 minutes). Sometimes we remind each other that we will be okay because humans have been in the alpine for at least the past 7,000 years. After each successful day, we like to celebrate with ice cream or a cold beverage and no one goes home without a smile on their face and maybe some windburn.

The final collaborative efforts each season are our alpine seed collection hikes each autumn. Seed is used for propagation and added to the living collections at the DBG alpine site Mount Goliath and Betty Ford Alpine Gardens. All of this collection information becomes accessible to anyone in the world for years to come. Since 2018, approximately 600 different species have been added to the DBG Kathryn Kalmbach Herbarium and biorepository from this partnership, with all data and imaged collections eventually becoming available through GGI and SEINet. The living collections at Mt. Goliath and Betty Ford Alpine Gardens have become two venerated high-elevation repositories of alpine biodiversity and ex-situ conservation efforts.

Nick Courtens in the field

Flat Tops Wilderness Area in Colorado

ENDEMIC ALPINES
OF THE SOUTHERN ROCKIES

MIKE KINTGEN
with JEN TOEWS

Famed for their ruggedness, spectacular scenery, and world-famous natural features seen at Yellowstone, the Tetons, and Pikes Peak, the Rockies stretch from Canada into northern New Mexico. Along their length, these alpine habitats are full of an astounding array of plants and animals. The Rocky Mountains are broken into four ecoregions, as designated by the Environmental Protection Agency: The Northern Rockies stretch from northern Idaho and Montana into northern Alberta; the Middle Rockies extend from central Idaho and Montana into Wyoming and Utah; and the Southern Rockies encompass the Colorado Rockies, the ranges in northern New Mexico, and several isolated ranges in eastern Utah. A fourth ecoregion includes the high peaks in Arizona and southern New Mexico. While sharing many similarities with the Southern Rockies, this ecoregion is distinct, with unique geology and biology.

Rising as a solid wall of mountains above the Great Plains from Las Vegas, New Mexico to southern Wyoming, the Colorado and New Mexico Rockies are some of the most iconic mountains of western North America. Historically referred to as the Crown of the Continent, the Colorado portion is home to most of the highest peaks in the lower 48 states, with over 50 mountains rising above 14,000 ft (4,300 m). The variety of substrates in the alpine, a wide precipitation gradient ranging from 17 - 80 inches (43 - 203 cm) annually, and a heterogeneous landscape have created diverse niches for many endemic plants.

Thirty-five alpine species are endemic to Colorado alone, one of the highest numbers of alpine endemic plants in North America. An additional 10-20 species are endemic to the Southern Rockies with a range centered within the Colorado Rockies. Finally, several species are endemic in the political borders of New Mexico, Arizona, and Utah but fall either on the border or beyond the Southern Rockies Ecoregion and are outside the scope of this article.

This article explores Southern Rockies endemics that I have sought out, serendipitously stumbled upon, or cultivated during my career at Denver Botanic Gardens.

Charismatic Columbine, Penstemon, Buckwheat, and Paintbrush
It's not surprising that some of the genera most associated with the West have endemic alpine members centered in Colorado.

Aquilegia laramiensis Although not a true alpine, I will begin this list with *A. laramiensis* since it fits in a rock garden nicely. Endemic to the Laramie Mountains of Wyoming, which technically do not reach alpine as the peaks top out at 10,000 feet (3,000 m), this little columbine is found on the summit of Laramie Peak, the highest peak in its native range. It has proven amenable to cultivation and enjoys cool and partially sunny sites in Colorado landscapes with regular watering. Like many columbines, *A. laramiensis* hybridizes in the garden, especially after several generations. It is listed as both a National Forest and Bureau of Land Management (BLM) sensitive species.

Aquilegia laramiensis in cultivation

Aquilegia saximontana is one of Colorado's most charming alpine plants, found from 9,000 to 13,500 feet (2,740 – 4,000 m) with populations concentrated at the tree line. Easily amenable to cultivation, it has been speculated that there might be more plants in cultivation than in the wild where seed predation from mammals severely diminishes seed set. Cultural conditions are similar to *A. laramiensis*. Note that *A. flabellata* var. *pumila* and even hybrids of *A. bertolonii* and *A. pyrenaica* often masquerade in cultivation as *A. saximontana*, which is differentiated by its small pendulous flowers.

Castilleja haydenii: With bright pink or magenta flowers, this plant catches one's attention in its native range of southern Colorado and northern New Mexico. I have tried growing it with no long-term success even in my high elevation garden in north Routt County. It would be a most welcome addition to a rock garden.

Left: *Aquilegia saximontana* Right: *Castilleja haydenii*

Left: *Castilleja puberula* Right: *Eriogonum arcuatum* var. *xanthum*

Castilleja puberula is less show-stopping due to its pale-yellow color, but this species is very interesting viewed from up close due to the lovely dissected hairy bracts. This specialty of the Front Range has scattered locations across southwestern Colorado and some potential populations in Idaho and Montana. It is tracked as a threatened species in Colorado and to my knowledge it has not been cultivated intentionally. It does grow in the constructed rock gardens around the visitor center at Mount Goliath, which is one of the most accessible places to observe it.

Eriogonum arcuatum* var. *xanthum occurs sporadically across the high peaks of Colorado and up into the Park Range of Routt and Jackson counties. This is one of the loveliest eriogonums for rock gardens. It has been cultivated several times, never persisting as long as one would like.

Eriogonum coloradense is found from the steppe up into the alpine, like several of our regional endemics. I have only observed the steppe populations in the Gunnison Basin. Although difficult to source, it has proven to be a very adaptable garden plant in my high elevation garden, and it grew splendidly at Denver Botanic Gardens but was not as long-lived.

Penstemon hallii: The specific epithet commemorates Elihu Hall, an early botanist in Colorado. Its range is centered in southern and central Colorado with some outlying populations in north-central Colorado. Large blue or violet flowers on a compact plant make this one of the best alpine penstemons for troughs. Easy in cultivation, it can be long-lived for a penstemon.

Left: *Eriogonum coloradense* Right: *Penstemon hallii*

Penstemon harbourii is another obligate high elevation dweller; this species is found in scree and frequents some of Colorado's high peaks in the central and southern part of the state. It resembles a blob of blue-violet flowers in its desolate rocky environment. It has proven much more difficult than *P. hallii* in cultivation. Jared Harbour, who this species commemorates, was Elihu Hall's cousin

Penstemon uintahensis is a species that is not found in the political boundaries of Colorado but is endemic to its namesake mountains just across the Utah and Colorado border. Found in spruce-fir forests and up into alpine elevations, this species superficially resembles *P. hallii* and is amenable to cultivation but has acted more like a biennial or very short-lived perennial in Denver and Steamboat Springs. As a note, the Uintah and Wasatch ranges are part of the Middle Rockies, but floristically are a fascinating mix of Southern Rockies flora with northern elements. Utah has a few other unique alpines, but they do not reach Colorado.

North American Endemic Genera with Endemic Species in the Southern Rockies

It is perhaps not surprising, given the somewhat isolated nature of North and South America both geologically and historically, that some genera are only found in North America. *Penstemon, Cymopterus, Besseya* (syn. *Veronica*), *Dieteria, Heuchera, Telesonix, Townsendia*, and *Xanthesmia* are all genera endemic to North America that also have alpine members. Three genera starting with "T" (*Telesonix, Tonestus*, and *Townsendia*) are endemic to the American West.

Besseya alpina (syn. *Veronica besseya*) is both growable and delightful to encounter in the wild. It is one of the first alpine plants to bloom each year. The purple-blue fuzzy spikes mean that winter's grip has come to an end in the highest parts of the Rockies. This species has done best in troughs in Denver, Steamboat Springs, and northern Routt County. This species is shy to bloom in cultivation, it seems.

Besseya ritteriana (syn. *Veronica ritteriana*) is far less showy than *B. alpina*, but its greenish-white spikes are a true plant nerd's dream. This

Top left: *Penstemon harbourii.* Top right: *Penstemon uintahensis.*
Bottom left: *Besseya alpina.* Bottom right: *Besseya ritteriana*

species is centered on the high San Juans of southern and southwestern Colorado, another small area that contains endemic alpine plants. The San Juans are a young mountain range compared to the rest of the Colorado Rockies and are comprised of both sedimentary rocks and widespread volcanic substrates. The endemic flora exploits both the limestone and volcanic areas.

Cymopterus alpinus (syn. *Oreoxis alpina*): This diminutive parsley relative represents an interesting branch of the Apiaceae, a family with a large representation in the Southern Rockies. *C. alpina* is quite common across the alpine tundra in Colorado, but it's often overlooked because of its small size and less charismatic flowers. The flower comes in yellow but paler individuals do exist. It is growable in a trough or crevice garden.

Cymopterus bakeri (syn. *Oreoxis bakeri*) is listed by Ackerfield as being endemic to Colorado, but *Flora of Utah* also claims the species and I have seen something identified as this species in the Cedar Breaks of Utah. There is a sticky mess in the field and herbarium as to which is the true plant.

Cymopterus humilis (syn. *Oreoxis humilis*) is endemic to Pikes Peak and currently is the only true endemic species on this isolated high mountain. This species has been cultivated for at least brief periods in several of my gardens.

Dieteria pattersonii (syn. *Machaeranthera pattersonii*, *Aster pattersonii*) is currently subsumed under *Dieteria bigelovii*, a low to moderate elevation species that is tall and biennial. *Dieteria pattersonii*, however, is a multi-stemmed perennial restricted to central Colorado and possibly northern New Mexico. I have only seen the New Mexico material in herbarium specimens, and it may, in fact, be a different taxon.

Heuchera bracteata, one of two Colorado endemic coral bells, has a sophisticated charm. *H. bracteata* has bright green to yellowish-green flowers which I find very attractive and refreshing in the late spring to summer amidst a rush of other brightly colored wildflowers. A true saxatile plant, it is always found on rocks. In Denver, it is easy to cultivate in the garden in shade and with some regular watering.

Heuchera hallii sports creamy white flowers in looser spikes than *H. bracteata*. This species is endemic to the greater Pikes Peak region often found within the Pikes Peak granite batholith. I have seen it only once in the wild but have grown it since I was a kid. Long-lived and durable, I would never be without it.

Top left*: Cymopterus alpinus* Top right*: Dieteria pattersonii*
Bottom left*: Heuchera bracteata* Bottom right: *Heuchera hallii*

Left: *Tonestus pygmaeus* Right: *Townsendia rothrockii*

Tonestus pygmaeus: The American West is covered by yellow composites and many superficially resemble one another (unless one teases them apart, sometimes literally). This species forms compact mounds and pseudo-cushions in the most exposed locations, which are covered with bright yellow flowers in high summer. It has been cultivated but is never very long-lived.

Telesonix jamesii: I would vote for this as one of Colorado's most charismatic alpines. After *Aquilegia* and *Eritrichium* have been sought out, photographed, and checked off the list, this plant comes to mind as one of Colorado's must-see alpines. Plants with bright magenta flowers growing up vertical cracks on Pikes Peak is a special sight. This genus has another species endemic to the north which grows on limestone, but it does not reach Colorado.

Townsendia rothrockii: Along with *T. leptotes,* this is one of our true alpine Easter daisies. A few other species reach the subalpine, but only these two

make it above treeline. This species is very growable and is one I propagate from seed each year as it is short-lived and has not self-sown at Denver Botanic Gardens.

Xanthismia coloradoensis: Along with the *Townsendia*, *Xanthismia* strives to make sure that not all composites are DYCs (Damn Yellow Composites). Like many asters, this species has had a bit of an identity crisis as of late, with some taxonomists placing it in the genera *Machaeranthera* or *Aster*, but hopefully the nomenclature is settling. With bright pink and pale pink flowers, it does well in a trough or rock garden where its presence, while often brief, is always welcome.

Telesonix jamesii

Genera Endemic to North and South America with Alpine Species Endemic to the Southern Rockies

North and South America were not connected until about three million years ago. Since then, plants and animals unique to each continent have migrated to the other. *Hymenoxys, Ipomopsis*, and *Eriogonum* represent genera that are native only to North and South America, with a concentration in the western and central U.S. and in the Andes and Patagonia.

Hymenoxys brandegeei is related to one of the most photogenic alpines of the Rockies, old man-of-the-mountain (*Hymenoxys grandiflora*). *Hymenoxys brandegeei* has smaller flowers but offsets size by being perennial as opposed to monocarpic. Both species have been cultivated at Denver Botanic Gardens with surprising ease. With *H. brandegeei* one does not have to keep a constant stream of seedlings coming since it is not monocarpic.

Ipomopsis globularis is a member of a genus that does red so well. It is good to know other species within this genus that do white to icy blue just as well. This species is restricted to the central part of the state, with outliers in Idaho, but sometimes those are considered to be something else. Growable in the garden it tends to be biennial, monocarpic, or a short-lived perennial. It is fragrant to some, but others find the scent offensive. It is found in central Colorado on the Mosquito Range and Hoosier Pass.

Cirsium

Recent genetic work on the high elevation thistles of Colorado and neighboring states by Dr. Jennifer Ackerfield, Head Curator of Natural History Collections and Associate Director of Research at Denver Botanic Gardens and the author of *The Flora of Colorado*, has resulted in newly described species and refined distributions of known species. I am highlighting these newly described and resurrected taxa to clarify the confusion previously surrounding this genus (Personal communication with Jennifer Ackerfield, Jan. 4, 2022). Dr. Ackerfield will be publishing more on this work in the future and also updating her findings in the next edition of *The Flora of Colorado*.

Cirsium funkiae is one of the most enigmatic of Colorado's high alpine flora. I almost consider *C. funkiae* akin to an alpine dragon in plant form. Found in screes and rockslides it so far has proven ungrowable at both Denver Botanic Gardens and in my high elevation garden. It is often monocarpic, like so many large alpine plants.

Cirsium scopulorum was included in *C. funkiae* until Jennifer Ackerfield's work demonstrated it was a unique taxon. Found further north in Colorado, it has pinkish flowers and, like *C. funkiae*, has proven difficult to cultivate long-term, only living for a year or two and never flowering. *Cirsium culebraensis*, *C. hesperium*, and *C. griseum* var. *osterhoutii* are also endemic to high elevations of Colorado and Ackerfield's research has clarified the relationship between these taxa.

Left: *Ipomopsis globularis* Right: *Cirsium funkiae*

The Best of the Rest of the Endemics

The following genera have no specific geographic distribution, but rather tend to have members scattered across the temperate regions of the Northern Hemisphere and many are even found in temperate or high elevation areas of the Southern Hemisphere. However, within these genera are taxa that are specific to certain regions or substrates.

Astragalus molybdenus, the Leadville milkvetch, is one I have only seen in the wild, limited to the Leadville limestone and similar substrates. It represents a group of alpines that are endemic to a few limestone areas of the central Colorado Rockies.

Aster alpinus* var. *vierhapperi is a disjunct rather than strict endemic, but it's rare in Colorado and has a fascinating distribution stretching from the Altai in Asia across to Alaska and down through the Canadian Rockies and into Colorado. Outside of Canada and Alaska, it may be most plentiful in Colorado. The distribution pattern stretching from central Asia, jumping the Bering Strait, and hopping down the Canadian Rockies and into the highest peaks of the Rockies is a pattern shared by some of Colorado's rarest alpines, but that is a story for another time.

It is perhaps not surprising that there are no endemic alpine *Carex* in Colorado. In terms of total numbers of species, *Carex* is the largest genus in the Colorado alpine. Those found in the alpine tend to be generalists inhabiting moist habitats or are found in specific high elevation habitats throughout the U.S. Rockies. A quick scan of BONAP (Biota of North America Program) range maps reveals the following species are worth noting. *Carex arapahoensis* is found in Wyoming, Colorado, and southeast Utah. *Carex ebenea* and *C. elynoides* are found in the Rockies from southern Montana to New Mexico and Arizona. *Carex nelsonii* is found in Montana, Wyoming, Colorado, New Mexico, and Utah. It is only common in Utah and Colorado according to BONAP. *Carex nova* is endemic to the Southern and Middle Rockies across six western states. *Carex perglobosa* is about as close to endemic in the Southern Rockies as one can find in a high elevation sedge found between 11,000 and 13,000 feet. It is listed as common in Colorado and two counties in Utah according to BONAP.

Delphinium alpestre: The Himalayas have their exquisite delphiniums, and so do the Southern Rockies. Found from New Mexico into Colorado, this scree-dwelling, cobalt-blue delphinium is growable, at least for short periods. It is one of Colorado's most beautiful but rarely seen alpines.

With six species endemic, the drabas win for having the most Colorado endemic alpine species in a genus. As they are a bit difficult to differentiate (true taxonomic identification relies on hair shapes and patterns on the leaves and stems), I have undoubtedly seen more than I realize.

Draba exunguiculata: I have seen this species along with *D. grayana* but I do not have photos to prove it.

Draba graminea is an adorable little plant endemic to the San Juans. My fingers in the photo give the scale on the individuals we found during the 2021 NARGS conference in Durango. It can make larger mats than the photo shows.

Left: *Delphinium alpestre* Right: *Draba graminea*




Top left: *Paronychia pulvinata* Top right: *Physaria alpina*
Bottom left: *Podistera eastwoodiae* Bottom right: *Polemonium confertum*

Draba smithii is the only white-flowered draba that is endemic to Colorado; it has relatively large flowers, nice grayish leaves and has been grown at both Denver Botanic Gardens and my home garden in a trough. Sadly, it did not persist and sets little seed.

Erigeron pinnatisectus: While not endemic to Colorado, its range is centered squarely in Colorado, extending into the Snowy Range of Wyoming and down into northern New Mexico. It is a superb *Erigeron* for the trough or rock garden. Sadly, it, like our *Aquilegia saximontana*, suffers identify fraud in cultivation, with forms of *Erigeron compositus* masquerading as it. It has pinnate leaves while *E. compositus* has a more palmate-shaped leaf.

Paronychia pulvinata, one of our greatest cushion-forming plants, is endemic in the Southern Rockies. It jumps over into the Uintahs, which are technically part of the Middle Rockies in terms of ecoregions but are spatially closer to the Southern Rockies than the Wind Rivers, Tetons, and Bighorns of Wyoming where it is absent.

Physaria alpina: The Brassicaceae, or mustard family, is high up there for numbers of endemic plants in cold, high places. *Physaria alpina* is one of the most attractive members of a genuinely attractive genus. Bright yellow to almost orange flowers surround a silvery rosette of leaves. It has been cultivated in Denver, Vail, and Steamboat Springs. The genus is found in North America, South America, and far eastern Asia.

Podistera eastwoodiae commemorates Alice Eastwood, a keen botanist working in Colorado at the end of the 19th century. My love of parsleys shows through again. One of the most overlooked plants superficially resembling the *Cymopterus* (syn. *Oreoxis*), it has wider leaves and larger flowers. I have only seen it once or twice in all of my jaunts. To my knowledge, it has not been cultivated. The genus is centered in the American West but, like several genera, a few taxa in *Podistera* skip across the Bering Strait into eastern Asia, most likely due to the land bridge that has formed several times in geologic history.

Polemonium confertum, Colorado's only endemic *Polemonium*, is even more stunning than the more widely spread and beautiful *P. viscosum*. It has larger heads of flowers and inhabits screes and rocky areas, while *P. viscosum* prefers stable tundra. Seed has geminated easily, and we will see how it does as a garden plant.

Primula angustifolia: Highly photogenic, a photo of John Fielder's still burns bright in my mind from childhood of the fairy primrose with *Eritrichium argenteum*, *Trifolium nanum*, and *Claytonia megarhiza*. This *Primula* is distributed squarely in Colorado only leaving the state to follow the Sangre de Cristo Range into New Mexico. The holy trinity of *Eritrichium*, *Trifolium*, and *Claytonia* can be found up into Montana, sometimes still cohabitating.

Ranunculus macauleyi: Most high mountain ranges have their buttercups. Botanists slice and dice them into various genera periodically but in the end, the gestalt is the same: waxy, shiny yellow, white, or pale pink flowers. This species is centered in Colorado and northern New Mexico in the San Juans and a bit beyond. Fuzzy black hairs on the reverse of the flowers set this species apart from Colorado's other two large yellow-flowered alpine buttercups. *Ranunculus macauleyi* tends to hang out around melting snowbanks and would be as tricky as *Ranunculus adoneus* in cultivation.

Senecio soldanella: I must admit I have a thing for yellow composites as well as parsleys. While there is a seemingly endless array of DYCs in the Rockies, very few are endemic to alpine elevations of the Southern Rockies. This exquisite dweller of screes has large purplish leaves and bright yellow sun-shaped flowers. It has been cultivated by a handful of the most devoted, but rarely for long.

Senecio taraxacoides: Another high elevation scree dweller, do not let the specific epithet turn you off. It is super cute and super challenging to cultivate. *Senecio taraxacoides* cohabitates with *Penstemon harbourii* and *Senecio soldanella* on some of our highest and most scenic screes.

Ranunculus macauleyi (top)*, Senecio soldanella* (bottom)

Packera porteri: *Packera* and *Senecio* were once lumped together, but now the *Packera* have their own genus. This is another high elevation scree dweller from the Elk Mountains of Gunnison County and down into the San Juans. I have seen it only once near Crested Butte. It is lovely, like all scree plants. I doubt more than a few people, if any, have tried to tame it in cultivation.

Eutrema penlandii: The genus *Eutrema* is found from Mexico across the high latitudes of North America and Eurasia. Colorado has one endemic species that is specific to high elevation fens. Cold, wet, and alkaline is what it wants. Seed germinates and plants have been grown on at DBG but, to my knowledge, we have never gotten it to flower in cultivation. The entire plant is not much larger than my fingernail. One can find it in it habitat by accompanying the botanists who monitor it or perhaps you could be looking down while momentarily pausing in its sedge-rich environment.

Clovers that Excite

Johan Nilson of Göteborg Botanic Gardens, after touring through Colorado alpine areas, considered our clovers some of our most interesting plants. I would agree with him.

Trifolium attenuatum, the paler pink of the two endemic clovers, is centered in southern Colorado. You will find it on the Spanish Peaks, the Sangre de Cristos, and in the San Juans. It has proven to be growable in my Steamboat garden.

Trifolium brandegeei: Deep pink, almost blood-red, flowers make this a stunner in the wild. The flowers are in short racemes, so it looks different from the other species which have more of a globose cluster. It has not been widely cultivated to my knowledge. My only attempt was fruitless, but I am willing to try again.

Everyone has a list or lists; I keep a list of Colorado alpine plants I have not seen or grown. Each year this list grows a bit shorter. Hopefully, in 2022, I will be able to find one or more of the following: *Alicelia sedifolia, Cirsium culebraensis, Cirsium griseum* var. *osterhoutii, Draba grayana*

Trifolium attenuatum (left), and *Trifolium brandegeei* (right)

(confirm with a photo)*, Draba malpighiaceae, Luzula subcapitata, Physaria scrotiformis,* and *Ptilagrostis porteri.*

This sizable article, for the first time, attempts to pull all the Southern Rockies endemic alpines together. This list highlights the biological importance of the Southern Rockies and the importance of the continued work towards the conservation of these special plants and areas. The West is a region whose population continues to grow at an alarming rate, gobbling up resources such as land and water. Such an increase in population has placed increasing stress on alpine areas in terms of the ever-increasing number of visitors to alpine areas and their impacts, which can trample these delicate areas. Combined with climate change this creates an uncertain future for these lovely gems.

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WHERE WILL YOU be June 14th to 16th of 2022? We hope you answered in Ithaca, New York, attending the NARGS Annual General Meeting.

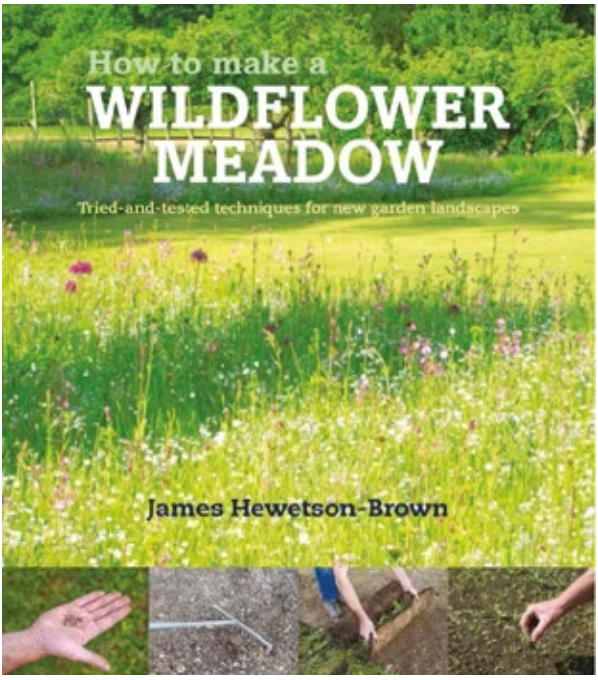
The Adirondack Chapter, along with its co-sponsor Cornell Botanic Gardens, is planning a rich three-day experience filled with the opportunities to visit gardens and natural areas, to hear knowledgeable speakers, to reconnect with friends, and to buy plants from choice nurseries. We hope you'll be more than pleased with our program line-up designed to stimulate you to cultivate your own alpine vision through exploration and inspiration.

More information: https://www.nargs.org/news/2022-02-03/nargs-alpine-visions-ithaca-ny-registration-open

Top: Views from Pagoda Hill owned by Michael Brennan and Bob Moss
Bottom: The gardens of Dianne and Dan Bordoni

Bookshelf

How to Make a Wildflower Meadow



How to Make a Wildflower Meadow
James Hewetson-Brown
Filbert Press, May, 2022

Naturalistic, romantic, wildflower meadow gardens are having a moment in our collective gardening consciousness, and this book is a good beginner's guide to some of the techniques and realities of creating this type of garden.

The book is divided into three sections. First, the introduction delves into why one might want to plant meadows and their history in the United Kingdom. The "why" section emphasizes both the ecological and aesthetic benefits of this style of gardening and starts out by setting expectations: wildflower meadows are still gardens and require work and planning to execute effectively.

The history section was interesting to me because the history of this type of gardening is very different in the U.K. than it is in North America. Here, our inspiration for naturalistic, meadow-style gardens are prairies which were maintained by grazing bison and regular fire. In the U.K., the source inspiration is old hayfields, which, over years of cutting, develop rich populations of beautiful wildflowers. That model of a hayfield managed by

humans may be easier to translate to more home gardeners than a vision of a North American prairie.

Part two is practicalities, and walks the reader through every detail of planning, designing, creating, and maintaining a meadow. I appreciate the level of detail and the emphasis on realistic exceptations as to the amount of planning, work, and time required to make a successful meadow garden. In the maintenance section, the differences between the U.K. and North America are notable. There is no mention of using controlled burns to clear the meadow annually, and instead is focused on annually cutting and removing the cut grass, as was done on traditional hay meadows. That difference of technique may serve as a useful inspiration for American meadow gardens, particularly for sites where the traditional controlled burn may not be practical. Specific plants mentioned are also quite different from what will be suitable for most North American meadow gardens, but the emphasis is on types of plants (perennials versus annuals) rather than on specific species, so it is easy to translate the principles discussed to a North American plant palette.

Part three is a series of eleven case studies, which combine beautiful, envy-inducing photos with detailed information on how each meadow was created and is maintained. Refreshingly, these case studies don't shy away from mentioning some of the difficulties and problems encountered along the way. The meadows featured range from small DIY projects, to large plantings in public spaces, to meadow green roofs. Every plant lover will find inspiration here that they can use in their own garden space.

This book is beautiful, inspiring, thoughtful, and thorough. While not every single detail translates perfectly to a North American garden, it is an excellent addition to the library of anyone interested in this style of gardening.

Joseph Tychonievich

NORTH AMERICAN ROCK GARDEN SOCIETY

Bulletin Board

spring 2022

volume 80 | 2

President's Message

There's a certain Slant of light,
Winter Afternoons –
That oppresses, like the Heft
Of Cathedral Tunes –…
Emily Dickinson

Who hasn't been intrigued by the beams that Dickinson describes so well—teeming with dancing dust motes on a warmish winter's day? For gardeners, however, we tend not to be oppressed (unless the plants or seed we ordered are sold out!)—rather we are constantly elated by our garden visions. The epiphanies of a garden—those magic moments that seem to be captured almost like a snow globe—fuel our passion. Who hasn't looked out on their garden in that certain slant of light, with the bold outline of dwarf conifers, the tracery of branches and below the snowdrops and crocuses glowing in the back light. These are moments we live for.

Often, it's an epiphany like this that can even alter our life path. I was a graduate student of Chinese at Cornell University one year in the mid-seventies. In the course of that year I gradually realized my linguistic skills weren't really up to the challenge. There would always be over a billion people more competent in Chinese than me—but Cornell proffered so much more. The gorgeous campus and the "Cornell Plantations" (now the Botanic Garden) were increasingly irresistible distractions. The Bailey Hortorium and its vast library dealt a death blow to my Chinese aspirations. Springtime in Ithaca is revelatory to a Western bred lad: the ephemerals in the eastern hardwood forest dazzled me, I wandered aimlessly for miles (realizing eventually that I was hopelessly lost)—trilliums galore, dogtooth violets by the thousand, dutchmen's britches…and in the distance a rocky cliff with a splashy freshet—better check it out. A dozen or so emerald green starfish clumps of

maidenhair spleenwort clung to the sheer cliff near the trickling water. That moment, perhaps, my fate as a horticulturist was sealed.

We cannot promise similar life-altering epiphanies if you join us in Ithaca this June. I fear this may be nearly sold out by the time you read this, but as members you shall eventually still have a chance to hear the presentations! After a half century's membership in NARGS I have learned participating leads to a never-ending cornucopia of precious moments with fellow gardeners at meetings, on tours! Who wasn't gob-smacked by those paintbrush photographs in the last issue of the *Quarterly*? Poring over the Seedlist is a recurring yearly anthology of revelations. I reveled in this past winter's Webinars. I experienced insight after insight listening and learning from an impressive lineup of fellow gardeners.

Epiphanies can come in very substantial ways: an anonymous donor gave the Society a $100,000 gift in January with a possibility of $200,000 more over the next two years. This is sure to provide an even greater lift to NARGS's rapidly expanding membership and reach.

For me, a crowning revelation was during the "Meadows" Webinar, hearing Fergus Garrett describe the British Arachnological Society's amazement at the biodiversity of spiders at Great Dixter—rediscovering endangered species and unimaginable disjuncts in a formal garden. Fergus demonstrates that gardens—real gardens—OUR kind of garden with diverse flora and responsible stewardship—can provide far greater ecological services than most any sort of other land use. Rock gardening is a great hobby, for sure. But it's much more than that!

"Πάντα στὸ νοῦ σου νἄχῃς τὴν Ἰθάκη.
Τὸ φθάσιμον ἐκεῖ εἶν᾽ ὁ προορισμός σου."
Ἰθάκη Κ. Π. Καβάφης

"Keep Ithaka always in your mind.
Arriving there is what you're destined for."
"Ithaca" by C P. Cavafy (translated by Edmund Keeley)

---Panayoti Kelaidis, nargspres@gmx.com

NARGS Donations

Donations to NARGS between November 1, 2021 and January 31, 2022.

To support the General Fund, Seed Exchange, *Rock Garden Quarterly*, Educational Trips, Web Site Development, in memory of Ralph & Mary Moore, in honor of Fort Lewis College (Durango, CO), and Circle of 100 Challenge.

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Or visit nargs.org/join

New and Rejoining Members

Welcome to all those who joined or rejoined between November 8, 2021 and February 23, 2022

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Lawless-Crimmins, Rose, Arvada, CO
Lehman, Gayle, Steamboat Spgs, CO
Levine, Andrew, Ridgefield, CT
Lindsay, Alec, Canning, NS
Loomis, Michael, Waynesville, NC
MacLeish, Jane, Washington, DC
MacQuarrie, Scott, Wilton, CT
MaGowan, Colin, Bishop, CA
Malanowicz, Nancy, West Chester, PA
Martin, Deborah, Boulder, CO
Mattus, Matt, Worcester, MA
Mayer, Kathryn, Ranchos de Taos, NM
McIntosh, Marla, Ellicott City, MD
Meinholz, Joseph, Prescott, AZ
Mersch, Edwin, Chicago, IL
Messervy, Lannie, Toronto, ON
Molema, Arie, Toronto, ON
Moore, Elizabeth, Ottawa, ON
Mortenson, Gary, Phippsburg, ME
Nemec, Laurie, Downingtown, PA
Nimmo, Fran, Fairlie, New Zealand
Nix, John, Raleigh, NC
O'Byrne, Terry, Wilmington, DE
Ohland, Barb, Camden, ME
OToole, Todd, Durango, CO
Pace, Carolyn, Erieville, NY
Paladino, Michele, Brooklyn, NY
Panczak, Bonnie & Michael, Littleton, CO
Parker, Katherine, New York, NY
Peralta, Sal, McMinnville, OR
Peri, Oron, Tivon, Israel
Pooke, Diana, Norval, ON
Port, Lisa, Lake Forest PK, WA
Radell, Marc, Lederach, PA
Ray, John, Chestertown, MD
Raywood, Michael, Parkesburg, PA
Reeves, Natalie, Eugene, OR
Reindl, Jeff, Littleton, CO
Ross, Christiana, Albuquerque, NM
Russo, Vince, Sterling Heights, MI
Sawyer, Denis & Rick, Montville, ME
Scharf, Peter, Debolt, AB
Schmidt, Cassian, Weinheim, Germany
Seaton, Nancy, Sunnyside, NY
Shinn, Randall, Fort Collins, CO
Shoemaker, Stuart, Laporte, CO
Short, Sharon, Cary, NC
Siegel, Julie, Evanston, IL
Simmons, Heidi, Copake, NY
Smith, Marcia, Shelburne, MA
Sremba, Amy, Hudsonville, MI
Stanley, Mary, Mequon, WI
Stanyar, Kyle, Toronto, ON
Steffes, Anthony, Winnipeg, MAN
Stevenson, Sheila, Fergusons Cove, NS
Stute, Manfred, Dortmund, Germany
Suzuki, Shiro, Gifu City, Japan
Swain, Patricia, Wellington, NV
Swantee, Frank, Conception Bay South, NF
Tombaugh, Sandra, Hartford, CT
Tonko, Sara, Minneapolis, MN
Topley, Maureen, River John, NS
Traum, Lee, Grosse Pointe, MI
Trimble, Elizabeth, Baltimore, MD
Turner, Emma, New York, NY
Turner, Richard, San Francisco, CA
Ulrika, Johansson, Gards Kopinge, Sweden
Van Horne, James, Gainesville, GA
Walker, Daniel, Calgary, AB
Walters, Thomas, Piedmont, CA
Ward, Judith, Denver, CO
West, Forrest, Fairfield, ME
Wilkins, Linda, Richfield, MN
Wilson, Sherri, Bainbridge Is., WA
Woods, Caroline, King's Lynn, U.K.
Wu, Scott, Bothell, WA

Seed Exchange

Many thanks to the Delaware Valley and Great Lakes chapters for handling the order fulfillments in the Main and Surplus Rounds (respectively) of the Seed Exchange so carefully and capably... and safely. We all appreciate the extensive work that they have done, even if we do not order seeds, since the Seed Exchange is a benefit that always attracts new members to NARGS. So these volunteers (and, surprisingly, they are not all members of NARGS) are a major part of helping to keep our society vigorous.

We hope that your chapter was able to receive a portion of the remaining seeds, for use by your members and/or community organizations. If not this year, then be sure to remind your chapter Chair to request them next year, when I contact all Chairs in early March to offer the seeds.

It's such a pleasure to be writing this with spring and summer all ahead - anticipation is often the better part (and certainly the easier part) of gardening. All those plans, all those catalogs, all those nurseries...

For anyone whose Small Lots of Seed permits have lapsed – or will do so before the next seedex season – there is a new online process for applying to receive your new or next permit. APHIS-PPQ has redesigned the application system, which is now called eFile. The process is quick and simple, without the necessity for an eAuthentication (going to a center to show your face and ID), and the quick electronic approval process means that the permit can be yours within 24 hours.

We have posted instructions for using the new eFile system on our website: https://www.nargs.org/small-lots-seed

If any readers would like printed instructions mailed to them, please contact:

Joyce Fingerut
537 Taugwonk Road
Stonington, CT 06378-1805
alpinegarden@comcast.net

With high season for blooms and seeds approaching, we hope that you will be out in your gardens – and in the wild – noting interesting plants and collecting their seeds. Keep a clear eye peeled for those special, rare, and sought-after alpine and woodland species. The Exchange is often the only way those plants can remain in our gardens.

Your local native plants are highly regarded by members in other countries, so be sure to include them. And seeds of what you might consider to be basic garden items will be perfect for new members and beginning gardeners (we all began somewhere). Please check our website (https://www.nargs.org/seed-donation-instructions) and scroll down for suggestions of the plants that are – and are not – welcome for the Seedex.

Seed donation forms and instructions (as well as the permit and mailing labels for international members) will be included with your summer issue of the Quarterly.

And please be vigilant in cleaning and packaging your seeds. More and more overseas governments are demanding an inspection of the seeds and a phytosanitary certificate before they will allow NARGS seeds to enter their countries. If seeds are not clean enough, and cannot reach our overseas members, we will lose their contributions to our Seed Exchange.

And you know how you love those donations from far away gardens and mountains!

The following recently became NARGS Patrons:

Beutler, Linda (Oregon)
Burnet, Thornton W., Jr. (North Carolina)
Gorkin, Alan (Connecticut)
Grushow, Jane (Pennsylvania)
MacFarlane, Radford (Delaware)
Mauney, Katherine (North Carolina)
Norris, Peter (Massachusetts)
Sliter, Lizette (New Hampshire)
Willis, John (Maryland)

NARGS Rocks: Virtual Study Days

NARGS Rocks Virtual Study Days were as successful this season as they were diverse. Many thanks go to co-hosts Bridget Wosczyna, Rod Haenni, and Kenton Seth for their help with lining up a stellar cast of speakers, as well as managing the conferences. We covered woodland gardens, succulents and meadows, entering into new conversations for each. Still online are previous videos about crevice gardening, troughs and our initial special: Taproot. Remember, you can still buy tickets and watch each virtual event at your leisure. Plus, the Durango Annual General Meetings recordings are free to all NARGS members. Just login. All recordings will remain online and may be rented by chapters for display at their meetings.

Look for these study days to continue next fall and winter. We plan to kick off the season with "Bulbs, Corms and Monocots for the Rock Garden" during those long dark days of November. We have had some suggestions for other topics like Garden Design & Construction, Plants in the Wild, Special Gardens, Plant & Pot Culture, Seed Germination, and specific Genera or Category. If you have a suggestion, feel free to email me, Elisabeth Zander. Go to our website, nargs.org and select Contact Us and tab General.

Elisabeth Zander
webmaster, www.nargs.org

Book of the Month

Do you like to read about rock gardening and horticultural subjects? Please share your useful insights with other members and get a free review copy of the book for your efforts. Reviewers are always sought for the NARGS website Book-of-the-Month feature. In return for submitting a 300-400-word review of the book of your choice, the book will be sent to you free of charge. Select your own title for review or suggestions can be provided.

Please contact Steve Whitesell at elysium214@aol.com for more information.

NARGS 2022 Online Election:
May 3 through May 16, 2022

The online election of three members to the Board of Directors will be held from May 3 - 16, 2022. The list of candidates and their qualifications were published in the winter issue of the *Quarterly*. There were no from-the-floor nominations. On May 3, members will be emailed a call to vote that will include directions and a contact for any questions. Please make sure your email address is up to date in the NARGS membership files. If you do not have email, you may mail a request for a printed ballot to NARGS, POB 18604, Raleigh, NC 27619-8604. The NARGS board will ratify the voting and results will be posted online.

-- Sarah Strickler, Recording Secretary

Upcoming NARGS Meetings:

Ithaca, New York June 14 – 16, 2022

Truro (Bible Hill), Nova Scotia June 8 – 11, 2023

NARGS Traveling Speakers Program

Just as it appeared that traveling was getting easier and safer, Omicron arrived, slowing down the return of our Traveling Speakers Program. Nevertheless, the Regional Chairs of the program are working on plans to bring speakers from abroad and across North America to chapters in 2022. To date, this includes the following events:

Kenton Seth and Paul Spriggs, authors of the soon-to-be-published *The Crevice Garden: A Bold Aesthetic for Adventurous Gardeners*. Berkshire Chapter of NARGS. Berkshire Botanical Garden, Stockbridge, Massachusetts. June 11, 2022.

Tom Freeth, Rock Garden Supervisor, Kew Gardens. Western chapters, July 2022. Details to be announced.

Stay tuned for information about other presentations as they become available. We will post information about speaker schedules on the NARGS website and in the *Quarterly*.

Rosemary Monahan, chair

Job Listing:
Horticulturalist, Kaul Wildflower Garden

The Kaul Wildflower Garden is four acre a native plant garden situated in what was once a rock quarry located at the Birmingham Botanical Gardens in Alabama. The garden was designed by Zenon Schreiber in the mid-late 60s. We have been studying the garden and working to return it to a state more closely aligned with its original design intent and seek a qualified candidate with a knowledge and passion for native plants and rock gardens. The following is a link to a copy of our job description: https://bbgardens.org/tyfoon/site/fckeditor/Horticulturist-KWG_1_5_22.pdf

We have learned of the death of the following NARGS members:

Sandra Ladendorf, Salinas, California (d. 2019)
Past president of NARGS (1990 - 1992)

John N. Spain, Middlebury, Connecticut (age 100)

Ann Wiss, Short Hills, New Jersey (age 100)

In Memorium: Alice Lauber

On January 2nd, Alice Lauber passed away at 94 years old, leaving the world more beautiful than she found it. Her subtle elegance and ready laugh belied her inner strength and keen intellect. She had just celebrated her 66th wedding anniversary the week before– a remarkable milestone.

Born to Ozzie and Elizabeth Holtham in Oakland, CA, Alice attended business school in Berkeley then landed a job as secretary to Dr. Melvin Calvin at U.C. Berkeley who went on the win the Nobel Prize in chemistry. She met Seattle native Ernie Lauber through a friend at a New Year's Eve party; they were married in 1955 and settled in Lake Forest Park, WA, in a home she and Ernie designed and built. Alice went on to work as assistant to the dean in the School of Metallurgical and Ceramic Engineering at the University of Washington for over 30 years; she loved the lively, academic environment.

Alice found beauty everywhere and she cultivated it quite literally between a rock and a hard place by becoming an enthusiastic and skilled rock gardener. Through her participation in the North American Rock Garden Society she visited many gardens in North America, Great Britain and New Zealand. She became Reccording Secretary of NARGS and served as President of the Northwestern chapter of NARGS. Her garden was featured in Better Homes and Garden magazine – a well-deserved honor.

Alice is survived by her husband, Ernest (Ernie) Lauber, sister-in-law Shirley Post, a multitude of beloved and loving extended family and friends.

She was one of everyone's favorite people, and she made everyone feel that they were hers.

Donations can be made in Alice's name to the North American Rock Garden Society and the Northwest chapter of PAWS.

Treasurer's Report – 2021 Five-Year Summary

Member tours planned for 2020 and 2021 were cancelled due to the Covid-19 pandemic and their cancellation had significant negative impact on net income for each year. However, our web-based video meetings were great successes and offset a significant portion of our usual tour income. We continued in 2021 to have marginal Net Income over Expense although net income declined and net expense increased. An exceptionally generous legacy gift in 2020 from a past lifetime member accounted for a significant portion of the increase in our cash and investments. Another generous gift received early in 2022 will add to that increase in investments for 2022.

Our membership numbers rose again this year after many declining years. Total membership revenue in 2021 was up over 2020 and general donation levels again increased. Our video presentations again led to increased membership as well as increased donation and meeting revenue.

In recent years, donations have generally saved us financially and continued to do so in 2021. Donations associated with our web-based video meetings and Seed Exchange added to an increase in monthly donations this year. A $7,000.00 donation early in the year designated for the Speaker's Tour also added to donations although planned speaker expenses did not occur due to COVID. The Speaker's Tour will return in 2022.

Tour revenue did not occur in 2021 because of Covid but we further invested in the tour registration and marketing capabilities on our website. We expect recovery of much of that investment from tours in 2022.

On the following page,, I have listed those areas of Net Income and Net Expense that have a significant impact on our operations. Net income in this table is the net of total income minus total expense for each program to more clearly show each program's impact on our finances. Quarterly financial analyses are available on our website.

-- Richard Lane, Treasurer

Net Income	2017	2018	2019	2020	2021	2020-21 change
Memberships	48,848	61,672	51,493	65,303	66,644	1,341
Donations	48,394	36,144	33,909	114,226	42,818	-71,408
Interest & Dividends	7,386	8,910	8,889	7,179	6,787	-392
Advertising	1,011	1,656	683	453	1,375	922
Book Service	23	1,118	527	563	702	139
Amazon Payments	754	631	637	249	95	-153.62
Seed Exchange	1,753	1,625	-3,389	201	-1,673	-1,874
Meetings and Video	5,114	1,118	6,102	11,781	12,029	248
Tours	16,492	43,793	35,332	-9,182	-14,552	-5,370
Total Net Income	129,775	156,665	134,183	190,772	114,225	-76,548
Net Expenses:						
Grants and Awards	5,100	10,984	13,030	373	11,903	11,530
Bank Fees	80	157	362	32	-56	-88
Speakers Tour	0	0	7,391	552	-908	-1460
Internet Service	7,627	13,717	12,189	9,011	34,756	25,745
Quarterly	51,969	50,188	52,162	40,712	46,459	5,747
Administration:						
Exec. Sec.	15,333	15,334	15,725	19,400	11,772	-7,628
Insurance	3,283	1,477	0	3,201	1,678	-1,523
Other	733	854	5,330	2,176	1,515	-661
Total Net Expense	84,125	92,712	106,189	75,456	107,119	31,663
Net Profit & Loss	45,650	63,954	27,994	115,316	7,106	-108,210

TOTAL LIABILITIES & EQUITY as of December 31, 2021

ASSETS

Checking/Savings
- Wells Fargo-Membership 55,528.03
- Wells Fargo - Main Account
  - WF - Main - Speaker Tour Funds 15,765.46
  - Wells Fargo - Main Account – Other (426.48)
  - Total Wells Fargo - Main Account 5,110.58
- Wells Fargo – Savings 39,774.19

Total Checking/Savings 110,641.20

Investments
- Investments - Unrestricted
  - Fidelity - Cash – Unrestricted 44,102.17
  - Invstmnt Accnt - Unrestricted
    - Investment Bal – Unrestricted 250,000.00
    - Unearned Capital Gain/Loss -UNR (56.50)
  - Total Invstmnt Accnt – Unrestricted 249,943.50
- Total Investments – Unrestricted 294,045.67
- Norman Singer Endowment
  - Fidelity - Cash – NSE 11,993.90
  - Investment Account - NSE (MKT)
    - Investment Bal - NSE (Cost) 151,730.37
    - Unearned Capitl Gain/Loss - NSE 4,654.83
  - Total Investment Account - NSE (MKT) 156,385.20
- Total Norman Singer Endowment 168,379.10
- Total Fidelity Investments 462,424.77
- Adjustment – Unearned Capital (4,598.34)

Total investments 457,826.43

Total Assets 568,467.63

LIABILITIES AND EQUITY

Liabilities

Capital One SPARK Business 895.97
- Tour Deposits
  - Patagonia Tour PayPal (1,350.15)
  - Patagonia Tour – Other 18,480.00
  - Total Patagonia Tour 17,129.85
  - Total Adirondack Pre AGM Tour (2,730.00)

Switzerland Tour Paypal (587.50)
Switzerland Tour Other 10,998.18
Total Switzerland Tours 10,410.68
Total Tour Deposits 24,810.53

Total Liabilities 25,706.50

Equity

Unrestricted (ret. Earnings) 379,231.42
Restricted Funds
Norman Singer Endowment Fund 151,730.36
Robert Senior Award Fund 1,135.72
Carleton Worth Award Fund 3,157.78
Total Restricted Funds 156,023.86
Net Income 7,505.85
Total Equity 542,761.13

Total Liabilities and Equity 568,467.63

PROFIT & LOSS January through December 2021

Income

Contributed Support
Memberships 66,644.31
Donations & Special Requests 42,817.70
Total Contributed Support: 109,462.01
Earned Revenues
Interest 102.41
Credit Card Rewards 398.97
Dividends 6,285.59
Advertising revenues 1,375.34
Program Revenue
Book Services 701.71
Amazon Payments 95.55
Seed Exchange 16,680.51
Video Services 17,618.35
Total Program Revenue 35,096.12
Other Miscellaneous Receipts 60.72
Switzerland Tour 14,001.82
Total Earned Revenues 57,320.97

Total Income 166,782.98

Expense

- Norman Singer Endowment Grants 11,903.10
- Fund Raising Expense 79.00
- Bank Fees 5.00
- Administrative Expenses
  - Executive Secretary 11,771.68
  - Legal & Filing Fees 84.20
  - Insurance – non-employee 1,678.20
  - Supplies 60.00
  - Telephone and Electronic Services 471.78
  - Postage, shipping, delivery 45.20
  - PayPal Virtual Terminal 360.00
  - Annual Elections 299.00
- Total Administrative Expenses 14,770.06
- Program Services Expenses
  - AGM Durango 3.49
  - Book Service 116.03
  - Seed Exchange 18,353.57
  - Speakers Tour (908.10)
  - Internet Services 34,756.15
  - Video Services 5,586.28
  - Quarterly 46,459.23
- Total Program Services Expenses 104,366.65
- Tour Expense
  - Switzerland Tour 14,001.82
  - Adirondack Pre-Tour 1,059.00
  - Website Development/Maintenance 13,492.50
- Tour Expense Total 28,553.32

Total Expenses 159,677.13

Net Income 7,105.85

North American Rock Garden Society 2021 Financial Review Report

Panayoti Kelaidis, President
North American Rock Garden Society
March 1, 2022

Dear Mr. Kelaidis,

I have examined the NARGS financial records for the year 2021 maintained by the Treasurer Richard Lane. The records include the following:

- Balance Sheet and Profit and Loss Statement as 12/31/2021
- Account reconciliations for each of the NARGS bank accounts for the period ending 12/31/2021
- Account reconciliations for the Fidelity investments Money Market Fund account and the Fidelity Investment Accounts as of 12/31/2021.
- Samples of the disbursement records.

After reviewing the financial records I have found the following:

- The year end balance sheet and profit and loss statements accurately reflect the financial status of the North American Rock Garden Society as of December 31, 2021.
- All bank accounts, the credit card account and the Fidelity Cash and Investment Accounts have been consistently and correctly reconciled and are accurately recorded in the financial statements.
- Examination of several individual disbursement records reveal that appropriate documentation and authorization was obtained to support the particular disbursements.

In conclusion, the review found no issues of concern.

Sincerely, Jeffrey B. Hurtig
20 Inglewood Place
Ottawa, ON Canada K1Y 4C5

NARGS Chapters (meeting place/area) and Chairpersons or Co-Chairs

Adirondack (Ithaca, NY)	John Gilrein
Alaska (Anchorage & Mat-Su Valley)	Florene Carney
Allegheny (Pittsburgh, PA)	Nancy Knauss
Berkshire (Stockbridge, MA)	Joyce Hemingson
Calgary Rock & Alpine Garden Society (Calgary, AB)	Patti O'Keefe
Columbia-Willamette (Portland, OR)	Terry Laskiewicz
Delaware Valley (Philadelphia, PA)	Louise Clarke
Fells (Newbury, NH)	Thelma Hewitt
Gateway (St. Louis, MO)	Mariel Tribby
Great Lakes (Southern MI)	Julia Caroff
Hudson Valley (Westchester Co, NY)	Don Dembowski
Long Island (Oyster Bay, NY)	Donald Ohl
Manhattan (New York, NY)	Judith Dumont
Mason-Dixon (Norrisville, MD)	Marika Sniscak
Minnesota (Minneapolis/St. Paul, MN)	Rick Rodich
New England (Waltham/Boylston, MA)	Estelle James
Newfoundland (St. John's, NL)	Todd Boland
New Mexico (Santa Fe/Albuquerque, NM)	Robin Magowan
Northwestern (Seattle, WA)	Kendall McLean
Nova Scotia (Halifax & Truro, NS)	Roslyn Duffus
Ohio Valley (OH & surrounding states)	Joan Day
Ontario (Don Mills, ON)	Jeff Mason
Ottawa Valley (Ottawa, ON)	Rob Stuart and Jane Lund
Piedmont (Raleigh, NC)	Cyndy Cromwell
Potomac Valley (Alexandria, VA)	Barbara Rose
Québec (Montreal, QC)	Pierre Morrissette
Rocky Mountain (Denver, CO)	Panayoti Kelaidis
Sierra (Sonora, CA)	Nancy Piekarczyk
Siskiyou (Medford, OR)	Jean Buck
Wasatch (Salt Lake City, UT)	Tony Stireman
Watnong (Far Hills, NJ)	Roxanne Hiltz
Western (San Francisco Bay area, CA)	(vacant)
Wisconsin-Illinois (Madison-Chicago)	Dave Collura

NARGS Structure

The officers of the North American Rock Garden Society consist of a president, a vice-president, a recording secretary, and a treasurer. The officers are elected by the membership.

The Board of Directors of NARGS consists of the four above-named officers, the immediate past president of NARGS, and nine elected directors.

The affairs of NARGS are administered by an Administrative Committee (called AdCom) consisting of the president, vice-president, recording secretary, treasurer, and one director-at-large, selected annually by the NARGS officers from among the nine elected directors.

Officers

President	Panayoti Kelaidis 1244 S Quince St, Denver, CO 80231-2513
Vice President	Todd Boland 81 Stamp's Lane, St. John's, Newfoundland & Labrador A1B 3H7
Recording Secretary	Sarah Strickler 2436 N Utah St, Arlington, VA 22207-4030
Treasurer	Richard Lane 4904 Hermitage Dr., Raleigh, NC 27612-2762
Director-at-Large	Brendan Kenney 5 1/2 Jane St, Apt. 4R, New York, New York 10014-6017
Immediate Past President	Betty Anne Spar 5051 N Grey Mountain Trl, Tucson, AZ 85750-5942

Directors of the Board:

2019-2022	Cyndy Cromwell, Cary, NC Brendan Kenney, New York, NY Jerry Rifkin, Merion, PA
2020–2023	Ed Glover, Mount Horeb, WI Susan E. Schnare, Andover, NH John Willis, Frederick, MD
2021–2024	Tony Avent, Raleigh, NC Mariel Tribby, St. Louis, MO Peter Zale, Kennett Square, PA

Managers

Executive Secretary	Bobby J. Ward (919) 847-6374 P.O. Box 18604, Raleigh, NC 27619-8604
Quarterly Editor	Joseph Tychonievich 1629 Sunnymede Ave. South Bend, IN 46615
Seed Exchange	Laura Serowicz 15411 Woodring, Livonia, MI 48154-3029
Webmaster	Elisabeth Zander 127 North St, Goshen, CT 06756-1202

Back Cover: Mountain death camus *(Zigadenus elegans),* Emily Griffoul

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