

Aquilegia

Magazine of the Colorado Native Plant Society

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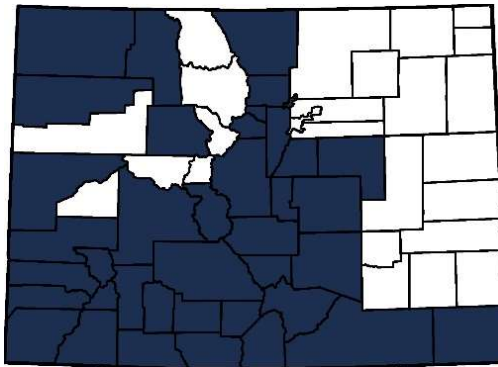




Ponderosa Pine, *Pinus ponderosa* (Pinaceae).

Ponderosa pines, like all pines, are gymnosperms—plants whose seeds (-sperm) are “naked” (gymno-); i.e., the seeds are not enclosed in a fruit. Gymnosperms are our oldest class of plants reproducing by seeds, arising about 375 million years ago. The seeds develop on top of scales; the aggregates of scales are called cones. Ponderosas are monoecious—the pistillate (top photo) and staminate (bottom photo) floral structures are located in separate cones, but both are produced on the same plant. Ponderosas are the defining plant of montane ecosystems in the western half of North America. The trees can be found in mountainous regions as far south as central Mexico and as far north as British Columbia. Recent genetic analysis suggests a complex evolutionary history, with multiple hybridization events leading to several different subspecies. The subspecies are generally confined to different habitats. See the Gymnosperm Database for more information

(https://www.conifers.org/pi/Pinus_ponderosa.php). KA



Map adapted from Ackerfield, J. *Flora of Colorado* (2015), p. 62

Photo credits: front cover and this page © Carol English; back cover © Linda Smith

***Botanicum absurdum* by Rob Pudim**



Scientific Plant Names Updated with the New Edition of *Flora of Colorado*

Aquilegia adheres to the botanical Latin plant names used in *Flora of Colorado* by Jennifer Ackerfield. The new edition of *Flora of Colorado* (2022) provides the most current Angiosperm Phylogeny Group system standards, (APG IV). Note changes that have been made to genera names and to families.

See the Angiosperm Phylogeny Website for more details on current nomenclature, as well as general discussions on botanical systematics.

<http://www.mobot.org/MOBOT/research/APweb/>

Aquilegia: Magazine of the Colorado Native Plant Society

Dedicated to furthering the knowledge, appreciation, and conservation of native plants and habitats of Colorado through education, stewardship, and advocacy

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Featured Story

Building a Reference Collection of Every Plant Species in Colorado: It Takes a Village (of Passionate Botanists!)

By Christina Alba

Last May, I had the opportunity to join my colleagues at Denver Botanic Gardens (DBG) on a specimen-collecting trip to Montezuma County on Colorado's Western Slope. We were excited to explore the rugged canyon country and unique plants that epitomize the southwestern corner of our floristically diverse state (Figure 1). We had a specific mission, too, which sharpened our excitement and guided our explorations.

A current project for the Kathryn Kalmbach Herbarium of Vascular Plants (KHD) at the Gardens is to build a reference collection that contains a physical specimen of every plant species in the state. This project embodies the original mission of KHD, which was founded by volunteers, including Kathryn Kalmbach herself, nearly 80 years ago: to house an example of every species that could serve as a reference for identification (Figure 2).

A reference collection stands apart from an herbarium's larger research collection, both physically, because it is housed within its own cabinet(s), and, in certain ways, functionally. For example, consider the size of KHD's research collection. We currently house approximately 70,000 vascular plant specimens that, as an accredited museum, we are charged with preserving in perpetuity. A main benefit of keeping a separate, much smaller reference collection is that it supports real-time updating of nomenclatural changes. With only one or two specimens per species, experts

can quickly move through a reference collection and make annotations—circumventing the laborious process of updating potentially hundreds of specimens housed in the research collection.

Plus, the reference collection is meant for, well, referencing! The specimens are easily accessed from one or two cabinets to support quick cross-referencing against field-collected material while working through a dichotomous key. Importantly, botanical workers such as county extension agents, graduate students, and our own staff botanists and volunteers can return from the field and immediately start identifying their collections in a space that does not require specimens to be frozen before entry (as with the research collection, where we go to great lengths to keep out detrimental pests). ▶



Figure 1. The team hikes through some characteristic piñon-juniper habitat with Sleeping Ute Mountain in the background. © Christina Alba



Figure 2. A pressed specimen of *Cucurbita foetidissima* (buffalo gourd), collected in 1942 by Kathryn Kalmbach, the namesake of Denver Botanic Gardens' vascular plant herbarium. The original mission of the herbarium was to serve as a reference collection, and DBG is now working to fulfill that.

◀ Given that the current count of plant species in Colorado stands at 3,192 (Ackerfield, 2022), building a reference collection is no small task. So, while we are making targeted floristic excursions like the one to Montezuma County (a subject to which I will return), we are also grateful to be integrating specimens from individual botanists and gifted collections from around the state. For example, we are lucky to be incorporating many *Astragalus* and *Penstemon* specimens collected by Loraine Yeatts, adjunct researcher at DBG, who has seemingly hiked (and skillfully photographed) every nook and cranny of our western canyonlands! We are also making use of specimens deposited to KHD by Tom Schweich, a volunteer with Jefferson County Open Space, who sparks excitement among staff every time he drops off his meticulously pressed and labeled collections. And Sue Janssen, a Gardens volunteer, has not only been spearheading the reference collection project, she has also been weeding her own garden with an eye tuned to undercollected urban species that need better representation. Sue also made collections this past fall on Tenderfoot Mountain in Summit County, where no collections had been made despite ready access and high use.

Another great outcome of building the reference collection is that it has nudged us to take another look at our holdings and identify gaps in both taxonomic and distributional completeness. For example, we might have only one or two specimens (or none!) in our research collection for a given species. Identifying these undercollected taxa encourages us to enhance their representation, not only to complete the reference collection, but also to improve our research collection. Given that plants are incredibly variable in their morphology and phenology, new specimens always meaningfully build a record of this variability in space and time.

Now, back to our collecting trip to Montezuma County! Before making the excursion, I made a list of plants that were likely to be in fruit or flower during our visit and that were also determined to have low representation in our collection. This list became worn and weathered as it guided our search as we made nearly 80 collections over several days. We spent time in Canyons of the Ancients National Monument, Sand Canyon, and several other areas around McElmo Creek that our local botanical guides, Marian and Peter Rohman, knew to be floristically interesting from their many years botanizing in the area (Figure 3). Figures 4–7 highlight a few finds that I personally found interesting, with descriptions of how the specimens improve our collections.

Finally, you simply never know what you are going to find when you get out there. One of the most ▶



Figure 3. Marian Rohman (left) and Jennifer Ackerfield investigate *Baccharis wrightii* (Wright's false willow) growing northeast of Yellow Jacket Canyon near the Colorado-Utah border. This species' Western Slope distribution is represented by only four herbarium specimens, with our collection from May 2022 adding a fifth. © Christina Alba



Figure 4. *Dimorphocarpa wislizeni* (tourist plant) and its lacy shadow showing its characteristic two-parted, gray-tomentose silicles subtended by horizontal pedicels. With the May 2022 collection, the KHD now holds five specimens of this species and its first from Colorado (the others are from Arizona and New Mexico). © Christina Alba



Figure 5. *Amsonia jonesii* (Jones's bluestar) shrub (left) and flowers (right). Jones's bluestar was at the end of its flowering window during our visit, but we found a reproductive individual to make a collection. It represented the seventh specimen of bluestar for KHD, the first one from Montezuma County, and our first accessioning of this species since 2007. © Christina Alba



Figure 6. While often overlooked, it is important to document species like *Bromus rubens* (foxtail brome), which is non-native to the United States and moving into Colorado from the southwest, where it has been reported as invasive. The May 2022 collection represents KHD's fifth. Interestingly, the herbarium also holds an accession from *B. rubens*'s native range, where the label describes the plant to be growing in sand on the coast of the Mediterranean Sea near Perpignan, France. © Christina Alba



Figure 7. An exciting find for the trip and new record for the state, *Aphyllon franciscanum* (clustered broomrape). © Jennifer Ackerfield

◀ exciting finds of the trip was totally unexpected—a newly documented species for the state, *Aphyllon franciscanum*, or yellow clustered broomrape (Figure 7)! This intriguing find was growing in straight sand and surrounded by *Eriogonum*. It had a beautiful creamy to lemon-yellow corolla with pointed lobes (Figure 7). The association with a buckwheat and the lobe morphology were important clues that allowed an *Aphyllon* expert to confirm that our find was *A. franciscanum* and not the similar-looking *A. fasciculatum* (which associates with sagebrush and has rounded corolla lobes). Our first collection of this species will be going into the research collection, but you know it will be on our list for the reference collection as well!

Christina Alba, PhD, is an assistant research scientist at Denver Botanic Gardens. She studies the ecological processes that shape plant diversity and distributions across various scales of organization—from individual plants to populations and to entire communities. Her research questions fall under the subdiscipline of disturbance ecology, with a focus on plant responses to phenomena such as wildfire, grazing, drought, biological invasions, and management interventions in both urban and wildland systems. Dr. Alba combines sampling approaches from different disciplines—including collections-based botanical floristics and quantitative plant ecology—to improve our understanding of what factors shape plant biodiversity.

Sue Janssen, Denver Botanic Gardens volunteer, and Jennifer Ackerfield, head curator of the Kathryn Kalmbach Herbarium of Vascular Plants, Denver Botanic Gardens, had input into this article. ☺

Featured Story

Green Roofs: An Urban Resource for Pollinators

By Kyle Ruszkowski and Jennifer Boussetot

The majority of flowering plants are pollinated by insects and other animals. These pollinators aid in the production of fruits, vegetables, and seeds, making them vital to both human and ecosystem health (1,2). Many pollinators, including Colorado's native bees, are likely struggling during this time of global insect decline (3,4).

This decline is caused by a confluence of known and unknown factors. Pesticide use (in ornamental and food crop production) and climate change are likely major factors negatively impacting pollinators globally (4). Warming temperatures alter both the pollinator life cycle and the life cycles of the plants on which they rely (5). Additionally, human-induced changes in land cover have become tremendous obstacles for pollinators. Native landscapes across the globe are converted into farmland and urban systems, which fragment and degrade the remaining habitat. Green infrastructure solutions, such as green roofs, may play an important role in conserving pollinator diversity in urban areas. The implementation of green infrastructure may reduce the ecological burden of land conversion to urban and suburban systems and provide a path for people to exist in concert with a variety of plants and pollinators that are native to the region.

Green urban infrastructure takes a variety of forms, typically at ground level. Green infrastructure implemented during city planning is most often designed to address stormwater challenges (6). In addition to stormwater solutions, green infrastructures such as parks, bioswales, green roofs, rain gardens,

and even turfgrass, provide direct and indirect benefits to humans, by reducing noise, mitigating the urban heat island, providing recreational space, and much more (7). Wildlife habitat provisioning is yet another boon that green infrastructure provides, but the efficacy of that habitat is dependent on the quality and density of the green infrastructure (7,8). Green roofs provide unique habitat and forage opportunities for urban pollinators that would otherwise be unavailable, but more research is required to fully understand the potential benefits.

Green roofs are rooftops that are engineered to support plants—essentially rooftop gardens. The two main factors limiting green roof implementation are cost and the structural limits of the building's ability to bear the weight of the green roof (9). Green roofs provide a series of measurable benefits to the building and the surrounding area. If installed correctly and properly maintained, a green roof can more than double the life span of a roof by reducing ultraviolet light damage to the roof and mitigating daily temperature fluctuations (10).

Green roofs also mitigate peak stormwater runoff. This is because they increase the time it takes the water to flow off the roof, alleviating the total volume of water that a storm sewer system needs to process at a single point in time and reducing the likelihood that the sewer system will overflow. Green roofs also provide a cooling effect through the evapotranspiration of the plants and substrate, which can help mitigate the effects of the urban heat island. Finally, green roofs provide habitat for many birds, plants, and ►



Kyle Ruszkowski stands by the newly planted Colorado State University Nutrien Building green roof on May 3, 2022. © Jennifer Boussetot



Kyle places blue vein traps to sample pollinators on the 'at grade' comparison plot next to the Colorado State University Plant Sciences Building on July 19, 2022. © Jennifer Boussetot

◀ arthropods in spaces that would otherwise be devoid of most life and suitable habitat.

Due to the unique growing environment on green roofs, the phenology of some flowering plant species is altered. We have found that green roof soil-less substrates have greater daily temperature fluctuations than comparable ground-level gardens. Green roofs will generally have higher sun and wind exposure and lower water-holding

capacity than ground-level gardens. Because of these warmer, drier conditions on the green roof, some species of plants are likely to flower earlier in the season (11,12). Our preliminary studies have found this to be true for two study species: *Allium* 'Millenium' and *Ipomopsis aggregata* (scarlet gilia). Both plant species bloomed approximately two weeks earlier in the season when compared to their replicates at grade. These effects were found in our studies in both Denver and Fort Collins. Additionally, our research has found that nectar sucrose concentrations are typically higher in *Ipomopsis aggregata* plants grown on the green roof than at grade.

The earlier bloom times and increased nectar sucrose concentrations have potential synergies with urban pollinator conservation. Some bee species have been found to emerge earlier in the season, likely related to global temperature increases (5). Green roof plant species blooming earlier in the season than their ground-level counterparts may provide urban foraging opportunities that would otherwise not exist. Additionally, honeybees have been found to alter their foraging patterns and behaviors based on the quality of the foraging patch (13). The higher nectar sucrose concentration of some flowering green roof plant species may reduce the area honeybees and other urban pollinators need to meet their metabolic needs. More research is required to better understand to what degree pollinators utilize green roof plants. However, we must point out that the alternative to green roofs is a roof devoid of life, which provides no obvious benefit to urban pollinators and other animals.

Green roofs provide unique habitat opportunities for flora and fauna in urban ecosystems (14). We are finding that the novel green roof environment triggers



Colorado State University Nutrien building green roof on July 21, 2022. © Kyle Ruskowski

phenological changes in some plant species, differentiating them from their ground-level counterparts by providing early-season forage opportunities and increased forage quality. In the wake of global insect decline, green roofs are playing an increasingly important role in maintaining and building the health of urban ecosystems.

Kyle Ruskowski is a graduate student studying ecology in Dr. Bousset's lab. He earned his BS in

horticulture at Michigan State University. Formerly, he was a horticulturist working in propagation at Denver Botanic Gardens.

Jennifer Bousset, PhD, is an assistant professor in the Department of Horticulture and Landscape Architecture at Colorado State University in the College of Agricultural Sciences. She specializes in green roof research on native species evaluations, plant drought tolerance, integration with solar panels, and rooftop agrivoltaics.

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► **“Green roofs...” continued on page 17**

North American Botanic Garden Strategy for Alpine Plant Conservation—An Update

By Jen Toews and Emily Griffoul

The alpine zone is broadly defined as the area above tree line and below permanent snow, and is home to many plant and animal species uniquely adapted to this harsh environment. These species are especially vulnerable to climate change, with some evidence that alpine environments are warming even faster than other terrestrial ecosystems (1). This means that the alpine zone is shifting higher in both latitude and elevation, and that lower-elevation species are moving into these formerly inhospitable alpine areas (2,3). But there is a clear upper limit of where alpine species can thrive, with our mountains in Colorado topping out at 14,439 feet at our highest peak, Mt. Elbert.

In response to these pressures, Betty Ford Alpine Gardens, located in Vail, and Denver Botanic Gardens worked together to publish the North American Botanic Garden Strategy for Alpine Plant Conservation (the Alpine Strategy) in 2020 (4). You may recall reading about the Alpine Strategy in the Fall 2019 issue of *Aquilegia*, when Dr. Jennifer Neale, director of research and conservation at Denver Botanic Gardens, wrote an introductory piece (5). The Alpine Strategy, a blueprint for the protection and conservation of alpine plants and ecosystems in the United States, Canada, and Mexico, focuses on the role botanic gardens and other organizations can play in preserving the natural heritage and ecological integrity of alpine zones in North America. It is based on two existing templates—the Global Strategy for

Plant Conservation (6) and the North American Botanic Garden Strategy for Plant Conservation (7), and, like these strategies, encourages transnational collaboration to conserve this special habitat.

The Alpine Strategy comprises 12 targets under four main objectives: to understand and document alpine plant diversity, to conserve alpine plants and their habitats, to promote awareness of alpine ecosystems, and to build capacity for the conservation of alpine plants and habitats.

One of the first steps in implementing the Alpine Strategy was to develop a comprehensive, up-to-date list of alpine plants occurring in North America. A taxa list is fundamental in understanding plant diversity, guiding conservation priorities and gauging progress in protecting important plant areas and conserving alpine plant taxa. Moreover, a list of plants, with accompanying profiles and photos, and accessible on a website, creates a valuable educational and outreach resource. For such a list to be useful, it must reflect a solid understanding of taxonomy: plants must be recognized as valid species, and any taxonomic disagreements should be highlighted. But it is a process. Compiling taxa into a database, verifying nomenclature, and maintaining currency are all time-consuming and never-ending pursuits.

Perhaps this is one reason why no known comprehensive list of North American alpine plant taxa existed. So, in 2019 Betty Ford Alpine ►



Some of our alpine plants. From the left: *Papaver kluanense*, or alpine poppy, is state rare and restricted to alpine zones, and is found primarily in the Mosquito Range. Rocky Mountain sky pilot, *Polemonium confertum*, is a Colorado endemic. Funky thistle, *Cirsium funkiae*, is newly described by Jennifer Ackerfield and is native to the Southern Rockies. Rothrock's Townsend daisy, *Townsendia rothrockii*, another Colorado vulnerable endemic. © Emily Griffoul



From the left: The rare, Colorado endemic *Aquilegia saximontana*, alpine dwarf columbine, growing above Refrigerator Gulch in the Tarryall Mountains. James' alumroot, *Telesonix jamesii*, growing in a crevice in Pike's Peak granite on Bison Peak in the Tarryall Mountains. *Gentianella acuta*, dwarf gentian, is common and widespread in the Northern Hemisphere. In Colorado, it occurs from the foothills to the alpine. The rare *Saussurea weberi*, Weber's saw-wort, growing on Horseshoe Mountain. © Jennifer Toews

◀ Gardens and Denver Botanic Gardens welcomed the challenge of merging existing regional lists and reconciling nomenclatural issues to create one list. Just over two years later, thanks to collaborative efforts among staff, interns, and volunteers from both institutions, a rough working list of alpine taxa of the United States and Canada now exists.

Currently this list includes more than 1,900 species and 2,300 unique taxa (8). In the coming months, we expect to add the flora of Greenland (456 species of vascular plants (9), many of which are alpine plants due to Greenland's high latitude) and Mexico (an assemblage of species with a high percentage of endemics (10) occurring primarily along the Trans-Mexican Volcanic Belt). We will also work with experts to identify and address regional knowledge gaps in the alpine flora lists of the United States and Canada. Finally, taxa lists represent a snapshot in time: plant names occasionally revert to an earlier published name, taxa are reclassified due to genetic analysis, species are newly described to science, range expansions occur, and, sadly, species become extinct. Thus, it is imperative for this list to evolve.

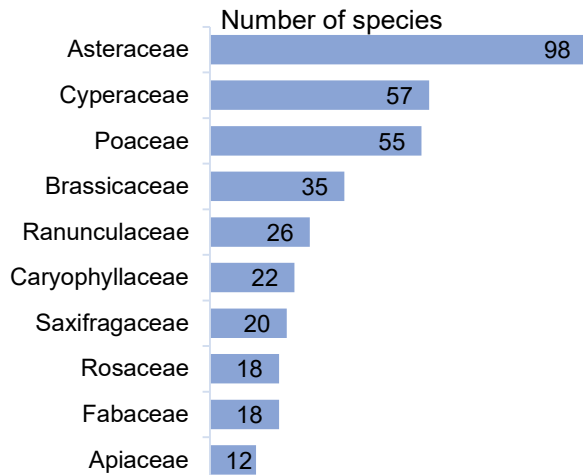
In addition to verifying scientific names of alpine plants, we are capturing species' distributions at state, province, and territory levels (sources used: Plants of the World Online, Biota of North America Program (BONAP), and NatureServe Explorer). The alpine life zone is present in 17 US states and eight Canadian provinces and territories (Mike Kintgen, personal communication), and our data can be queried to produce lists of species found within these geopolitical boundaries. A query of Colorado, for instance, returns 534 species and 575 unique taxa found above tree line, which we define as above 11,500 feet for the state.

If these numbers seem high—Mike Kintgen, curator of alpine collections at Denver Botanic Gardens, speculates there are between 300 and 400 vascular plant species in Colorado's alpine—it's because some montane and subalpine species have likely been vouchered in suitable microclimates above tree line and thus have been included. Furthermore, tree line increases in elevation as latitude decreases in the Northern Hemisphere, and thus is higher in southwestern Colorado. As a result, our data likely includes some species whose ranges do not extend into the alpine proper; we intend to identify and remove such species from our lists. On the other hand, we may discover that more species exist above Colorado's tree line than was previously thought.

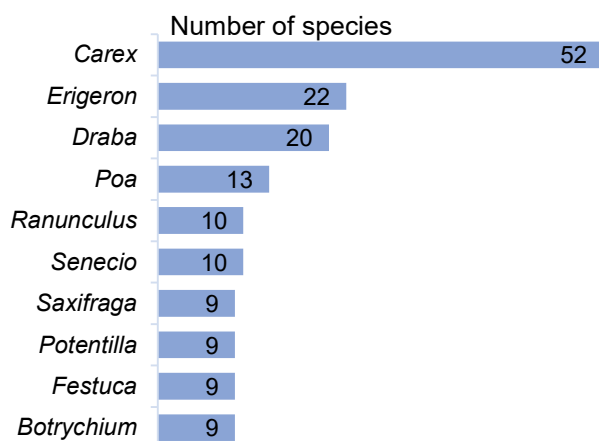
Although this list is evolving, patterns are emerging and data indicates the most species-rich family in Colorado's alpine is Asteraceae, 98; followed by Cyperaceae, 57; and Poaceae, 55. Regarding genera, *Carex*, 52, is the most species-rich, followed by *Erigeron*, 22; *Draba*, 20; and *Poa*, 13. Thanks to the work of Dr. Jennifer Ackerfield (11), head curator of natural history collections at Denver Botanic Gardens, and many other botanists in Colorado, we know that 29 alpine species are endemic to the state, approximately 80 are state rare or have a threat assessment ranking of S1-S3 (12), and 29 species are restricted to the alpine zone (found only above tree line). Rare species, species with narrow ranges, and those restricted to vulnerable habitats such as the alpine are important to highlight as they may merit more protection.

The Alpine Strategy uses NatureServe's global conservation statuses, an important metric for determining conservation priorities. Taxa with rankings of G1–G3 (see definitions below) are highlighted on ▶

Top 10 Most Species-Rich Families in Colorado's Alpine



Top 10 Most Species-Rich Genera in Colorado's Alpine



NatureServe Global Conservation Status Ranks (13)

G1	Critically Imperiled —At a very high risk of extinction or collapse due to a very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.
G2	Imperiled —At high risk of extinction or collapse due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
G3	Vulnerable —At moderate risk of extinction or collapse due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

◀ the list. On a global level, according to our data, five Colorado alpine species are “Critically Imperiled” (G1), eight are “Imperiled” (G2), and 42 are “Vulnerable” to extinction (G3). Note that some species’ threat assessments are outdated and others have never been assessed, providing opportunities for partner organizations and citizen scientists to participate in furthering the objectives of the Alpine Strategy, likely through researching and assessing these gaps.

The alpine plant list is important because we need to know *what* we are conserving. But we also want to know *where* we are focusing these efforts. Over the last several years, staff and partners of both gardens have developed a map of the alpine areas of North America to comprehend where this habitat occurs. This has also been the basis for understanding the land management of these alpine areas, and assigning a protection designation according to metrics from the International Union for Conservation of Nature (14). Taken together, the alpine list and the alpine land designation map allow us to “measure progress by calculating the percentage of alpine plants that are protected” (5). It also allows us to identify Important Plant Areas—places with a high level of biodiversity or home to rare or threatened plants that usually qualify for additional protection (15). *In-situ*—or “on-site”—conservation is the practice of conserving species in their habitats. This means we need to gauge how many species are in protected areas and which of those may need additional protection.

Regarding *ex-situ* conservation, the alpine list has already been shared with public gardens housing alpine collections to gauge progress on the Alpine Strategy’s target of conserving 60 percent of all alpine taxa *ex-situ* by 2030 (4). An important repository of diversity, *ex-situ* conservation includes seed banking, cryopreservation, and cultivating and monitoring both tissue culture and alpine plants in the living collections of botanic gardens and arboretums (4). Over the last several field seasons, staff from both gardens have worked to collect seed from alpine plants for long-term preservation at the National Laboratory for Genetic Resources Preservation and to voucher alpine species to increase our understanding of alpine plant distribution and biodiversity. Additionally, scientists at Denver Botanic Gardens are researching how well these alpine species survive in a seed bank through artificial-aging experiments (16). As we work toward the targets here in Colorado, we are recruiting partner organizations to continue this work in other states and provinces.

The next big step for the alpine list will be to migrate it to the [Alpine Strategy’s website](#), making it readily ▶



Delphinium alpestre, the alpine larkspur, growing along the border of Summit and Park Counties near Boreas Mountain. © Emily Griffoul



The rare Colorado endemic *Ipomopsis globularis*, or Hoosier Pass ipomopsis, is extremely fragrant and distinctive. It is restricted to the alpine zone and found only in the Mosquito Range. © Emily Griffoul

◀ available to museums, universities, governments, native plant societies, and the public. Profiles of alpine plants with photos will be added and will help achieve the goals of furthering the understanding of North America's alpine flora. A publicly available list can also be used to illuminate gaps in alpine plant knowledge, providing opportunities for partners and community scientists to fill in these gaps.

In that vein, we welcome feedback on the alpine plant list. The [Colorado alpine list](#) can be found on the CoNPS website. If you are interested in reviewing the full list of all the alpine plants in North America, please let us know and we'd be happy to send it. This is a dynamic document that will evolve with our understanding of where these taxa fall in the evolutionary tree, and as plant names change to reflect such knowledge. We have tried to include the most up-to-date information available, but if you notice any errors or omissions or have expertise that could address gaps in North American alpine plant knowledge, we would love to hear from you! Please fill out this [form](#) to submit feedback on the list, or email us directly. Additionally, if you are researching alpine plants or habitats, join our [Alpine Strategy Network](#)! We are compiling a database of all the alpine research happening so we can identify gaps in knowledge. And if you are looking for more ways to get involved in the Alpine Strategy, check out the new Colorado Alpine Ecoflora project [here](#). This is a community science botany project powered by iNaturalist, the free, easy-to-use nature observation app, which will help us understand the distribution and phenology of alpine plants in our state, and that we hope will inspire our botany community to appreciate these amazing plants even more.

Emily Griffoul joined Betty Ford Alpine Gardens in 2020 as the conservation scientist, and leads the Gardens' implementation of the Alpine Strategy through field collections and her role as the project coordinator. She has previously worked in ecological and conservation research all over the West and received a master's degree in ecology and evolutionary biology from University of California, Irvine. Emily is particularly interested in connecting and engaging with the public and invites everyone to come learn about conservation science and what we can do to protect alpine habitats! emily@bettyfordalpinegardens.org

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Web addresses

Colorado alpine list: <https://conps.org/wp-content/uploads/2023/02/CONPS-List.xlsx-Final-1.pdf>

Feedback Form:

<https://docs.google.com/forms/d/e/1FAIpQLSfMtGHJKIKOtqPIDSIdnXckyMBxA01BRJA5YwuHZmBZhEZBQ/viewform>

Ecoflora project:

<https://www.inaturalist.org/projects/colorado-alpine-ecoflora>

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Penstemon harbourii, Harbour's penstemon, is a rare Colorado endemic, G3/S3S4. © Emily Griffoul



Phacelia sericea, silky phacelia or purple mist, overlooking the Gore Range from Uneva Peak. © Emily Griffoul

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Alpine Climate Change in the News

Research at the Rocky Mountain Biological Laboratory (RMBL, pronounced “rumble”), located near Crested Butte, has focused on the long-term relationships between climate and ecology in subalpine and alpine habitats. Learn more about their research from the following articles: <https://bigpivots.com/warming-meadows/> and <https://bigpivots.com/study-finds-complexity-to-climate-changes-underway-at-9500-feet-in-colorado/>

Colorado’s other high-elevation research stations are located at Niwot Ridge, which houses the CU Boulder’s Mountain Research Laboratory (<https://www.dailycamera.com/2022/06/18/cu-boulders-mountain-research-station-celebrates-100-years-studying-alpine-ecology/>) and the Institute of Arctic and Alpine Research (INSTAAR) laboratory (<https://www.colorado.edu/today/2022/09/12/study-impacts-longer-hotter-summers-ecologists-haul-5000-pounds-sand-mountain>).

Ongoing Monitoring for the Endangered Pagosa Skyrocket

By Savanna Smith

Background on Species and Conservation Actions

Pagosa Springs may be famous for its hot springs, but this small town in southern Colorado is also the primary home for an endangered rare plant—the Pagosa skyrocket (*Ipomopsis polyantha*). This plant is only found in Archuleta County, in the vicinity of Pagosa Springs. The striking forb is a member of the phlox family (Polemoniaceae) and sports dozens of flowers clustered along the length of the rachis (flowering stalk). The small, insect-pollinated flowers are white to light pink and flecked with purple spots, making them a beautiful sight for those who stop to look closely.

The plant's rarity stems from its restricted geographic range as well as its habitat specificity. Plants are primarily found on the slopes or the toe slopes of Mancos Shale soils. It grows in open grasslands or on the edges of open forests, in a narrow elevation band ranging from 6,800 to 7,300 feet (1). The species is ranked G1/S1 by the Colorado Natural Heritage Program (CNHP), meaning it is critically imperiled on the global and state levels.

In addition, it was federally listed as an endangered species under the Endangered Species Act in 2011. It is also considered a Tier 1 Plant of Greatest Conservation Need by Colorado Parks & Wildlife (2).

Several rare plant conservation partners have worked together for many years to ensure the continued protection and monitoring of this species. The Colorado Natural Areas Program (CNAP) helps manage and conduct annual monitoring at the Pagosa Skyrocket Natural Area, a small, 88-acre property southeast of Pagosa Springs that is estimated to contain at least 50 percent of the known individuals for the species—the largest subpopulation. Historically, the Natural Area was owned privately and used for light horse grazing.

Archuleta County purchased the site in 2010 and initially planned to develop the property for public recreation. However, once it was discovered that a federally endangered species occurred on the property, these plans were scrapped and CPW purchased the site in 2016, using funding from the US Fish & Wildlife Service (USFWS). The parcel was formally designated as a State Natural Area in 2017 and is managed for the protection of the Pagosa

skyrocket. CNAP currently works with the USFWS to ensure that monitoring contributes to the Endangered Species Act recovery goals.

Current Monitoring Methods

Since the site's designation as a state Natural Area, CNAP has been conducting research on *I. polyantha* (3). Last year marked the sixth year of CNAP-led annual monitoring at the site. Partner organizations such as the CNHP and USFWS join the effort most years. Annual monitoring efforts occur in just a few days' time in mid-June to align with peak flowering time.

Our primary goal of monitoring is to ascertain the trend of the skyrocket subpopulation at the Natural Area: Is it stable,

increasing, or decreasing? In 2020, CNHP staff began complementary monitoring at other sites throughout the species' range, enabling a fuller understanding of how the entire species is doing. To answer our question at the Natural Area, we set up two study designs: two permanent macroplots, and several randomly placed 1m² samples throughout the property. The macroplots enable a robust quantitative measure of the trend of Pagosa skyrocket over time within the boundaries of the plot. These also complement the macroplots placed in other areas throughout the species' range. One macroplot, Macroplot North, is located along the middle and toe of a west-facing slope below a barren knoll of Mancos Shale. The Natural Area is peppered with these ►



Figure 1. Pagosa skyrocket, *Ipomopsis polyantha*, flowers. © Raquel Wertsbaugh, CNAP



Figure 2. Pagosa Skyrocket Natural Area, June 2019.
© Raquel Wertsbaugh, CNAP



Figure 3. Pagosa skyrocket 2022 Monitoring Crew.
© Emma Balunek, CNAP

◀ sparsely vegetated knolls, where only a few native species and another rare plant, the smooth Easter daisy (*Townsendia glabella*), grow. Our other macroplot, Macroplot South, is located slightly downslope of one of the many irrigation ditches that cross the property. At both macroplots, we randomly select subplots each year and collect data on the number of plants at different points in their life cycle.

We also conduct property-wide sampling, which allows us to estimate the annual population of *I. polyantha* in the entire Natural Area. It entails taking counts of juveniles and adults within randomly placed 1m² frames throughout the occupied habitat in the site. Extensive mapping in 2011 by Ecosphere (a local environmental consulting firm) produced a detailed map of the Natural Area with all areas of occupied habitat delineated, totaling roughly 26 acres. The random sampling throughout the entire property enables calculation of a property-wide estimate of skyrocket density, which is then multiplied by the total area of occupied habitat to come up with an estimate for the total number of Pagosa skyrocket on the Natural Area.

While population numbers are the primary objective of our annual monitoring, we are also investigating several other questions about the species' life history. A secondary goal is to investigate the environmental attributes that contribute to Pagosa skyrocket's ideal habitat. Since the Natural Area contains the highest density of plants known within the species' range, this is an ideal study site from which to learn. Over the years, we've taken measurements on soil-infiltration rates, vegetation community composition, slope, aspect, and more. In 2019 and 2020, we set up soil-monitoring stations near both macroplots. The sensors at these stations collect hourly data, 365 days a year, on soil temperature at 10 cm and soil moisture at two depths (5 cm and 15 cm). These depths were based on observations of Pagosa skyrocket rooting depth. Lastly, we are learning more about the

demography of the species. Pagosa skyrocket is known to be a short-lived, monocarpic perennial that occasionally acts as a biennial. Under favorable conditions, the biennial plants will germinate and overwinter in year one, and then send out a flowering stalk, reproduce, and die in year two. However, rosettes are known to stay in the vegetative stage for multiple years before flowering, presumably waiting for the combination of adequate resources and other favorable conditions. We have recently set up several permanent demography plots across the site that allow us to follow the fate of individual plants over time. This will help us interpret the trends we see in the ▶

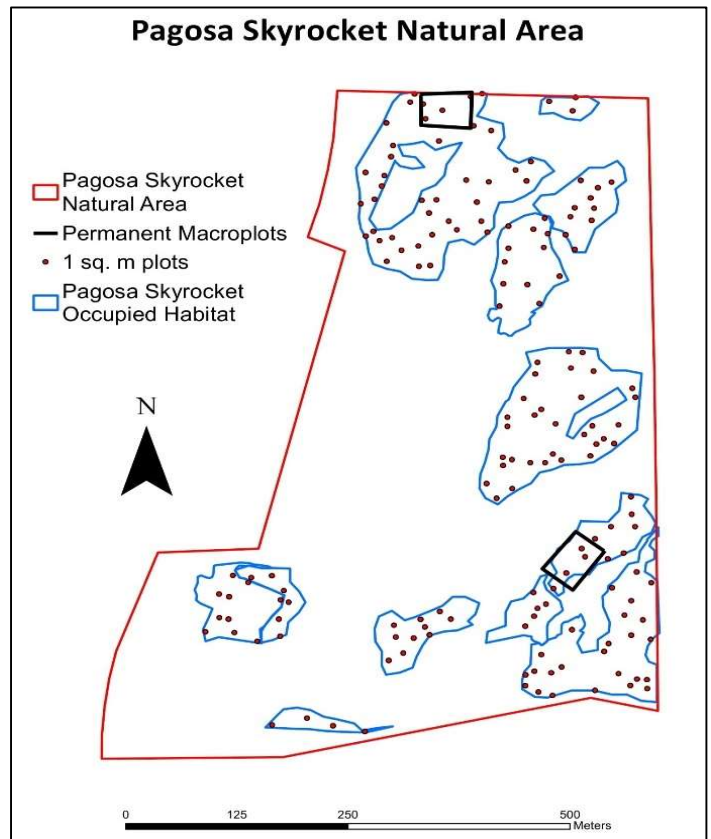


Figure 4. Diagram of the Pagosa skyrocket monitor sampling. © Savanna Smith, CNAP



Figure 5. Researchers count plants in a 1m² plot.
© Lucy Haggard, CNAP

◀ macroplots and allow correlation of plant phenology with weather conditions and other variables.

Preliminary Results and Trends

Data collection at Macroplot North occurred from 2018 to 2022. The average density of Pagosa skyrocket ranged from a high of 2.4/m² in 2019 to a low of 1.0/m² in 2022. At Macroplot South, data was first collected in 2018, then from 2020–22. The average density in this plot has ranged from 11.9/m² to 24.5/m². Macroplot South is located downslope from an irrigation ditch. We believe that the extremely high density of Pagosa skyrocket here is due in part to supplemental moisture related to the ditch. The data from the soil monitoring station supports this hypothesis—soil moisture is generally higher on average and more consistent, meaning the site is likely supplemented by irrigation seepage during dry periods.

Across the property, the total number of Pagosa skyrocket plants has also had high annual variation. In 2019, we estimated over one million plants, with seedlings and rosettes making up the majority of plants. Precipitation was much higher in 2019 than in

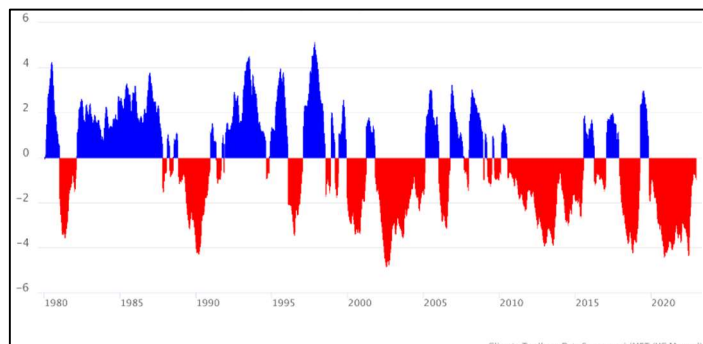


Figure 6: Palmer Drought Severity Index for Pagosa Springs, CO, 1980–2022. Periods of drought are represented by negative numbers (red), while positive numbers (blue) indicate wetter conditions. Source: [Historical Climate Tracker](#)

any other year sampled, likely leading to the large number of juveniles. Another interesting trend is a decline in the number of juveniles and an increase in the number of adults since 2019. This trend has also played out at Macroplot North and in other areas throughout the species' range. As a short-lived perennial, this may represent a natural cyclical demographic trend for the species where the relative ratio of basal rosettes to flowering plants fluctuates predictably over a three-to-four-year cycle. Of course, climate—specifically the timing and amount of precipitation—is likely a large driver behind trends as well (Figure 6). Further years of data collection on density, demography, and climate will help clarify the drivers behind population fluctuations.

Observations and data collected over the years have begun to provide insight into the important environmental variables that make up ideal Pagosa skyrocket habitat. Earlier observations by other researchers indicate that Pagosa skyrocket is adapted to some level of disturbance—a common characteristic of short-lived perennials and biennials (4,5). Within its range, we hypothesize that the highest density of Pagosa skyrocket is found in areas of moderate bare ground. Areas with high amounts of bare ground are correlated with low water infiltration and inhospitable soil types. Areas of low bare ground are indicative of higher competition for resources. We also think that slope and slope position play a role in density. Areas with steep slopes have high levels of erosion, moving seeds downslope. Plants are often found at the lower end or toe of slopes, where they receive additional moisture during precipitation events due to runoff from the steep, impermeable shale knolls above.

With all this data collected, you'd think we'd have figured out everything there is to know about the species! However, trends can be difficult to interpret due to the myriad of different factors at play. Temperature ▶

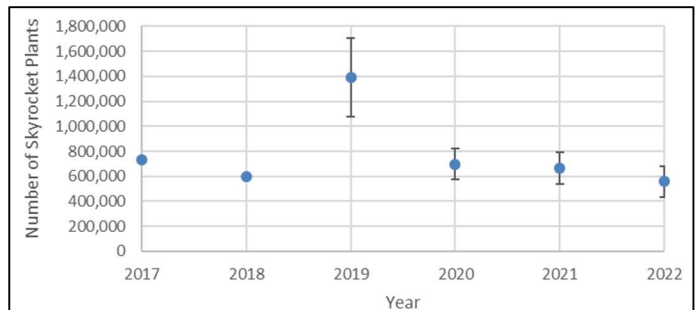


Figure 7. Estimated total number of *I. polyantha* plants in occupied habitat, 2017–22. The estimated number is calculated from the average density of Pagosa skyrocket plants per m² multiplied by area. Estimated occupied habitat varied from 25.4 to 27.12 acres due to slight mapping differences. Confidence intervals of 80% are shown for 2019–22, but could not be constructed for 2017–18 due to different sampling methods.



Figure 8. A researcher flags adult Pagosa skyrocket plants in Macroplot South. © Lucy Haggard, CNAP

their work on this project over the years—setting up the monitoring protocols, tirelessly counting plants each year, and continuing to provide valuable expertise and insights into the data.

Savanna Smith is a botanist contracted to the Colorado Natural Areas Program at Colorado Parks & Wildlife. She has extensive experience monitoring rare flora across Colorado and has led the annual monitoring at the Pagosa Skyrocket Natural Area for the past two years. Savanna is deeply interested in understanding the complex interactions that make up Colorado's diverse ecosystems, and is always seeking new opportunities to learn and grow in her field.

Web Addresses

State Wildlife Action Plan Rare Plant Addendum:
<https://cpw.state.co.us/Documents/CNAP/Rare-Plant-SWAP-2015.pdf>

Historical Climate Tracker:
<https://climatetoolbox.org/tool/Historical-Climate-Tracker>

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◀ and precipitation, as well as the numbers of the plant itself, can vary drastically from year to year. Long-term monitoring is essential to disentangle the natural population fluctuations from any sort of true species trend. Of course, there is also the question of climate change and how resilient the species will be to warming temperatures and changing precipitation patterns. As we collect more data, we should be able to correlate population fluctuations with seasonal precipitation, allowing better understanding of the species' trend and climate drivers. All this is to say, we will be keeping an eye on this plant for years to come. Though it is too soon to say anything conclusive about the long-term fate of the Pagosa skyrocket, we are hopeful that enhanced awareness, knowledge, and appreciation of the species will contribute to recovery, enabling it to persist for years to come.

Acknowledgements

I thank all of the CNAP field technicians and CNHP Siegele Interns for their help in collecting data over the years. Thank you to Raquel Wertsbaugh at CNAP for the continued support for this work. Special thanks to Jessica Smith and Renee Rondeau at CNHP for all

◀ "Green roofs..." continued from page 8

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Provenance and Trees

By Jim Borland

Followers of the TV show *Antiques Roadshow* are familiar with the importance of the provenance of each piece presented. Typically, the appraiser wants to know how old the piece is, where it came from, who owned it, what the original purchase price was, and who made it. Though this information gives the viewer a somewhat titillating look into private lives, it also gives the appraiser the information he or she needs to appraise the authenticity or quality of the object, and thus its worth.

Similarly, provenance with regard to plants gives foresters information they need to assure the success of a reforestation project. Success in reforestation, however, looks different from success in planting a tree in your backyard. In your backyard, you have control over appropriate planting times, proper planting sites, hole preparation, aftercare, including staking if needed, and watering. Note that none of these elements are geographical, geological, meteorological, or pedological (pertaining to soil characteristics) in nature. A nursery has control over similar aspects of plant growth. Except for cold hardiness, nurseries have seldom been concerned with other provenance issues, or origins of the tree if dug from the wild, or seed source if grown from seed.

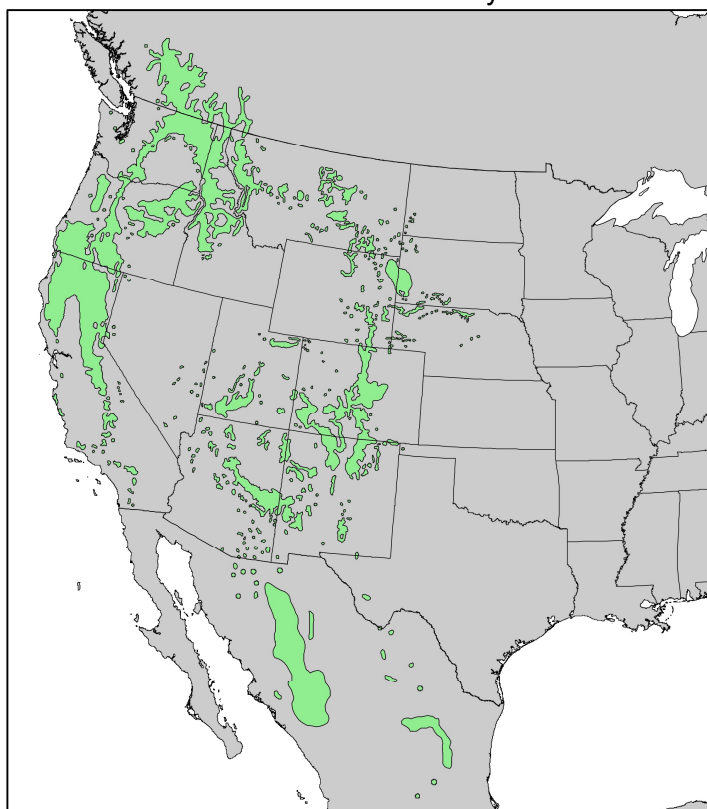
Trees planted in a forest setting need not only to survive on their own, but also to thrive and, most important, eventually give rise to healthy, future generations of trees. They and their progeny must be fully suited to the altitude, latitude, precipitation patterns, temperature patterns, day lengths, soil textures, depths and pH, growing-season lengths, and so on, at the planting site where they are growing.

All ponderosa pines (*Pinus ponderosa*), for example, are grown from seed, whether planted by Mother Nature or by a nursery staffer in the greenhouse or in the field. As such, each tree is genetically different from every other tree and thus reacts slightly differently to a common set of environmental conditions. Each “group” of seeds sown, although composed of genetically different individuals, probably came from one source that generally will react differently to environmental conditions than another

group of seeds from another source. Each year’s planting may consist of seeds from a “group” different from those of previous years. Seed selections are typically based on seed price first and only secondarily on how well the seeds will grow or how fast they will respond to their growing soils and the local climate. It is assumed, if any thought goes into it at all, that if trees grow well in a nursery setting, they likewise will do well in any domestic landscape. This, however, is where the whole growing equation disintegrates.

The full natural range of the ponderosa pine extends south from British Columbia along the entirety of the Pacific Coast to Durango, Mexico and east to North and

South Dakota, from sea level to 10,000-foot elevation. Within this range resides what most botanists recognize as two distinct varieties: *ponderosa* and *scopulorum*. These are again subdivided into major geographic races, three for variety *ponderosa* and two for *scopulorum*, the latter known as the Rocky Mountain races that occupy the northeastern portion of the species’ range.



Ponderosa pine range map. From USGS Geosciences and Environmental Change Science Center: Digital Representations of Tree Species Range Maps from "Atlas of United States Trees" by Elbert L. Little, Jr. https://commons.wikimedia.org/wiki/File:Pinus_ponderosa_%26_arizonica_range_map_1.png

“Provenance...” continued on page 21 ►

Plant Profile

The Mighty Ponderosa Pine Tree and Its Amazing Ecosystem

By Carol English

In the heat of the summer, wrap your arms around a ponderosa pine tree, *Pinus ponderosa*. Wiggle your nose into the bark and smell its pure sweetness. Some say it smells like butterscotch; others say it smells like vanilla. I say it smells divine, taking me back to my childhood when my mom would bake cakes in our old kitchen. Once, when I was guiding some boys on an Outward Bound course in the Sierra Nevada mountains, I was accused of hiding a vanilla soda in my backpack. One of the boys had looked at me and said, "You are hiding a vanilla soda in your pack! You need to share that now." "I promise you I do not have a soda," I replied. "Smell this tree my pack is leaning against. This is what you smell, and it is the sweetest, most soothing smell you will experience."

I'm not sure I ever convinced that youngster, but the ponderosa pine tree's distinctive smell comes from chemicals in the bark called terpenes. Abert's squirrels, also called tassel-eared squirrels (*Sciurus aberti*), can smell the terpenes. They not only smell them, they can distinguish tasty terpenes in one tree from the non-tasty terpenes in a different tree. Tassel-eared squirrels are entirely dependent on ponderosa pines for their survival. They eat the inner bark in winter and the pine nuts and pine cones when they are available, typically in the warmer seasons.

These squirrels also help the trees in a few different ways. They disperse the pine seeds, thin out the forest naturally, and spread a type of mycorrhizal fungus the trees need for survival. Ponderosa pines depend on the underground mycorrhizal fungus. The fungus attaches itself to the tiniest of tree roots, assisting the tree with mineral nutrition, water absorption, and disease resistance, all of which allows the tree to survive in dry conditions. The reproductive portions of the fungus pop up as mushrooms in late summer. The squirrels eat the mushrooms, then poop and spread the spores, thus spreading the fungus.

In late fall and winter, when pine nuts are scarce, tassel-eared squirrels survive on the thin living tissue

layer under the bark, called the cambium. After choosing a tree with the proper terpene taste, kind of like humans choosing their favorite type of ice cream, the squirrel grabs a small branch, bites off the pine needles, and proceeds to eat the little stick, rotating it with its tiny hands like it's feasting on an ear of corn. It shaves off the bark with its sharp teeth and eats the very thin inner cambium layer. When it is finished, the squirrel drops the now light-brown core to the ground.



An Abert's squirrel eating the seeds of a ponderosa pine cone. © Carol English

As you stroll through a stand of ponderosa pine trees, you may notice pine needle bundles on the ground, along with pinky-finger-size, barkless sticks. They are all signs that tassel-eared squirrels have been dining on a tree's sweet cambium layer. I have seen these signs while walking in Willow Creek Park in Crestone, Colorado, where there is a small grove of ponderosa pines. The squirrels will return to the same tasty tree again and again. Eventually, the tree may become so stressed that it dies. This is not a bad thing; it is nature's way of thinning out the forest. If the ponderosa forest is too crowded, the trees become unhealthy, and competition for water and nutrients increases. Long ago, horse carriages could easily drive

through a ponderosa pine forest because the big healthy trees were spaced far apart.

Thinning the forest is also critical to the fire regimen, another very important player in this ecosystem. In a natural ponderosa pine forest, fire will come through about every 30 years, clearing out the duff and small, sickly trees. Large, mature, healthy trees are typically not harmed by these fires as the fires tend to be slow-moving, low-intensity, ground-burning fires that would simply scorch the bases of the mighty pines. Because humans have suppressed fire in these forests for so many decades, duff has accumulated and the forests have become too crowded. Now, when a fire comes through, it is fueled with more duff and more little sick trees, growing way beyond a ground fire and killing even the strongest mature trees.

"Ponderosas..." continued on page 32 ►

Restoration Roundup

Wildlands Restoration Volunteers Collect Cones for Forest Recovery

By Cameron Taylor

Recent catastrophic fires, such as the Cameron Peak and Calwood fires of 2020, have led to large-scale landscape restoration efforts in Colorado conifer forests. As a result, there have been increased efforts by not-for-profit organizations and collaborative groups to help bring these ecosystems along in their recovery. One such organization is the Wildlands Restoration Volunteers (WRV), whose mission is to heal the land and build community by empowering communities and volunteers to take restoration efforts into their own hands through participation in various projects.

One project offered by WRV is the planting of ponderosa pine seedlings in the areas most severely impacted by recent wildfires. Many of these areas are not experiencing the expected amount of natural regeneration given the high severity of these fires resulting from decades of fire suppression. Historically, fires occurred more often but were less severe, allowing ponderosa pines, which are fire tolerant (evidenced by their thick bark and tall crowns), to survive. As a result of less-frequent but higher-intensity fires that kill even the most fire-adapted species, ponderosa pines face an uphill battle in their natural regeneration from seed. WRV and its partners seek to supplement natural regeneration by strategically planting ponderosa pine seedlings in areas most conducive to their long-term survivability, considering environmental factors such as slope, aspect, burn severity, and previous cover types.

Unfortunately, because the scale of the spread of recent fires, there is now a shortage of ponderosa pine seedlings available for restoration efforts. To ease these constraints, WRV has collaborated with several organizations such as the Coalition for the Poudre River Watershed, the Big Thompson Watershed Coalition, and the Nature Conservancy (to name a few) on Cameron Peak reforestation. These partners have begun efforts to locally source seed from mature ponderosa pines adjacent to burned areas and at similar elevations as those areas they seek to restore.

To do so, WRV and its volunteers first scout locations where mature cones can be collected. Cones must be collected as soon as they are ripe (when they change color from greenish yellow to purplish brown), before the scales of the cone open and the seeds drop. This usually happens in September and October. Harvesting too early might result in unviable seeds; too late, and the seeds will have dropped already. Once healthy, mature, cone-producing trees have been identified, WRV volunteers use pruning poles to remove cones from accessible branches, ensuring they do not remove more than 10–20 percent of the cones from any individual tree. One cone can contain upward of 50 seeds!

It's also important to note that some years may be better than others, given various climatic factors and that any given year may be a mast year in which entire forests of ponderosa pine will produce substantial amounts of cones compared to other years. Harvested cones are stored in a dry location where they can cure, resulting in the scales of the cones opening to reveal the seeds housed within them. WRV and the Cameron Peak Reforestation group have pooled their resources and sent harvested cones to a processing facility in Bend, Oregon, to ensure only viable seeds remain. Once the seeds are returned, they will be grown in professional nurseries across the Rocky Mountain region to later be used in ongoing forest restoration efforts.

In all, while there is much work to be done to restore ponderosa pine forests, groups such as WRV and the Cameron Peak Reforestation group are finding new and creative ways to engage with and empower the public to restore landscapes impacted by high-severity fires. Given the ponderosa pine's fire and drought ►



WRV and their collected ponderosa pine cones. © WRV



A WRV volunteer gets ready to transplant ponderosa pine seedlings. © Annemarie Fussell

pinus belong here and are well suited to weather the challenges that lie ahead due to climate change. WRV hopes that someday fire may return to playing its important role in our forests.

Cameron Taylor is the forests project manager for the Wildlands Restoration Volunteers. Born and raised in the foothills of Colorado, Cameron has always had an appreciation for stewardship and the outdoors. Restoration first piqued Cameron's interest after he participated in the Rocky Mountain Youth Corps immediately after high school. From there, he received his undergraduate degree in forest biology from Colorado State University. After working for the USGS, where he focused on post-fire effects on forests, he served in the Peace Corps, addressing local environmental issues in rural Malawi. Through this work, Cameron realized that the best way to use his skills to help others and the environment was through the further advancement of a career in stewardship. This led him to obtain his master's degree in Natural Resources Stewardship-Ecological Restoration Specialization from CSU. When he is not working for WRV as a project coordinator, he likes to raft, kayak, climb, fish, and play music along the Poudre River.

References

<https://www.nps.gov/articles/wildland-fire-in-ponderosa-pine.htm>

https://www.fs.usda.gov/rm/pubs_journals/2019/rmrs_2019_korb_j001.pdf 🌀

◀ tolerance, it is imperative that we ensure its ongoing presence on our landscapes. Ponderosa



◀ **“Provenance...”** *continued from page 18*

Within each variety, race, and further subdivisions are “groups” that respond in measurably different ways to differences in growing-season length, soil texture, depth, pH, elevation, and average growing-season temperature, among others. Responses to these differing conditions include flowering periods, pollen-shedding periods, cone development, seed shedding, specific gravity of ripe cones, number of seeds per cone, temperatures at which roots grow best, rate of growth (e.g., diameter, height, etc.), stem form, needle length, initiation of leader growth, seasonal pattern of root growth, ability to germinate under moisture stress, reaction to biotic and abiotic factors, nutrient status, incidence of animal damage and frost injury, and wood-specific gravity, among many others.

Failure to match these group features to the conditions found at the planting site jeopardizes the future of the species as well as the individual tree. For example, ponderosa pines grow on all slope aspects in the Rocky Mountains. In east-west canyons on the East Slope they grow on both the north-facing and south-facing slopes. During certain springs, huge clouds of pine pollen rise on the wind and often travel for miles, certainly from one side of the canyon to the other. Yet, although the pollen is spread far and wide, the genes don't mix. Research shows that the genes

of trees on north-facing slopes do not find their way into new trees growing on the south-facing side of the canyon, and vice versa. Trees on either side of the canyon are genetically different and remain so by inter-fertilizing their own clan.

Foresters are becoming wise to this location specificity. For example, in central Idaho, the Forest Service ensures that planted seedlings of ponderosa pine originate from within 600 feet elevation of the planting site.

In conclusion, it's important to understand the specific location needs of what you are planting, and to understand that even though you may have "textbook" growing conditions, the species may have even more specific requirements than you can know. If you want to ensure planting success in your home garden, it might be best to pick a species that has been proven to grow in a variety of conditions. Reforestation efforts should utilize seed sources from nearby locations whenever possible.

Jim Borland has been fooling around with native plants for more than 40 years in private, commercial and public venues. His home garden contains thousands of native plants, most grown from seed at home and not supplementally watered for 20 years. Jim has written hundreds of articles, given talks too numerous to count and continues to grow and plant the two or three native plants not yet in his garden. 🌀

Member Profile

Jill Handwerk, A Giant of Rare Plant Conservation

By Jessica Smith and David Anderson

Jill Handwerk has been a key contributor to both the Colorado Natural Heritage Program (CNHP) and the Colorado Native Plant Society over the past three decades. Jill is retiring from CNHP in early 2023, providing this opportunity for a retrospective of a career dedicated to conservation and service.

Jill joined CNHP in 1996. She has worked with numerous partner agencies during that time, including

Colorado Parks & Wildlife, US Fish & Wildlife Service, the Bureau of Land Management, US Forest Service, non-profits, herbaria, local governments, and volunteers through CNHP's Adopt-a-Rare Plant program. Jill led the creation of the Rare Plant Addendum to Colorado's State Wildlife Action Plan (SWAP). The 2015 addendum is significant to rare plant conservation in Colorado as it added plants to the SWAP for the first time. The Rare Plant Addendum was an outgrowth of the work of the Rare Plant Conservation Initiative, formed by a team of numerous partners culminating in a Colorado Rare Plant Conservation Strategy written in 2008. The SWAP is an important policy document that serves as a roadmap to conservation for species of greatest conservation need in the

state. Jill also contributed to CNHP's comprehensive report, *The State of Colorado's Biodiversity*, in 2011.

Jill has also been a dedicated member of CoNPS, serving as president from 2000–2004 and on the board of directors from 1997–2004. She was a primary organizer of the Rare Plant Symposium for 18 years, leading the review of Colorado's Threatened, Endangered, G1, and G2 plants. The Rare Plant Symposium is an annual meeting held in conjunction with, and on the Friday before, the Colorado Native Plant Society Annual Meeting. Jill

was recognized for her service to CoNPS in 2015 as the recipient of a Special Merit Award.

Jill grew up in Colorado and received a Bachelor of Science in Horticulture from Colorado State University in 1977. She received a Master of Science in Agricultural Business Management from the California Polytechnic State University in 1983. She worked at Cargill Hybrid Seed in Fort Collins for nine years

before joining CNHP as the botany information manager—and the rest is history. Often, when Jill's twins, Emily and Elliot, were young, the halls of CNHP would be brightened by their presence as they spent time at work with Jill on days when they did not have school, and sometimes on afternoons after school. Their art from those days has decorated Jill's office for many years. The growing season started for years at CNHP with Jill's Easter Party. Jill has always been a very warm, hospitable person, housing some CoNPS members when the Annual Meeting was taking place in Northern Colorado, and housing CNHP staff when they came to the Front Range from the West Slope for meetings or field travel.

Time flies and, 26 years later, Jill has spent countless hours with boots on the

ground monitoring and surveying for rare plants across Colorado. Some highlighted projects include developing the use of drones to monitor Parachute penstemon (*Penstemon debilis*) on the sheer cliffs of the Roan Plateau and alpine monitoring of the Mosquito Range mustard (*Eutrema penlandii*) with Carol Dawson, Steve Olson, Dee Malone, and other friends. During her time at CNHP, the number of records in CNHP's statewide database has grown from roughly 4,000 to more than 23,000 mapped locations of plants. She became the Botany Team

“Jill Handwerk...” continued on page 29 ►



Jill Handwerk with a funky thistle, *Cirsium funkiae*.
© Pam Smith

News, Events, and Announcements

Please check the **Calendar of Events** online at <https://conps.org/event-calendar-2/#!calendar> for up-to-date information on webinars, chapter meetings, garden tours, field trips, and other events.

CoNPS may offer some chapter meetings, workshops, and lectures as webinars or other online meetings. Others might be postponed or canceled. Information will be posted online and will be promoted via the CoNPS E-News.

CoNPS-Sponsored Events



Webinar: Habitat Gardening and Native Plants for Year-Round Interest

February 11, 9:30AM–12:00NOON

Presenter: Irene Shonle

Want to bring beauty to your garden while making a difference for our native pollinators and birds, right in your own yard? Then, this webinar might be for you! It's designed for anyone who wants to create an oasis for pollinators and other wildlife while bringing more color and beauty into the world. The first half of this webinar will cover the importance and how-tos of habitat gardening. The second half will discuss what to plant for color, texture, etc. for year-round interest—delighting both you and the creatures that inhabit your garden. Members, \$25; non-members, \$35.

Irene Shonle, PhD, is the horticulture associate for Colorado State University Extension in El Paso County and has worked extensively with the Native Plant Master program. She is also a former Vice President of CoNPS. Irene has taught in the field, in the classroom, and at conferences around the State; and she gardens mostly with natives at her home and in demonstration gardens.



Webinar: The Sandsage Prairie of Colorado: A Biodiversity Hotspot Hiding in Plain Sight

February 18, 9:30AM–12:00NOON

Presenter: Jim Locklear

Sandsage prairie is an ecological system unique to the central and southern Great Plains. A blend of grassland and shrubland with sand sagebrush (*Artemisia filifolia*), the signature species, sandsage prairie occurs in discontinuous tracts across eight states in association with dune fields and other areas of sandy habitat. Colorado has more sandsage prairie than any other state, an estimated two million acres on the eastern plains. This overlooked and underappreciated ecological system hosts a

surprisingly high level of biological diversity, including many regionally endemic plants and animals, ecological specialists, and species of conservation concern. The aim of this introductory webinar is to raise awareness of the importance of sandsage prairie as a biodiversity refuge and hotspot for Colorado and the Great Plains. Members, \$25; non-members, \$35.

Jim Locklear has been Director of Conservation at Omaha's Lauritzen Gardens since 2010. Jim is the author of Phlox: A Natural History and Gardener's Guide and editor of the revised edition of the wildflower classic, Jewels of the Plains. His forthcoming book, In the Country of the Kaw, profiles the natural history of the Kansas River basin, including its headwaters region in eastern Colorado. Jim's research on sandsage prairie has been published in the Natural Areas Journal and The Journal of the Botanical Research Institute of Texas.



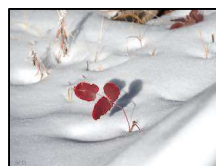
Volunteer at Harlequin's Gardens

February 18, 10:00AM–12:00NOON

Hosted by Harlequin's Gardens

Please come join us to support our CoNPS Plant Sale partner and sponsor, Harlequin's Gardens. We can help grow the plants for our CoNPS Plant Sale by volunteering at the nursery. We can also help by donating seed for the propagation efforts.

<https://conps.org/home-2/events/event-calendar-2/#!event/2023/2/18/volunteer-harlequin-apos-s-gardens>



Field Seminar: Winter Plant ID

March 11, 9:00AM–12:00NOON

Location: Littleton, Colorado

Leader: Beth Hanson

Stay tuned! Please see the CoNPS Event Calendar for further information.

Beth Hanson, MS, is a Park Interpreter and Volunteer Coordinator at South Suburban Parks & Recreation and a Native Plant Master. ►



◀ Webinar: How to Design a Native Plant Garden

March 16, 6:00-8:30PM

Presenter: Deryn Davidson

This webinar will cover the basics of the landscape design process and how you can apply them to a native plant garden. The elements and principles of design, site analysis, water conservation, and plant selection will all be covered. Whether you're going to hire a pro or DIY, this webinar will give you the language and tools to create a beautiful native plant landscape for your home yard. The webinar is designed for people new to landscape design with beginner to intermediate native plant knowledge.

Deryn Davidson's passion for native plants and pollinators grew during her time as a horticulturist at the Ladybird Johnson Wildflower Center in Austin, TX. As the Sustainable Landscape State Specialist for CSU Extension, Deryn leads the Landscape for Life program and is responsible for supporting public and private efforts to create more sustainable and resilient landscapes across the state.

San Luis Valley Chapter Meeting

February 14, 6:00–7:30PM, Virtual and In-Person

Chapter business will be discussed, including an update on planning the annual conference, upcoming hikes, and ideas for speakers.

Plateau Chapter Meeting

Speaker: Jim Pisarowicz

February 16, 7:00–8:30PM, Virtual

Come help us plan our 2023 season; Jim will give a talk as well. Details TBA.



Winter Botany Hike

Leader: Carol English

February 19, 10:00AM – 2:00PM

We will hike from North Crestone Creek Parking Area uphill for a couple of miles along the creek. We will look up close at many winter trees and shrubs, and some grasses and perennial plants.

Carol English has taught environmental education and high school science, worked as an interpretive specialist, and is a Native Plant Master. She researched and wrote a thesis on pollination biology for a rare Colorado penstemon. She now does consulting work on rare plants and wetland delineation.

CoNPS Chapter Events



Building Ecological Resilience in Grasslands

Speaker: Chris Helzer

February 9, 6:30–8:30PM, Virtual and In-Person

Hosted by the Metro-Denver Chapter

Grasslands are tough and resilient ecosystems, but that resilience relies upon several important factors. Ecological resilience is also strongly tied to humans, and has been for tens of thousands of years. So what's our role? How do we work with grasslands to maintain the species diversity and habitat heterogeneity they rely upon to survive and adapt to changing conditions? There's a lot of hope for grasslands and the species that rely on them (including ours), but it will take a concerted and thoughtful effort for us to ensure that future.

Chris Helzer is Director of Science for The Nature Conservancy in Nebraska, where he conducts research and evaluates prairie management and restoration work. He is also dedicated to raising awareness about the value of prairies through his photography, writing and presentations. Chris is author of two books, The Ecology and Management of Prairies in the Central United States and Hidden Prairie: Photographing Life in One Square Meter, and the blog, The Prairie Ecologist (<https://prairieecologist.com/>).



The Power of Citizen Science: eBird and iNaturalist at Cross Creek Park

Speaker: David Rudin

February 21, 6:00–8:00PM, Virtual
Hosted by the Southeast Chapter

Dave will talk about two citizen science projects he has been involved with at the Cross Creek Regional Park in Fountain, just south of Colorado Springs. Dave used eBird and iNaturalist to document plants and animals at the park prior to the start of major renovation work on the dam within the park. He has led guided birding hikes, organized a Bug Bioblitz, and did monthly plant surveys with Curt Nimz while helping people connect to the park.

Dave Rudin grew up exploring the hills and valleys of the northern Appalachian Mountains in southwest Pennsylvania. He has been leading guided birding hikes in the Pikes Peak region for over ten years and has birded across the United States and in Mexico and Central America. He has really been a naturalist his whole life. Professionally he has been a teacher for over 20 years, both as a public-school elementary teacher and an environmental educator. ▶

◀ Native Plant Restoration in the Mancos Canyon

Speaker: Hannah Ertl

**February 28, 6:30–8:30PM, Virtual and In-Person
Hosted by the Southwest Chapter**

Hannah Ertl is the Indigenous Lands Ecologist for Trees, Water, People (<https://treeswaterpeople.org/>). The mission of this organization is to improve lives by helping indigenous communities in the western hemisphere to protect, conserve, and manage their natural resources.



Aurora Water-Wise Program

**Speaker: Amanda Slover
March 8, 6:30–8:30PM,
Virtual and In-Person**

Hosted by the Metro-Denver Chapter

The Aurora Water-wise Garden celebrates its 20th year through 2023 with new volunteer programs, plant collections, and studies. Located in the City Center, the Aurora Water Conservation's ten-acre garden is a cross between a wildscape and a manicured landscape. Learn more about their goals for their landmark anniversary and what Aurora is doing to conserve water in the landscape.

Aurora hopes you will discover vegetation to use in your home landscape by visiting the themed beds 'Go Native,' 'Z-zone,' and 'Pollinator's Paradise' for design techniques and landscape ideas.

See more at

https://www.auroragov.org/residents/water/landscaping/aurora_water-wise_garden and
<https://www.auroragov.org/residents/water/landscaping>

Water Conservation Specialist Amanda Slover manages the 10-acre Aurora Water-wise Garden with a seasonal staff and the volunteer program that supports them. Amanda founded the Aurora Seed Library, directs the Aurora Seed Farm, and leads Nome Park Community Garden. Amanda is passionate about educating Aurora in horticulture, especially through the lens of water conservation.



Use of Natives in Ornamental Landscapes

**Speaker: Alex Smith
March 16, 6:00–8:00PM,
Virtual**

Hosted by the Southeast Chapter

Alex's presentation will be on Colorado native plant substitutions for popular nonnative plants in the landscape. He will be reviewing principles of plant selection and how our choices can impact the future of Colorado's ecosystems.

Alex Smith has worked in the horticulture industry and is currently with the CSU Extension Service for El Paso County. He will be speaking at Progreen this year on marketing Colorado native plants. He is a new board member for the Colorado Native Plant Society.



Botanical Adventures in Belize

Speakers: Lauren Bansbach and Michael Remke

**March 30, 6:30–8:30PM, Virtual and In-Person
Hosted by the Southwest Chapter**

Lauren Bansbach and Michael Remke are instructors of biology at Fort Lewis College.

Weekend Botanizing in the Dominguez-Escalante National Conservation Area

**Leaders: Mary Menz and Jim Pisarowicz
April 21-24**

Celebrate Earth Day in a beautiful early-blooming location on the Western Slope. We'll meet at the Potholes Campground between Delta and Grand Junction.

This site is located in the Dominguez-Escalante National Conservation Area (elevation 4,800 to 8,000 feet), where we'll find the oft-overlooked and colorful pallid milkweed, Aztec milkvetch, cliff fendlerbush, and Indian breadroot, to name a few species. These species bloom for short periods of time and are habitat-specific. Each year brings a different perspective to the landscape, depending on winter precipitation, spring temperatures, and more.

We will have a group camp Friday night at the Potholes and Jim will give a night-time presentation on Spring-Fall blooms.

Questions? Contact either of us BEFORE Thursday, April 20. Mary Menz, mary.t.menz@gmail.com or Jim Pisarowicz, jim.pisarowicz@gmail.com



Ute Indian Museum Ethnobotany Garden Tour, Montrose

**Leaders: Mary Menz and Jim Pisarowicz
June 1, 8:30–10:30AM
Hosted by the Plateau Chapter**

Enjoy a guided tour of the Ethnobotany Garden and learn about native plants used culturally, ceremonially, and medicinally by the Ute People. Wear bug spray and a hat, and bring plenty of water to drink. ►

◀ Buckhorn Lakes Park Field Trip, South Montrose

Leaders: Mary Menz and Jim Pisarowicz

July 14, 8:30AM–12:00NOON

Hosted by the Plateau Chapter

Join us as we explore the Buckhorn Lakes areas, where we'll see many wildflowers and nonnative plants, too. We'll learn about the plants of this County Park that is typically overlooked, except by people who fish the several lakes.

CoNPS Committee Updates

Conservation Committee

The CoNPS Conservation Committee has two major goals. The first is to provide articles for the Conservation Corner column in each of the quarterly publications of *Aquilegia*, and the second is to provide public comment on issues that affect Colorado native plants and habitats.

The committee is co-chaired by Linda Smith, Brad Klafehn, and Mo Ewing and has about 20 members who volunteer to help with public comment and 12 who volunteer to write articles. We contributed four articles to *Aquilegia* in 2022.

We make two types of public comments: those that we write directly on behalf of CoNPS, and comments we sign onto that are written by other agencies.

In 2022, we wrote the following comments on behalf of CoNPS:

- In January, we filed protests against the Bureau of Land Management's (BLM) June 2022 oil and gas leasing sale which endangered rare plants in multiple leases across Colorado. Of the 119 potential tracts under consideration, BLM offered only six. Just three were bid on, and of those, only one was in a Potential Conservation Area identified by Colorado Natural Heritage Program (80 acres in Pawnee National Grasslands).
- In February, Denise Larson wrote comments on the Fish and Wildlife Service's Draft Recovery Plan for Parachute Beardtongue. CoNPS was the sole substantive commenter. On August 17, 2022, USFWS issued the final recovery plan (available at <https://ecos.fws.gov/ecp/species/7099>), which accepted about half of our recommendations.
- In May, Gay Austin wrote a botanical report on a dispute between a private developer and the town of Twin Lakes about an alleged diversion of a stream which affected some biologically important fens.
- In December, Brad Klafehn, with help from Susan Campbell, provided comments to the Colorado Oil

and Gas Commission on the detrimental effects of ozone on native plants, as part of a petition for rulemaking on the cumulative impacts of ozone. The Commission agreed to hold a stakeholders' workshop in preparation for future rulemaking on the subject.

Over the course of this year, we also signed on to the comments of other agencies regarding native plants:

- We signed on to a letter supporting President Biden's opposition to Investor-State Dispute Settlements in the North America Free Trade Agreement, which are used by countries to attack one another's climate policies.
- We signed a letter to several congressional committees to provide funding to the BLM and the USFS to recover threatened and endangered species and restore their habitats on our nation's public lands.
- We also signed a letter commenting on Willow Creek Land Exchange. A non-federal party was proposing to convey one parcel of land containing approximately 50.23 acres to the United States in exchange for one parcel of National Forest System land at the Winter Park ski area containing approximately 6.87 acres. The Forest Service expects a draft environmental analysis to be available in the spring.
- At the end of the year, we signed on to a letter to protect old growth forests in the US.

Grants Committee

The **Alice Eastwood scholarship** was awarded to Miles Moore, a student at University of Colorado Boulder. In his own words: "Enamored with the beauty of Colorado's native flora and their fascinating evolutionary histories, I am an amateur botanist, a research technician with the Institute of Arctic and Alpine Research, and a senior at the University of Colorado Boulder. A non-traditional student, I found my place in academic science after spending time in the AmeriCorps restoring trails in the backcountry of Colorado with the Rocky Mountain Conservancy. There, I discovered my interest in native flora, prompting me to begin my studies at Front Range Community College. Now, at CU Boulder, I study the ecology of native alpine hemiparasites, like *Castilleja occidentalis* and *C. puberula*. I use my programming and data analysis skills to study the long-term datasets related to Alpine-Tundra vegetation from the Niwot Ridge Long-term Ecological Research Program.

Receiving this scholarship means a great deal to both my wife and me, who are both full-time students and working full-time. Receiving this scholarship means I will take on less tuition debt to put myself ►

◀ through school, reducing our burden as a couple now and in the future.”

Horticulture Committee

Horticulture activities are at the heart of the CoNPS’s mission, engaging members and the public in the appreciation, knowledge, and conservation of native plants and ecosystems. Gardening and planting events and webinars occurred all over the state in 2022 and attracted many non-members.

Maggie Gaddis and Kathy Okon lined up a series of webinars in the spring on gardening with native plants. Denise Wilson organized the statewide native garden tours and many volunteers helped run the tours at members’ homes. Denise also organized and ran the native plant sale with assistance from volunteers. Other events were run at the chapter level, many without direct involvement of the Horticulture Committee.

Chapters organized native plant swaps in the spring and native seed swaps in the fall. These were collaborative events with other like-minded organizations, such as People and Pollinators Action Network, Wild Ones Front Range, Wildlands Restoration Volunteers, LWV Pollinator Habitat Group, Denver Botanic Gardens, and the cities of Colorado Springs and Fort Collins, among others. Leading up to these events, members engaged in seed collections and seed cleaning events. Seed from 2021 was available to volunteer growers, who germinated seed under lights in basements, in hobby greenhouses, and stratified seed flats under snow. Seed from 2022 is now available for growing out for 2023.

The Certified Native Garden Program certified several new gardens, all achieving gold or silver status. We hope some of these can be on the garden tours in 2023.

With two new board members, Alex Crochet and Alex Smith, both who have backgrounds in horticulture, we are looking forward to more collaborative activity in 2023. You may contact any of us to get involved. You can always amend your member profile to join the Horticulture Committee.

Media Committee

The Media Committee is a multi-functional committee within CoNPS, with the majority of its members involved in the production of *Aquilegia*, the CoNPS magazine that generally comes out four times per year. Media committee members also are responsible for the CoNPS website, our social and official groups on Facebook, and other social media postings such as Twitter, Instagram, SciStarter.org, and LinkedIn. With the advent of monthly committee meetings, we have focused on improving communication and coordination between the different components of the committee. In addition, we are working on developing

methods to improve the dissemination of content from our publication platforms.

We can always use new members to our committee. Are you interested in reporting on events around the state or in neighboring areas? Are there topics you would like to see covered? Would you like to write about your area of expertise or interview a community member? Please join our talented and energetic group!

CoNPS Chapter Updates

Boulder Chapter

The Boulder chapter planned and managed the 2022 CoNPS Annual Conference, which was a great success! We began our monthly winter chapter meetings in October; these will continue through the early part of 2023. We are beginning to plan summer field trips. If you are interested in leading field trips or joining the chapter steering committee, please contact boulderconps@gmail.com

Metro-Denver Chapter

The year 2022 started with the aftereffects of the devastating Marshall fire, which wiped out whole neighborhoods and left thousands without homes during the coldest part of the year. Statewide, CoNPS collaborated to help our members who lost their homes to the fire, and we had a generous outpouring of support.

The Metro-Denver chapter hosted our monthly meetings at the beautiful Denver Botanic Gardens (DBG), which were held in-person with a virtual attendance option. We also hosted networking events and co-hosted the native plant swap/giveaway in the spring and the native seed swap/giveaway in the fall.

Many of our members participated or volunteered at the native plant sale, DBG's Eco-Flora Project, the Project Budburst phenology study, Boulder-Metro Denver BioBlitz, and the Denver/Littleton garden tours.

A few of our members led a total of 15 field trips, held at locations such as Clear Creek Canyon, North Washington Open Space, Loveland Pass Lake, Reynolds Park, and Mt. Falcon. Shout-out to all the field-trip leaders for making it possible!

Lastly, our chapter hosted the holiday gathering for our last meeting at the DBG location. We had a great turnout, with lots of food, prizes, books, and even a trivia contest hosted by Kelly Kirk.

For the upcoming year, we would like to make a few things happen that would make for a more engaging, interesting, and valuable experience for our members as well as having a greater impact on our community. For one, we would like to increase our in-person activities and hands-on educational events. One of the primary ways we have accomplished this in the ►

◀ past has been our field trips, and, for that, we need volunteers to lead them. With that in mind, we would also like to get more of our members involved in the field trips, either by attending or by leading.

Another goal we have is to increase education surrounding water conservation in the metro area. To that end, our March speaker will be Water Conservation Specialist Amanda Slover, who will talk to us about the Aurora water-wise program and demonstration garden.

We would also like to make available activities that convey more information on native plants. We hope to engage a broader audience of members in our chapter and gain new members by doing so. We are using input from our members on what they would like to see and activities they would be interested in participating in. Communication is important for exchanging information; we encourage members to reach out to us at metrodenverconps@gmail.com. We are also lucky to have our leadership team composed of Kelly Kirk, Rick Miller, Elizabeth Wu, and Rahman Minhas. Each of us has our own unique background that we bring to the table. We are already off to a good start for 2023!

Northern Chapter

The Northern chapter ranges from the alpine east of the Continental Divide, into the montane and foothills and east onto the plains, north of Denver and Boulder. It is a challenge to cover this geographically extensive and botanically diverse ecosystem for our members.

A few hikes were conducted in the foothills, notably a “moss walk and talk” by our local expert, Stacey Anderson. CU Professor Emeritus Timothy Seastedt gave a talk on grasslands and carbon sequestration. We learned that grasslands are equal to or better than forests at sequestering carbon due to the deep root systems. Christina Alba, DBG assistant research scientist, talked to us about the effect of cheatgrass on the recovery of foothills areas from fire. Citizen-science field trips were conducted at the River’s Edge Natural Area’s native plant gardens in Loveland. Phenology observations, nearing 1,000, were entered into the Budburst website.

In August, we participated in the Poudre RiverFest, a free family-oriented event centering on the Poudre River and water quality and supply. In September, seed was collected at High Plains Environmental Center from the native plant gardens there and used for the seed swap event, with a seed cleaning at the Wildlands Restoration Volunteers office in Fort Collins. Approximately 450 persons were reached through events in the Northern Chapter in 2022, about 200 members and 250 non-members. Online events

generated more attendance from members, and outreach events reached more non-members.

The Northern Chapter is seeking folks for its leadership team to help with generating ideas for events, leading plant hikes to our many interesting ecological areas, and, always, to help run events. Contact Ann Grant at odygrant@gmail.com to join our team and watch the event calendar!

Plateau Chapter

The Plateau chapter led several field trips last year. In the spring, we traveled to Escalante Canyons, Black Canyon of the Gunnison National Park, and Ouray. Our summer field trips were held in the San Juan Mountains.

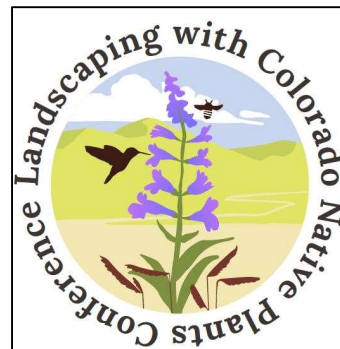
San Luis Valley Chapter

We will be hosting the 2023 CoNPS annual conference. Want to be involved? Contact slvchapterpresident@gmail.com

Southeast Chapter

During 2022, the SE Chapter held six meetings and 11 field trips. For 2023, the chapter is planning both in-person and virtual events, currently through April. Several SE Chapter field trips are being planned for 2023. These plans will be discussed at the April 18 monthly meeting.

Cross-Pollination Events



Landscaping with Colorado Native Plants Conference

February 25, Virtual

The Landscaping with Colorado Native Plants Conference promotes the inclusion of native plants in our landscaping to

benefit pollinators and songbirds, save water, and restore the beauty and health of nature in the places we live, work and play. This year, experts in horticulture, ecology, and landscape design will share how to plan, plant, and maintain beautiful and biodiverse native landscapes from the ground up. With the theme of climate resilient landscapes, this year’s conference offers inspiration and insight to both novice and experienced gardeners.

<https://events.zoom.us/j/AvrQAHu1qNyUF5MkTneo6cFMZyndvBwjfWmy24XxasET78lh2RnC~AggLXsr32QYFjq8BIYLZ5I06Dg> ►



◀ Conference on Adapting to Climate Change March 1-31

The Durango Botanic Gardens will host a

hybrid online and in-person conference on how residential gardeners, HOAs, and municipalities can adapt their landscaping strategies to changing climates. The virtual conference will feature eight recorded presentations ranging across a variety of topics and will be available for registrants to view throughout the month of March 2023. On March 16, Panayoti Kelaidis, senior curator and director of outreach for the Denver Botanic Gardens, will address conference attendees at the Durango Public Library. Presenters from the online portion of the conference will also be available for discussion and to answer questions.

Maggie Gaddis, executive director of CoNPS, and Alex Crochet, city horticulturist for Colorado Springs, will present on the role native plants play in adapting landscapes to climate change.

The conference is entitled “Envisioning a Changing DurangoScape: Practical Approaches to Adapting Yards and Landscapes to a Changing Climate.” The following topics to be presented: What will the Four

Corners climate be like in the future? What are some alternatives to conventional grass lawns? What role will native plants play in mitigating climate change? What role does landscaping play in wildfire mitigation? How is Durango responding to changes in our urban landscape and forest? How and why should you build a crevice garden?

The Colorado Native Plant Society Southwest Chapter and the Mountain Studies Institute are co-sponsors of the conference. Members of both organizations can register at a discounted fee.

To learn more and register, visit www.durangoscape.org/

Weehawken Wildflower Walks Spring, summer dates

Ridgway writer Mary Menz and Montrose photographer Jim Pisarowicz (Plateau Chapter) will share their extensive plant knowledge and excitement for the area with you. Different elevations and habitats provide opportunities to view a wide variety of Colorado’s native plants and wildflowers through spring and summer. Registration includes a copy of their book, *Common Wildflowers of the San Juan Mountains*. More information will be provided a few days prior to each event; the first two are slated for April 21 and May 5. <https://weehawkenarts.org/> 🌀



◀ “Jill Handwerk...” continued from page 22

Leader in 2007 and has left her mark on the work-study students whom she has guided, the students she has taught core heritage methodology, and those of us lucky enough to be on the Botany Team at the Colorado Natural Heritage Program.

Jill has worked tirelessly as an advocate for native plants in Colorado and for the conservation of our rarest plants. She has been profoundly successful through her efforts and has had a tremendous influence on raising awareness and the success of conservation outcomes. Although we will miss Jill in the halls at the CNHP, we still expect to see her participating in the rare plant conservation community and on the trails looking at wildflowers.

Jessica Smith is the Botany/Vegetation Ecology Team Leader for CNHP. She has more than 20 years of experience assessing plant communities and



populations in a variety of ecosystems around the country. Her work with CNHP focuses on Colorado’s rare plants and native vegetation, with projects including rare plant population monitoring and inventory, species distribution modeling, and collection of native plant materials for restoration. She enjoys teaching grass identification, attending CoNPS field trips, and camping with her family.

David Anderson grew up in Aurora, CO. He has worked at CNHP for 23 years and has been CNHP’s director since 2008. In his role, he collaborates with CNHP’s staff and partners in efforts to advance successful conservation, guided by data and science, throughout Colorado. Dave’s tasks are focused very much on coordination and outreach, and on developing new projects and initiatives. At CNHP, he started out as a member of the Botany Team, and he has worked throughout Colorado studying rare plants and plant communities. Prior to his work in Colorado, he worked in the Alaskan and Canadian Arctic on botany field projects, and he was a Peace Corps volunteer in the Solomon Islands from 1997–99. 🌀

Become a CoNPS Member

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- New
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- Family \$35
- Patron \$250
- Renewal
- Senior (65+) \$17
- Plant Lover \$50
- Benefactor \$500
- Individual \$25
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- Life Member \$800

Printed Color Copy of the magazine, *Aquilegia*, \$20

CHAPTERS: Boulder, Metro-Denver, Northern (Ft. Collins-Greeley), Plateau (Grand Junction and West Slope), San Luis Chapter (Crestone, Alamosa, Salida), Southeast (Colorado Springs-Pueblo), Southwest (Durango), or Unaffiliated

If this is a change in address, please write your old address here.

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Check box to receive information on volunteer opportunities

DUES include the electronic version of the *Aquilegia* magazine, published quarterly.

The full color electronic publication arrives by PDF in member email boxes in February, May, August, and December. For those members without email addresses, please apply for a scholarship to receive print copies.

Membership dues cover a 12-month period.

You may also join online at <https://conps.org/join-donate/>

CONTRIBUTIONS to CoNPS are tax deductible:

John Marr fund for research on the biology and natural history of Colorado native plants \$ _____

Myrna P. Steinkamp Memorial fund for research and other activities to benefit the rare plants of Colorado \$ _____

Alice Eastwood Scholarship fund to help support undergraduates pursuing bachelor's degrees that ultimately advance the mission of the Society \$ _____

Mission Grant to support the mission of the Society \$ _____

Total included: \$ _____

Please make check payable to:
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Send completed form and full remittance to:
 CoNPS Office
 1536 Wynkoop Street Suite 911
 Denver, CO 80202



Can You Identify These Cones?



Answers (clockwise from upper left): Colorado blue spruce (*Picea pungens*), bristlecone pine (*Pinus aristata*), common juniper (*Juniperus communis*), limber pine (*Pinus flexilis*), Douglas fir (*Pseudotsuga menziesii*), and lodgepole pine (*Pinus contorta*). All but *Juniperus* (Cupressaceae) are in the Pinaceae family. © Anna Wilson

Colorado Native Plant Society



1536 Wynkoop St., Suite 911,
Denver, CO 80202
<http://www.conps.org>

Please welcome our new board members! Alex Crochet is the city horticulturist for Colorado Springs. Gwen Kittel is a former CoNPS board member, willow expert, and member since 1985. Alex Smith is with the CSU Extension Service in El Paso County.

And please extend your thanks to Chrissy Alba for her service to CoNPS. Although she has stepped down from the board, we know she will continue to be an advocate for Colorado's native plants.

◀ "Ponderosas"... continued from page 19

Another essential player in this ecosystem is the bark beetle. The mountain pine beetle (*Dendroctonus ponderosae*) is a native beetle that plays an essential role in thinning out the forest naturally. The beetles normally target weakened or stressed trees since healthy trees use pitch to push out the beetles and their larvae. These beetles live for one year and have blue-stain fungus in their heads. When they bore into the bark in early summer, the fungus enters the cambium layer just under the bark and spreads throughout, eventually killing the tree. Bark beetle populations naturally fluctuate, although climate change increases the likelihood of more than one generation of beetles within a single year. In addition, extended drought stresses and weakens ponderosa pines, which makes them more vulnerable to bark beetle attack.

It was 1993 when that boy, probably 14 years old, asked me if I was hiding a vanilla soda in my pack. I wonder what he is up to now at 44 years old. At 62,

I still find myself wrapping my arms around the ponderosa pines and inhaling that classic sweet smell.

To learn more about ponderosa pines, read *Graced by Pines: The Ponderosa Pine in the American West*, by Alexandra Murphy (Mountain Press, 1994).



A lone ponderosa pine, a common occurrence prior to fire suppression. © Linda Smith

Carol English grew up in the mountains of northern California, loving nature at a very young age. She has undergraduate degrees in earth science, secondary science teaching, and biology and botany. Her undergraduate thesis was on the pollination biology of a rare Colorado penstemon (*Penstemon degeneri*). She is a Native Plant Master and has taught Native Plant Master classes for CSU and the Audubon Society. Carol's professional career includes teaching high-school science, working as an interpretive specialist for Jefferson County Open Space, and working as a botanist for the Colorado Natural Areas Program, the Colorado State Land Board, and Yosemite National Park. In 2012, she started her own business called CoVeg, named in honor of Colorado vegetation. She also does fieldwork with Elliot Environmental Consulting, and On Pointe Consulting, working with rare plants and doing wetland delineation. ♻️