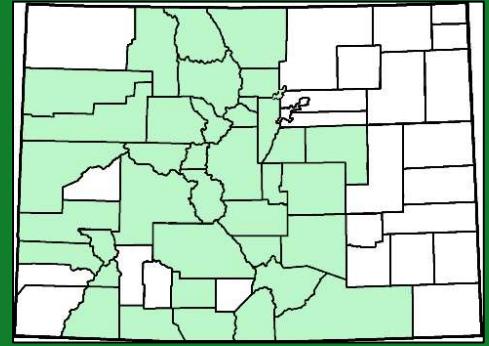


# *Aquilegia*

**Magazine of the Colorado Native Plant Society**

Volume 46 No. 2 Spring 2022





Map adapted from Ackerfield, J. *Flora of Colorado*, p. 706 (2015).

**Pasqueflower, *Anemone patens* var. *multifida* (Ranunculaceae).** Pasqueflower is one of our earlier blooming native plants, and certainly among the showiest (front cover). The five to eight petal-like sepals are 2–4 cm in length and usually a shade of light purple. The blossoms track the sun throughout the day. This tactic, along with the plant's bell-like shape, reflects heat into the center of the flower, resulting in an increase in temperature of 10°C or more compared to its surroundings. The increased temperature hastens pollen and seed maturation. It also attracts insects, which will often rest overnight in the closed blossom. The silvery hairs covering the entire plant also help trap heat. The basal leaves are finely dissected, giving them a feathery appearance. The elliptically shaped achenes (fruits) are attached to long, feather-like plumes that help disperse the seeds by wind (see photo above). Pasqueflowers (also known as prairie crocuses) are found throughout the US and into the far northwestern regions of Canada. Note that discussions continue to this day on the correct scientific name for this plant. Stay tuned for the new edition of Ackerfield's *Flora of Colorado*! Photo credits: front cover @ Linda Smith; this page @ Kelly Ambler.

### **Botanicum absurdum by Rob Pudim**



Some of our newer members may not be familiar with Bill Weber. Dr. William A. Weber was one of the founding members of CoNPS in 1975 and was active in the society until his death in 2020. His *Colorado Flora* went through four editions (the later additions were co-authored with Ronald C. Wittmann) and was the primary resource for identifying plants in Colorado for nearly 30 years. To get a sense of Bill as a person and of his accomplishments, please see Ron Wittmann's tribute (<https://conps.org/tribute-to-william-weber/>). This is one of many articles about Dr. Weber published in *Aquilegia* over the years.

# 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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**Managing/Design Editor:** Kelly Ambler, alpineflowerchild@gmail.com  
**Production Manager:** Alan Moores  
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**Botanical Names Editor:** Elizabeth Taylor  
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#### OTHER CONTACTS

**COMMITTEE CHAIRS:** **Conservation:** Mo Ewing, bayardewing@gmail.com; **Education & Outreach:** empty; **Field Studies:** Steve Olson, olsonsteven412@gmail.com, Lara Duran, ld.ecowise@gmail.com; **Finance:** Mo Ewing; **Horticulture:** Ann Grant, odygrant@gmail.com; **Media:** Kelly Ambler, alpineflowerchild@gmail.com; **Research Grants:** Stephen Stern, stern.r.stephen@gmail.com; Christina Alba, christina.alba@botanicgardens.org; **Restoration:** Haley Stratton, hbstratton94@gmail.com; **Scholarships:** Cecily Mui, chmui@hotmail.com

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**CoNPS PAID STAFF:** Maggie Gaddis, executive director, ColoradoNativePlantSociety@gmail.com; Anne Beard, membership and communications coordinator, CoNPSoffice@gmail.com; Denise Wilson, marketing and events coordinator, CoNPSpromote@gmail.com; Kathleen Okon, workshop coordinator, CoNPSworkshops@outlook.com; Joni Wagner, bookkeeper, joniw2000@yahoo.com.

## Featured Story

# Frank Tweedy's Colorado "Novelties" Mark the End of an Era

By Hollis Marriott

In the summer of 1882, in the Cascade Mountains of Washington Territory, three men left their camp at Snoqualmie Pass, "a crowded garden of pinks, reds, purples and yellows," to climb a high peak nearby. One of them, Frank Tweedy, stopped occasionally to examine wildflowers, a passion he would soon regret. When he looked up and saw no one, he realized he had fallen behind. He shouted over and over, but the responses were so faint they could have been echoes. "I wandered all day and climbed several peaks," he would write years later in his 1926 unpublished autobiography, *Life of Frank Tweedy: Confessions of a Tenderfoot*.

Tweedy was a topographic surveyor, assistant to head topographer Richard Urquhart Goode of the Northern Transcontinental (railroad) Survey. That day, Goode had hoped to establish a survey station atop the peak, but it was Tweedy who was carrying the theodolite, an important surveyor's instrument for measuring angles. Thanks to Tweedy's botanical dawdling, the day ended in failure.

"You jolly well made an ass of yourself!" Tweedy fumed to himself, while waiting for the others to return to camp. But, to his surprise, he wasn't fired. Instead, Goode quietly explained to him, "You can't make a success of two things, botany and topography both, at the same time." But Goode was wrong.

### New England beginnings

Frank Tweedy was born in New York City in 1854 to well-off parents in the clothing business. He attended Union College in Schenectady and graduated in 1875 with a degree in civil engineering. Following his graduation, he was hired by the Adirondack Survey. Tweedy spent four seasons in the central Adirondack Mountains, completing surveys for six maps. He also collected plants.

Tweedy's botanical training remains a mystery, but his specimens show he was a serious and able botanist (see SEINet for records of his collections). He didn't shy away from difficult groups and apparently found wetland plants especially interesting, collecting

bulrushes, pondweeds, bladderworts, and numerous sedges. He published his discoveries—state records and other notable range extensions—in the *Bulletin of the Torrey Botanical Club*.

### Genuine discoveries

After he joined the Northern Transcontinental Survey in 1882, Tweedy found himself in a very different botanical world. No longer would he concern himself with state records and range extensions. Washington Territory was largely unexplored botanically and a sharp-eyed collector might well find "novelties"—species new to science!



Frank Tweedy, date unknown. Union College Special Collections Schaffer Library, Schenectady, NY; used with permission.

During his two seasons in Washington Territory, Tweedy made at least 112 collections representing 90 species. Among them was a reedgrass from the Wenatchee Mountains, which botanist Frank Lamson-Scribner called *Deyeuxia tweedyi* (now *Calamagrostis tweedyi*). Tweedy's reedgrass was the first of many novelties named in his honor.

After passing the civil-service exam for assistant topographer, Tweedy went to work for the U.S. Geological Survey in Yellowstone National Park in 1884. He surveyed topography for four maps, and collected plants, of course. In 1886, he self-published *Flora of the Yellowstone National Park*, an annotated catalogue of 657 species (605 based on his own collections), including novelties such as Tweedy's plantain, *Plantago tweedyi*.

For the next two decades, Tweedy surveyed and collected in the Rocky Mountains. Among his more productive projects were the Livingstone and Dillon geologic maps in southwest Montana (1886–88), where he collected at least 10 new species, including Tweedy's fleabane (*Erigeron tweedyi*), snowlover (*Chionophila tweedyi*), and thistle (*Carduus tweedyi*, now part of *Cirsium eatonii*).

But it was in Colorado that Tweedy hit the jackpot. In the mid-1890s and early 1900s, as topographer for the Telluride, Durango, Boulder, and Central City maps, he made well over a thousand collections, some 20 of which were determined to be new species! ►

◀ Table 1 details some of the plants Tweedy discovered in Colorado. Yet, if we check today's Colorado flora references, we find most have vanished.

### Names come and names go

Budding botanists are taught to use scientific names, despite the sometimes off-putting Latin. Scientific names are unambiguous, universal, and seemingly enduring. However, when we go out into the real world, we learn otherwise. Scientific names do change and more frequently than some of us would like!

There are many reasons for name changes, but one is especially common—the "law of priority" (Mori, 2013). This informal law states that if a given species is described by more than one botanist, the first-published name is accepted (others become synonyms). The law of priority was frequently broken in the nineteenth-century American West, where large areas were poorly known botanically, and new species were to be expected. Floras and relevant literature were inaccessible or nonexistent, and communication with other botanists was slow at best.

In the case of Frank Tweedy's plants, however, an additional factor was at play. While Tweedy was adept at spotting and collecting possible novelties, he didn't publish information about the new species himself.

Like many plant collectors at that time, he sent specimens of interest to experts at botanical institutions. They decided which were new species, and then described and named them.

Many of Tweedy's specimens, including those from Colorado, went to Per Axel Rydberg, an expert on the flora of the Rocky Mountains and employed at the New York Botanical Garden. But Rydberg was a notorious splitter; he often classified specimens as new species based on what others considered minor details (Tiehm and Stafleu, 1990).

Indeed, most of Tweedy's Colorado novelties did not survive later taxonomic study. Many were determined to be species already in existence and banished to synonymy under the law of priority. Several were demoted from species to variety or subspecies. There is a single survivor—the North Park or sagebrush beardtongue (*Penstemon cyathophorus*). In 1901, Tweedy was surveying the Encampment mining district in southern Wyoming. However, "By reason of the faulty determination of the forty first parallel...the State boundary was located approximately one third of a mile north of its proper position, consequently a narrow strip along the southern edge of the district...is in the State of Colorado" (Spencer, 1904). It was in this narrow strip that Tweedy ►

Table 1. Plants Collected by Tweedy in Colorado			
Original name, with author	Current scientific name	Common name	Collection location
<i>Penstemon cyathophorus</i> Rydb.	<i>Penstemon cyathophorus</i>	North Park penstemon, sagebrush beardtongue	CO/WY state line
<i>Acrolasia latifolia</i> Rydb.	<i>Mentzelia dispersa</i> var. <i>latifolia</i>	Bushy blazingstar	Ward
<i>Arenaria tweedyi</i> Rydb.	<i>Eremogone fendleri</i> (var. <i>tweedyi</i> recognized by some)	Tweedy's sandwort	La Plata Mts
<i>Carduus griseus</i> Rydb.	<i>Cirsium griseum</i> var. <i>griseum</i>	Gray thistle	Telluride
<i>Chrysopsis amplifolia</i> Rydb.	<i>Heterotheca resinolens</i>	Rockyscree false goldenaster	Telluride
<i>Aragallus patens</i> Rydb.	included in <i>Oxytropis lambertii</i> var. <i>bigelovii</i>	Purple locoweed	near Boulder
<i>Carduus erosus</i> Rydb.	<i>Cirsium coloradense</i>	Colorado thistle	Durango
<i>Chrysopsis caudata</i> Rydb.	<i>Heterotheca resinolens</i>	Rockyscree false goldenaster	near Boulder
<i>Draba chrysantha</i> var. <i>hirticaulis</i> O.E.Schulz	included in <i>Draba graminea</i>	Rocky Mountain draba	Telluride
<i>Elymus villiflorus</i> Rydb.	included in <i>Leymus ambiguus</i>	Colorado wildrye	near Boulder
<i>Mertensia canescens</i> Rydb.	included in <i>Mertensia oblongifolia</i>	Languid lady	Central City
<i>Penstemon suffrutescens</i> Rydb.	included in <i>Penstemon crandallii</i> ssp. <i>crandallii</i>	Crandall's beardtongue	Ridgeway
<i>Trifolium stenlobum</i> Rydb.	included in <i>Trifolium attenuatum</i>	Rocky Mountain clover	La Plata Mts

Note: The *Cirsium* scientific names reflect current research rather than that of *Flora of Colorado*. Ackerfield JR, Keil DJ, Hodgson WC, Simmons MP, Fehlberg SD, and Funk VA. 2020. Thistle be a mess: Untangling the taxonomy of *Cirsium* (Cardueae: Compositae) in North America. *J Systematics Evol.* 58:881-912.



Holotype for *Penstemon cyathophorus* Rydb. Collected by Frank Tweedy near the Colorado–Wyoming state line, 1901. New York Botanical Garden, Steere Herbarium. Used with permission.



Sagebrush beardtongue (*Penstemon cyathophorus*) photographed near North Park, June 2019. Note the prominently exserted stamens. © Kelly Ambler

◀ collected a penstemon of interest. He sent the specimen to Rydberg, who used it as the holotype (basis for description) for *Penstemon cyathophorus*.

Botanists today find the North Park beardtongue difficult to identify with confidence unless it's in full flower. It's especially similar to Harrington's beardtongue, differing mainly in the number of stamens prominently (not just a little!) exserted beyond the corolla: four in *Penstemon cyathophorus*; two in *P. harringtonii*. In spite of this subtle difference, this Rydberg species has survived its latest trial—update of the genus *Penstemon* for the *Flora of North America* (Freeman, 2019).

### End of an era

Surely some readers are wondering, "Why didn't Tweedy find more novelties in Colorado?" The

likely answer is: timing. Though the Rockies continue to yield new species even today, the great era of botanical exploration was coming to a close by the early 1900s. No longer could a plant collector with an eye for novelty collect multiple new species per season (Williams, 2003).

Did Frank Tweedy recognize this change? Is that why his large-scale botanizing ended after his projects in

Colorado? We don't know. In any case, after one more field project in New Mexico, he worked for the USGS in Washington, DC until his retirement in 1926. He lived another decade before passing away in 1937 at age 83 (Lesica and Kruckeberg, 2017).

It's surprising how few botanists have heard of Frank Tweedy. In his time, he was highly respected for his contributions. At least 35 species were named in his honor. Until a few years ago, his online presence was negligible, but now there's a Wikipedia article where you can learn much more ([https://en.wikipedia.org/wiki/Frank\\_Tweedy](https://en.wikipedia.org/wiki/Frank_Tweedy)).

*Hollis Marriott started her botanical adventures in the deserts and chaparral of California. In 1977, she was lured to Wyoming by a seasonal job at Devils Tower National Monument. Now, after working for over 40 years as a field botanist in Wyoming and South Dakota, she is retired, at least theoretically. But that doesn't keep her away from plants. She is a member of the Wyoming, Colorado, and Great Plains native plant societies, and is part of a group revising Theodore Van Bruggen's The Vascular Plants of South Dakota. Her travels in the American West always include botanizing. She lives in Laramie, Wyoming and can be reached at her blog, In the Company of Plants and Rocks (<http://plantsandrocks.blogspot.com/>).*

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## Featured Story

# A Floristic Inventory of McInnis Canyon National Conservation Area

By Stephen Stern

Western Colorado is home to abundant public land, much of which is administered by the Bureau of Land Management. The most spectacular of these lands are designated as National Conservation Areas due to their cultural, ecological, and scientific values. McInnis Canyons National Conservation Area is located west of Grand Junction and encompasses 123,739 acres of high desert, canyon country. This area includes sandstone arches, important fossil sites, the historic Old Spanish Trail, the Ruby Horsethief section of the Colorado River, and the world-class mountain biking of the Kokopelli trail. The MCNCA borders the western edge of the Colorado National Monument.

While the flora of the Colorado National Monument are well known, largely due to extensive plant collecting by the late William Weber (see Hogan et al., 2009, for complete collecting history), the MCNCA has received less botanical attention. Understanding the flora of this area is crucial for management decisions, and the 2012 Science Plan for the MCNCA stated that a full list of the flora in the MCNCA was a high scientific priority (BLM, 2012). In 2013, I received funding from the Bureau of Land Management to produce a checklist of the plants of MCNCA, with additional goals of strengthening collaboration between Colorado Mesa University and the BLM, and for providing CMU undergraduate students with botanical training.

Collecting in such a large area presents significant challenges, particularly given the lack of road access. In fact, there are only two main access roads. Interstate 70 passes through the northern edge of the NCA north of the Colorado River and the four-wheel-drive Black Ridge Road allows access to parts of the southern portion of the NCA. In addition to these

routes, boat access via the Colorado River was utilized to collect plants. The high desert also varies greatly in climate from year to year. We collected over various field seasons to ensure that any seasonal abnormalities, such as drought or unusual temperatures, were less likely to affect the species documented on the checklist.

Training undergraduate students in field techniques was a major goal of this project (Figure 1). Most of the

BLM funding was used to pay CMU undergraduates to work in the field collecting plants. Student interns were also trained in herbarium work, including identification, curation, and data entry. In addition to BLM funds, the St. Mary's Saccomanno Research Institute/CMU Internship Program in Biological Research supported interns. All collections in the field were made by CMU undergraduates Orianna Rubin (2014), Jessica Condon (2016), Grace Gardner (2020), and Nora Oviatt (2020). These interns each spent hundreds of hours in the field and herbarium.

Numerous other CMU students and community members also participated in the project.

To accomplish the goal of producing a checklist of the plants of MCNCA, 644 plant collections were made in MCNCA during this project. There are now 1,198 collections from within the NCA (based on results from a February 2022 search of Intermountain Regional Herbarium Network at <https://intermountainbiota.org/portal/> with a strict boundary of the NCA). This yields a species list of 526 taxa. All collections are listed on [intermountainbiota.org](https://intermountainbiota.org), with full label data and images for most (>75%) of our collections. Given the size of MCNCA, we made great effort to collect from locations throughout the area (Figure 2). ►



Figure 1. Colorado Mesa University interns carried out plant collecting in MCNCA (clockwise from top left): Orianna Rubin in MCNCA; Grace Gardner identifying plants in the CMU herbarium; Bryn Marah pressing grass specimen; Nora Oviatt in the CMU herbarium; Jessie Condon and Michael Bacciarini in Knowles Canyon in MCNCA.

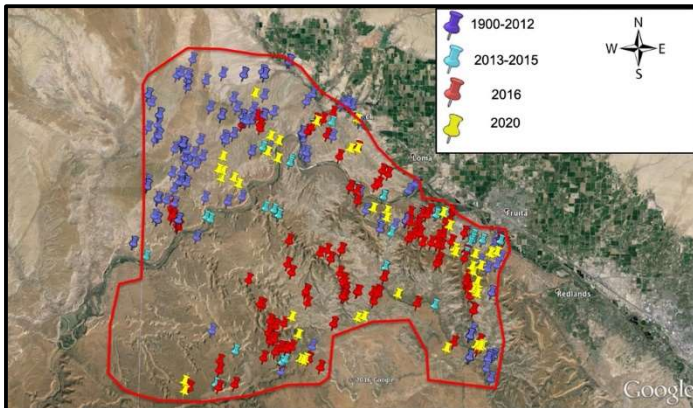


Figure 2. Map of MCNCA collection sites. Loma, Mack, and Fruita, CO are along the northeast boundary. The boundary of MCNCA is outlined in red. Pin colors indicate year of collection, with historical collections in purple and collections from this project in blue, red, and yellow. Each pin represents a collection site, with the number of collections per site ranging from one to 20.

◀ All plants that were collected were made into herbarium specimens for permanent storage at the Walter Almond Kelley Herbarium at CMU. The process of making an herbarium specimen involves drying and mounting the specimen and producing a label with all the information regarding the collection of the specimen, such as date, specific location with GPS coordinates, plant attributes, and habitat information (Figure 3). Duplicates were made when possible and these will be distributed to Colorado herbaria.

While making voucher specimens is a time-intensive process, it allows verification of the species identification and provides a permanent record. Because collections, both new and historical, are continually being added to the [intermountainbiota.org](https://intermountainbiota.org) database, the number of specimens in the MCNCA checklist will continue to increase over time. The online database also allows anyone, from the public to land managers, to search for information about the area's plants.

Intensive collecting in MCNCA has resulted in a better understanding of plant distributions. The first plant collected for this project was *Astragalus preussii* (Preuss' milkvetch), a species that was not previously known in Colorado (although since that collection, older specimens have been added to the [intermountainbiota.org](https://intermountainbiota.org) database). This species is common in Utah, but its range barely extends into Mesa and Montrose Counties in Colorado. Similarly, *Calochortus ciscoensis* (Cisco sego lily), a species initially thought to be endemic to Grand County, Utah, has also been found in Colorado in MCNCA. Our collecting has also recorded new county records for Mesa County and found new occurrences of rare plants, such as *Amsonia jonesii* (Jones' bluestar,



Figure 3. Field specimen (top) and herbarium collection (bottom) of *Stanleya pinnata* (prince's plume) from MCNCA. This spectacular species is characteristic of the Colorado Plateau and may occur individually, as in this figure, or in large stands. The sandstone cliffs in the background and pinyon-juniper habitat, mixed with desert shrublands, are characteristic of much of MCNCA. The specimen image is available on <https://intermountainbiota.org/portal/>

Figure 4), *Lomatium latilobum* (Canyonlands lomatium), and *Oreocarya osterhoutii* (Osterhout's

“Floristic survey...” continued on page 14 ►



## Featured Story

### Jack Carter's Enduring Legacy to CoNPS

By Jennifer Boussetot

Dr. Jack Lee Carter (1929–2020) was a professor of biology and taught botany at Colorado College for 24 years. He was an author of multiple editions of three titles, including *Common Southwestern Native Plants* and *Trees and Shrubs of Colorado*. Jack was a **major** supporter of the Colorado Native Plant Society and its mission. He and his wife, Martha, were advisors to the CoNPS board from 2015, when they moved back to Colorado, until his death. See CoNPS' *Aquilegia* 2020, Volume 44, Number 2, page 30 for more on Jack's legacy.

Jack wanted to make sure that the fruits of his labor funded and supported CoNPS into the future. Therefore, in 2017 he **donated** the rights to his most popular, best-selling title *Common Southwestern Native Plants* to CoNPS! And, as you may know, we secured funding through the kindness of Constance Holsinger to pay for the printing of the book. This book grew out of Jack's botanical collection trips in Colorado, New Mexico, Utah, and Arizona. He simply observed what species he came across the most often. After enough herbarium sheets and descriptions were written, he said the book "wrote itself." It was Martha who finally convinced Jack to actually publish the book. Here we are, 20 years later and about 10,000 total copies sold of the three editions!

Jack always talked about how this book not only "wrote itself" but also "sold itself." I have witnessed that happening. When the third edition was first published in 2018, I marketed it by sending complimentary copies to hundreds of national park bookstores, state park bookstores, and more organizations with bookstores! I did some marketing by touring/speaking through all four states the spring after the book was published. But since then, I have

hardly had to market it—it sells itself through the parks system bookstores.

This book is listed among the titles available through the Western National Parks Association, so every week or so I send books all over Colorado, New Mexico, and Arizona. It is a delight to know that hikers at national parks all over the west pick up OUR book. Utah isn't far behind—we are "in" with the Canyonlands Natural History Association, which oversees the bookstores at Arches, Natural Bridges, Canyonlands, etc. Last year, they sold 100 copies of *Common Southwestern Native Plants*—during the pandemic! According to their buyer, it is their best-selling plant title.

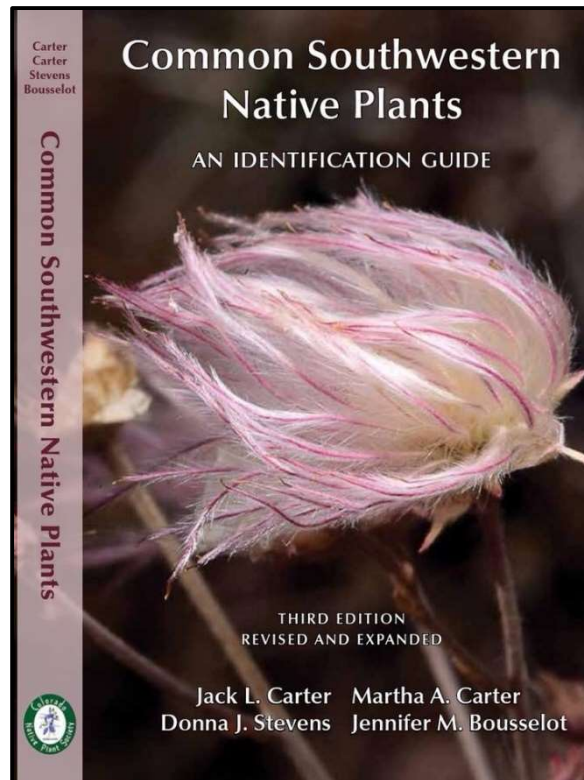
I have no doubt that we will continue to sell this book consistently through these channels (see list below of where our books have sold since January 1).

We want to sincerely thank our generous donors for making the reprint of the third edition of *Common Southwestern Native Plants* possible. First and foremost is a tremendous thanks to Constance Holsinger and the Terra

Foundation for supplying the matching donation. Jesse Clark of Stream Landscape Architecture and Thomas Ziener both made significant donations toward the match—thank you kindly, donors! Thanks also to Matthew Redmond of Agriburbia, Inc., and an anonymous donor in memory of Jack L. Carter. Your contributions will ensure that Jack Carter's incredible legacy continues to support the mission of CoNPS.

Boxes of books sent to these locations so far in 2022:

- Canyonlands Natural History Association (UT)
- Chiricahua National Monument (AZ)—twice
- El Malpais Visitor Center (NM)
- Friends of Bosque del Apache Nature Store (NM)
- Great Sand Dunes National Park (CO)—twice
- Petroglyph National Monument (NM)
- Saguaro National Park (AZ)—twice
- Santa Fe Botanical Garden (NM)
- Tuzigoot National Monument (AZ) 🌀



# Hopping Around: Mutualism between Ants and the Hops Azure Butterfly on Hop Vines

By Emily Mooney, Luis Lowe, Gabrielle Isaacks, and Rob Schorr

*This study was funded in part by the John Marr Grant in 2020.*

Our native hop variety, *Humulus lupulus* var *neomexicanus*, rambles along canyons and willow thickets of the Front Range and Western Slope (Figure 1A). Hop plants are dioecious with staminate (male) and pistillate (female) flowers on separate plants (Figure 1B). Female hop plants usually get all the attention. Fruits of female hops—known as cones—have a long tradition of use by humans, most notably as a flavoring agent in beer (1). However, male hop flowers are quite literally the world for the hops azure butterfly, *Celastrina humulus* (Lycaenidae). The chubby green caterpillars of this butterfly feast on the pollen-rich male flowers (2,3). While doing so, the caterpillars can form a mutually beneficial relationship with ants (3). In the field, we see ants vigilantly patrolling caterpillars in a behavior known as tending (Figure 1C). Ant tending reduces both predation and parasitism of insects that receive this attention (4). This protection does come at a cost to the caterpillars, though—ants get their payday from a special dorsal nectary organ (DNO) on the hind end of lycaenid caterpillars. The DNO produces a syrupy reward that contains both sugars and amino acids eaten by ants (5). Other structures on caterpillars—known as tentacular organs—emit pheromones that reinforce tending behavior (6).

Mutualism with ants is quite common in lycaenid caterpillars (5). In *Celastrina humulus*, the mutualism is more of an on-again, off-again relationship. Kubik and Schorr (2018) found hops azure caterpillars associated with ants in 10 of 15 sites along Monument Creek near Colorado Springs. Given the benefits for both ants and butterfly caterpillars shown in other species, we wanted to know why this mutualism is sometimes absent in *C. humulus*. Casting a broad net, our research took place in two phases. In the field, we monitored caterpillars and measured a variety of variables that could explain why some caterpillars were tended by ants and others were not. In the laboratory, we then analyzed chemical differences in male hop flowers that could affect larval traits or tending by ants.

In early July, we located host plants and caterpillars along a one-kilometer section of Monument Creek near the Air Force Academy. We found and tagged 94 distinct bines (vines with clusters of male flowers) of which 78 hosted *Celastrina* larvae. We subsequently visited these bines every two days to monitor the abundance of *C. humulus* caterpillars per bine (Figure 2). During these surveys, we used a simple numerical score (0–5) to assess the developmental stage of flowers. We also noted when caterpillars were tended by ants and by which species of ants. Both the male ►



Figure 1. Left photo: leaves of the native hop plant (*Humulus lupulus* var *neomexicanus*). Middle photo: panicle of male hop flowers. Right photo: a *Celastrina humulus* caterpillar being tended by an ant.

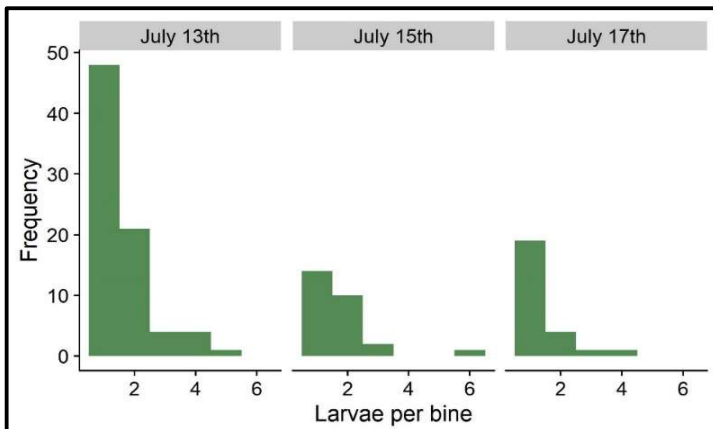


Figure 2: Frequency of observed counts of *C. humulus* larvae per hop bine across three survey dates in July; most observations were of one to two caterpillars per bine.

◀ flowers and the caterpillars developed fast! By mid-July, the caterpillars had all but disappeared and many male flowers were senescent.

We observed ants tending only about half of the caterpillars in our sample. We measured a variety of factors that might explain this pattern. This included site-level abiotic factors such as light as well as biotic factors such as density of caterpillars per bine. In this situation, we have one response variable—whether caterpillars were tended by ants or not—and a number of variables that could be driving this pattern. We therefore used a model-selection approach, which allowed us to find the variables that best explained the likelihood of ant tending. In our final analysis, we considered the density of caterpillars per bine, area of the hop patch, and developmental stage of the flowers as possible predictors. Statistically speaking, we found that the area of the hop patch and the developmental stage of the flowers predicted whether a caterpillar was tended or not. Caterpillars on bines in bigger hop

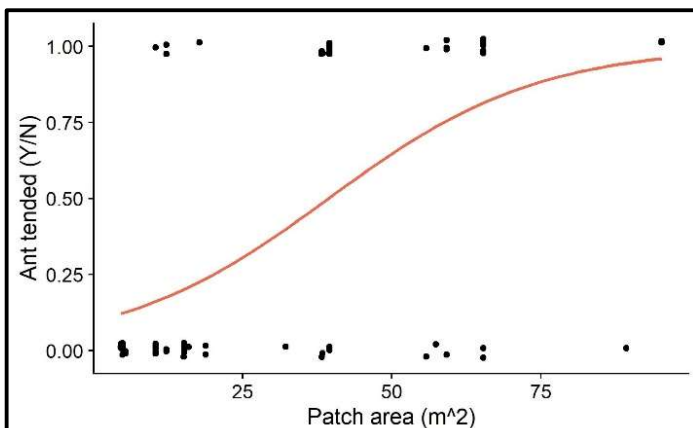


Figure 3: Logistic regression results showing that *C. humulus* larvae feeding on bines in larger hop patches were more likely to be ant tended. The Y-axis shows a numerical scale where 1 represents ant-tended caterpillars and 0 represents caterpillars that were not ant-tended.

patches were more likely to be tended by ants (Figure 3). Likewise, caterpillars on bines with flowers at later developmental stages were more likely to be tended by ants.

In the second phase of research, we headed to the laboratory to test for differences among flowers of different stages. Quality of plants as insect food mostly depends on two factors: their nutrient content (proteins and carbohydrates) and the levels of defensive compounds (7). In terms of nutrients, nitrogen-containing proteins are perhaps the most important for herbivores. Caterpillars need to grow fast to (hopefully) avoid getting eaten or parasitized by some other animal (8). Plants also fight back by loading up their tissues with so-called secondary metabolites, many of which act as defense compounds against herbivores, and intriguingly, humans often find these bioactive compounds attractive as medicines or flavors (9). We assessed both protein and secondary metabolite concentrations of male hop flowers. We extracted proteins from hop flowers of different stages and then applied what is known as the Bradford assay, which measures the total amount of protein in a sample. For secondary metabolites, we analyzed the relative concentrations of certain tertiary alcohols, specifically  $\alpha$ - and  $\beta$ -acids, using high-performance liquid chromatography (HPLC). These acids are well-known secondary metabolites from *Humulus* species that lend beer its hoppy flavor. Alpha-acids include humulone and cohumulone, whereas  $\beta$ -acids include lupulone and colupulone (10). We found that as male flowers develop, both proteins and  $\alpha$ -acids content decline at later flower stages (Figure 4). At the bud stage, flowers have the highest amounts of  $\alpha$ -acids and protein. Interestingly,  $\beta$ -acids did not show this same decline with flower stage.

Bringing these observations together suggests intriguing links from hop plants to mutualist ants. *C. humulus* larvae were more likely to be tended by ants when they were feeding on flowers at later stages. These flowers at later stages were also those with lower concentrations of  $\alpha$ -acids and proteins. Perhaps those  $\alpha$ -acids are repellent to ants? In the related native North American hop *Humulus lupulus* var. *lupuloides*, genotypic variation in insect repellency is linked to these acids (11). Or maybe caterpillars feeding on lower protein flowers grow more slowly? This would make tending by protective ants important. Other lycaenid larvae can alter the quantity or composition of their nectar secretions to attract ants (5). Knowing this, we decided to take advantage of an opportunity to experiment with field research techniques. ▶

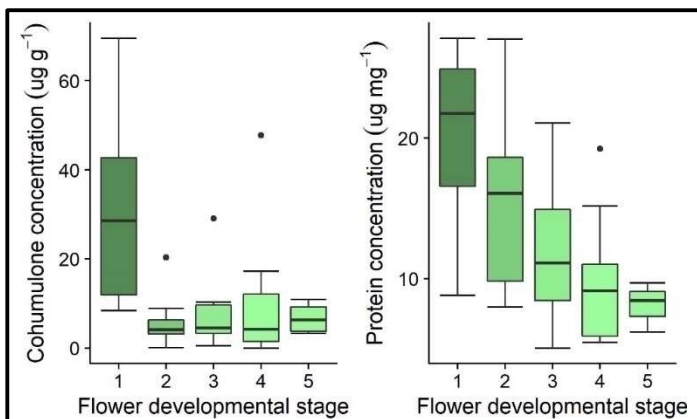


Figure 4: Content of the  $\alpha$ -acid cohumulone and protein in male hop flowers of different developmental stages. For reference, flowers ranked at the first developmental stage (1) are small round unopened buds, and flowers ranked at the last stage (5) were all open with anthers beginning to dehisce.

◀ Testing out new methods is critical to the process of science, and this was the case when we sampled and analyzed the nectar from *C. humulus* caterpillars. We were inspired by studies of other caterpillar species where the authors had sampled this nectar. One can read papers to know that—ostensibly—this can be done. It is another thing entirely to stick a fragile glass tube between a wriggly caterpillar and its hungry ants to sample a teensy drop of nectar! We succeeded in sampling this nectar, and then we applied an analytical method developed for aphid honeydew. Larval nectar contains the sugars sucrose, trehalose, and melezitose. Melezitose is known to be particularly attractive to ants (12).

Support from the CoNPS Marr Grant in 2020 fueled our multidisciplinary effort, and we followed up these observations with a feeding trial that tested how *C. humulus* larvae grew on diets of hop flowers at varying phenological stages. Our results reflected phenological variation in protein content, with larvae growing the most when fed earlier-stage flowers. In summer of 2022, we will continue to monitor these hop plant patches, which will provide a three-year data set to model how host plant factors mediate this mutualism between ants and hops azure larvae.

**Acknowledgments:** We received help in the field in 2020 from UCCS undergraduate Abbey Swift and UCCS alumnus Clint Hamilton. We also thank the Undergraduate Research Academy at UCCS, which helped to fund field and laboratory work.

*Emily Mooney is an associate professor in the biology department at University of Colorado, Colorado Springs. Her laboratory team studies the influences of global change*

*on plant-insect interactions. More information about her ongoing research projects can be found at <https://uccsplantecology.com/> Coauthors Luis Lowe and Gabrielle Isaacks are also from UCCS; Rob Schorr is from the Colorado Natural Heritage Program.*

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# Effects of Fire Severity on the Floral Visitor Community, Pollination, and Reproduction of a Dominant Flowering Subalpine Shrub

By Blyssalyn V. Bieber, Adrian L. Carper, and Shannon M. Murphy

Anthropogenic climate change is driving extreme fire events with lasting effects on biological communities and the ecosystem services they provide. The Rocky Mountains have forests that are recovering from mixed severity wildfires that burned approximately 20 years ago, which can help us understand how native floral visitors and their pollination services are impacted long-term by fire severity. We hypothesized that if high severity fire negatively affects floral visitor communities, then floral visitor abundance and diversity should be lower at high severity sites compared to unburned or low severity sites. Consequently, if fire severity affects floral visitor communities, then reproductive fitness of wax currants should be similarly affected.

To determine how fire severity impacted flower visitation and pollination of a Colorado native shrub, we sampled the community of floral visitors foraging on wax currants (*Ribes cereum*) throughout the flowering season in high severity, low severity, and unburned sites in the Pike National Forest within Jefferson County, Colorado. We sampled from sites within the burn boundaries of the Hi Meadow and Buffalo

Creek fires. We selected 3 high severity, 3 low severity, and 3 unburned sites from each of the fires ( $n = 9$  sites/fire). We sampled floral visitors from 5 wax currants at each site. By comparing diversity, using the Shannon-Wiener diversity index ( $H'$ ), and abundance of floral visitors on wax currant plants, we saw a trend of both lowest diversity ( $H' = 0.86$ ) and lowest abundance ( $n = 11$  Hymenoptera) of floral visitors at low severity sites. Notably, we were the first to document the pollinator community for wax currant plants and found that native bees in the genus *Lasioglossum* were the most common pollinator at all fire severities.

We simultaneously conducted the pollinator exclusion experiment using wax currant plants to compare effects of pollination services across fire severities. We used a nylon mesh bag to cover about 10 inches of treatment branches on wax currant plants so that no floral visitors could pollinate the flowers. Using 90 wax currant plants, we had 4 treatment branches on each wax currant: open to all floral visitors, open to early season floral visitors, open to late season floral visitors, and open to no floral visitors. The branch open to all floral visitors remained open with no exclusion bag for the entire flowering season. The branch open to early season floral visitors was open to floral visitors the beginning of the flowering season (end of May) and bagged in the second week of June.

The branch open to late season floral visitors was bagged the beginning of the flowering season and open to floral visitors starting in the second week of June. The branch open to no floral visitors was bagged from end of May to mid-July. In mid-July, we counted the number of fruit on each branch and compared mean fruit set across treatment branch and fire severity.

We found that the pollinator exclusion

treatment affected fruit set of wax currant plants ( $p < 0.0001$ ). The treatment branch open to no floral visitors had the lowest mean fruit set indicating insect floral visitors are indeed effective pollinators. We found fruit set was lowest in the treatment open to no floral visitors, then increasing to higher fruit set in the treatment open to late season floral visitors, even higher fruit set in the treatment open to early season floral visitors, and finally the highest in the treatment branch open to all floral visitors. We see a similar trend in all of the fire severities; however, low severity and high severity are significantly different from each other ( $p = 0.03$ ) with wax currant plants in low severity ►



Wax currant, *Ribes cereum*. © Kelly Ambler

◀ sites having the lowest fruit set overall and showing highest fruit set in open to early season floral visitors.

This study helps to bridge a knowledge gap in our understanding of how climate change will influence ecosystem services within the Rocky Mountain region as we may see continued increase in high severity fires. Thanks to the support of the Colorado Native Plant Society and John Marr Grant, we were able to travel to our field sites and purchase supplies to carry out the pollinator exclusion experiment on wax currant plants. This research allowed us to fill in a key aspect of natural history of an important native plant and pollinator resource in the Rocky Mountain Region. The results in this report are preliminary and we are

currently working on the analysis to publish this work in a peer-reviewed journal. Our research will continue in future years to document more of the pollinator community at these fire sites and study other native plant species and how they are affected by fire history.

*Blyssalyn Bieber is a master's student at the University of Denver in the Murphy lab, and the recipient of the John Marr Grant. This work was done with the help of her collaborators Dr. Shannon Murphy and Dr. Adrian Carper. She received her BS at Misericordia University studying general biology and her research interests center on plant-insect interactions. She plans to continue working with insects and hopes to have another dream job of nature walks in the mountains looking at flowers and floral visitors.* ☺



◀ “Floristic survey...” continued from page 8

cat’s-eye). Of these, *Amsonia jonesii* appears to be relatively common in MCNCA, but it is rare in Colorado, as this is the easternmost extent of its range.

Another goal of the project was to encourage student collaboration with the BLM. CMU students were able to work with BLM personnel in several different capacities, including attending BLM training, patrolling the river with rangers, monitoring river restoration projects, oil and gas pad monitoring, rare plant surveys, tamarisk removal projects, fire restoration projects, range monitoring and nested frequency transects, ephemeral stream data collection, and more. These opportunities gave students an excellent understanding of the breadth of the BLM’s role in land management.



Figure 4. *Amsonia jonesii*, Jones’ bluestar.  
© Stephen Stern

There have been numerous ways that the work in this project has been communicated to the public. I have led groups on plant identification trips in MCNCA and given numerous talks on the project. These include talks at the Colorado Native Plant Society annual meeting, talks to the Colorado Canyons Association, and seminars for New Dimensions, an elder education program in Grand Junction. Each of the four interns has also given talks on the project for audiences at CMU, the BLM, and the Colorado Native Plant Society.

This project has resulted in a checklist for MCNCA and a much greater understanding of the flora of this area. It is difficult to assess when a floristic project is complete—that is, when all the species in an area have been collected. Given the rarity of finding new species for the checklist in the last field season, we believe our checklist represents the vast majority of the species in the area. This checklist will give a baseline of the MCNCA diversity to measure future changes and will hopefully encourage further long-term investigation. Future studies include comparison of the checklist of MCNCA with the adjacent checklist of the Colorado National Monument. Finally, this project provided excellent training for undergraduates and opportunities for collaboration between CMU and the BLM.

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# Botany Basics

## General Classification of Plants

By Maggie Gaddis

Plants are eukaryotic photoautotrophs, meaning that they are organisms with cells that have a nucleus, and they make their own food using light and carbon dioxide. Plants are subsequently divided into two groups based on the presence or absence of a vascular system. A plant's vascular system is like an animal's circulatory system, transporting water and nutrients throughout the plant body.

### Nonvascular Plants

Nonvascular plants are in a group known as bryophytes, which includes liverworts, hornworts, and mosses. These plants lack structural systems to carry chemicals throughout their bodies. Because of this, nonvascular plants have a hard time regulating the amount of carbon dioxide and water in their systems and usually must live in moist environments similar to the environment inside their plant bodies.

Nonvascularity also limits plant stature; therefore, all liverworts, hornworts, and mosses are small and

devoid of woody biomass. Nonvascular plants also do not produce seeds. Instead, these plants reproduce through spores.

In Colorado, you're most likely to find nonvascular plants near mountain lake inlets, in alpine regions, and on the northside of rocks and tree trunks (Figure 1). The north- and east-facing slopes in Colorado present colder and wetter environments due to the angle of the sun, particularly in the winter months when the sun stays low in the southern sky.

### Vascular Plants

Vascular plants have structural systems that transport photosynthetic products, nutrients, and water throughout the plant (Figure 2). The xylem transports minerals and water absorbed from the soil through roots. The phloem brings photosynthetic products from the leaves down throughout the plant body. Plant hormones are also transported through these vascular systems. ►



Figure 1. Bryophytes are often found on the north sides of trees and rocks in Colorado (top). The sporophyte (brown stems) and the gametophyte (low green vegetation) are distinct stages in a plant's alternation of generations (bottom). © Maggie Gaddis

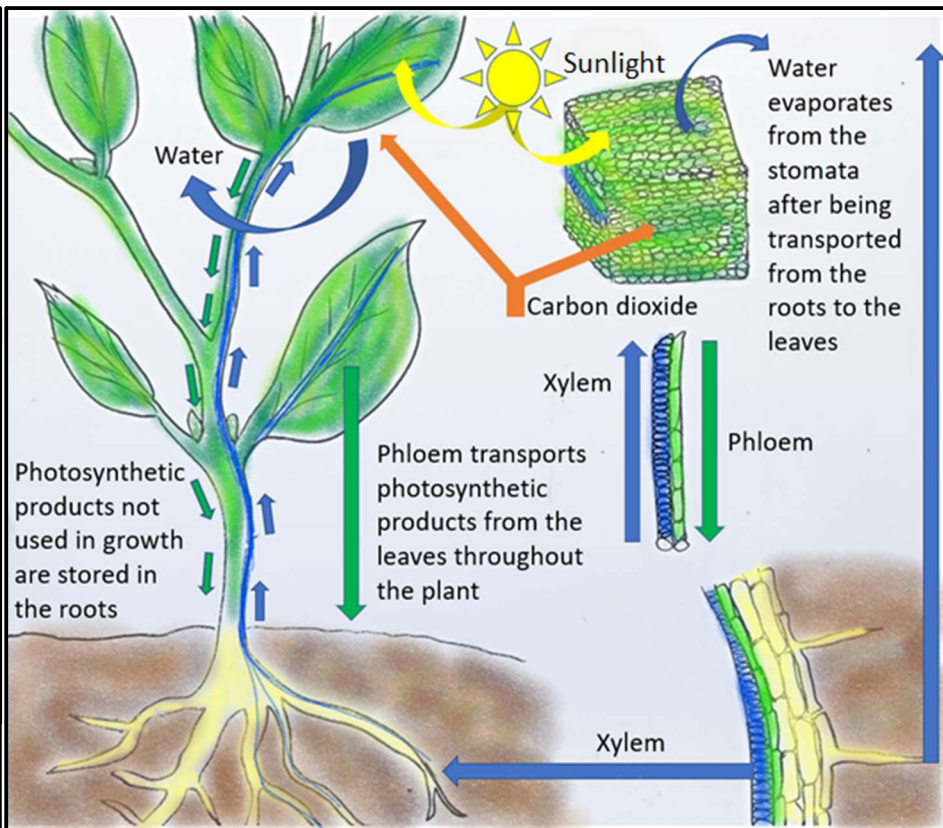


Figure 2. Vascular plants conduct water and nutrients through the xylem (blue tubes) and photosynthetic products in the phloem (green tubes). © Maggie Gaddis



Figure 3. The sporophyte generation (top photo) is the dominant generation of ferns (cliffbreaks fern, *Pellaea sp.*). The sporangia, or sori, develop on the underside of fern fronds (center photo). The gametophyte is a tiny heart-shaped structure that is rarely found in the wild (bottom photo). © Top and middle photos, Maggie Gaddis; bottom photo, © <https://www.fs.fed.us/wildflowers/beauty/ferns/reproduction.shtml>

### ◀ Seedless Vascular Plants

Seedless vascular plants include club mosses, horsetails, ferns, and whisk ferns. Ferns are the most familiar of the seedless vascular plants, as they are common plants of the temperate forests in the United States, and they also easily grow in containers. The fern life cycle takes part over two generations: the diploid sporophyte, which is the spore-producing generation, and the haploid gametophyte, which produces the gamete.

These generations are physically very distinct. The “fern,” which is the part of the plant you likely recognize, is the diploid sporophyte. The fronds of ferns produce sporangia (also called sori). To our eyes, the sori look like brown dots on the bottom of the green fronds of ferns. Within these sori, meiosis occurs, and gamete (sex cell) spores are released. Meiosis is the process by which the chromosomal

material of cells is divided to produce gametes. A spore grows into a gametophyte through the cell division process called mitosis. The gametophyte is a small leaflike structure also known as a prothallus. Upon the surface of the gametophyte, both sex organs, the female archegonium and the male antheridium, mature at different rates to promote cross-pollination. When fertilization occurs, a zygote forms. This zygote then grows into the fern frond, and thus, the cycle continues (Figure 3). This sexual stage of reproduction in ferns requires a moist environment

in which the spores can float on the surface of the prothallium until they unite in fertilization.

### Seed Plants

For nonvascular and seedless vascular plants, a moist environment is essential. The emergence of vascular seed plants signaled the first evolutionary adaptations for drought tolerance. The seed is an effective tool to promote the survival of offspring despite environmental variation—a niche containing the ▶



Figure 4. Examples of gymnosperm reproduction structures, called cones. The male cones of a ponderosa pine in Colorado are shown in the top photo. In the bottom photo, each woody scale of this lodgepole female pinecone holds one seed, which was independently pollinated. © Maggie Gaddis



◀ embryo itself, a food source, and a shelter in the form of a seed coat. The food source can be an endosperm and/or seed leaves (cotyledons), depending on plant classification. Seed plants are divided into two groups: gymnosperms and angiosperms.

## Gymnosperms

Gymnosperms are usually evergreen and have seeds that are not contained within an ovary ('naked' seeds; Figure 4). Gymnosperms do not need pollinators to get their reproductive work done; they are wind- or gravity-pollinated. They have modified stems called cones, which contain the reproductive cells. The

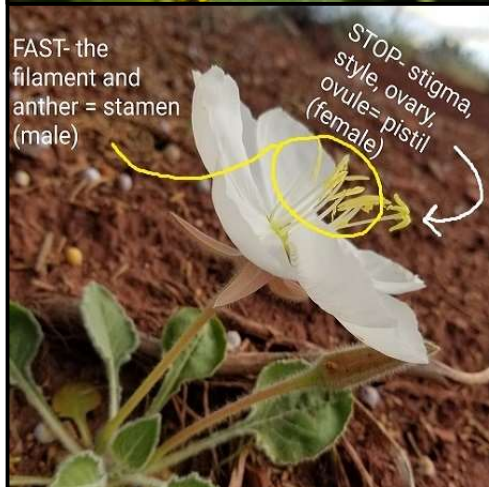


Figure 5. Angiosperms attract pollinators to facilitate sexual reproduction, despite their sedentary existence. Pollen (composed of male gametes) is released from the anthers, adhering to the pollinator, which then transports the pollen to the female part of a neighboring flower. The pollen develops a tube to transport the gametes down the style to the ovary, which holds the ovules (female gametes). The seed (the zygote) subsequently develops from the union of the male and female gametes. © Maggie Gaddis

female cones are the cones with which you are likely most familiar—they have bracts, can be woody, and contain archegonia, the female reproductive organs of gymnosperms. Male cones are smaller, often situated at the ends of branches, and release male gametes. The exceedingly small spores, commonly called pollen, float on the winds. When the pollen encounters a female cone, the ovum is fertilized. The seeds subsequently develop within the cones. Some conifer seeds, such as pine nuts, have culinary importance.

## Angiosperms

Angiosperms are the most diverse group of flowering land plants, with more than a quarter of a million known species. The term *angiosperm* comes from the Greek words *angeion* (receptacle or vase) and *sperma* (seed), translating to “enclosed seeds.” Many angiosperms have showy flowers to attract pollinators that transport the male genetic material (pollen) to the female reproductive organ (ovary), which sits at the base of the flower (Figure 5). The flower is just a billboard, an enticing call for visitation.

Buds develop at the tip of growing stems (apical meristems) of plants. Flowers form from these buds. The petals of the flower are collectively called the corolla and the sepals are collectively called the calyx. The corolla plus the surrounding calyx are together called the perianth. The corolla comes in a variety of shapes, sizes, and colors, depending on the plant. Some corollas have clear, distinguishable parts, while others may be joined together making one single sheet of tissue.

When it comes to pollination, the corolla has a significant role. Some pollinators are attracted to the corolla based on what they see. Bees, birds, and moths are important pollinators. Bees have a particularly sharp eye for corollas. Bees can see ultraviolet light, which allows them to see markings that humans cannot see on flower petals. These markings help guide the bees to the center of the flowers, drawing the bees in and eventually leading to pollination. In other plants, such as grasses, the corolla is adapted to wind pollination instead of insect pollination.

## Summary of Plant Classification

All plants are autotrophic eukaryotes. Nonvascular plants cannot move chemicals throughout their plant bodies. Vascular plants transport water and nutrients from the soil via the xylem. Phloem transports photosynthetic products throughout the plant from the leaves where they are created. Among the vascular plants, seedless plants produce spores that travel passively with the aid of gravity and wind. When the environmental conditions are right, a gametophyte begins to grow. Upon this gametophyte, fertilization occurs, and a new sporophyte develops. Seed plants have elaborate strategies for attracting pollinators which incidentally do the work of pollination while foraging. Pollination is the process of gamete transference.

*Dr. Maggie Gaddis is the Executive Director of the Colorado Native Plant Society. Maggie also teaches botany and resource management courses at UCCS in the Pikes Peak region. She is a restoration ecologist, ecological gardener, and mother of three children, four chickens, one dog, one cat, and countless plants! 🌿*

## Discovering iNaturalist

By Mo Ewing

I finally broke down and bought an iPhone. It took awhile because I didn't want to be one of those people who walk around seeing the world through a screen, or who answered their telephone when dining in a restaurant with friends. Even though I didn't intend to use the thing as a telephone (which would interrupt me when I was hiking somewhere beautiful), I was interested in the apps, which seemed really cool. In particular, I was interested in trying out those apps that identify flowers.

So I bought the phone, looked at the flower apps, and picked one called PI@ntNet because it supposedly had the largest database of photos that would help me identify plants in my own photos. I took the phone into my backyard and PI@ntNet correctly identified *Vinca minor*. It didn't do so well identifying the bark of the silver maple tree in our backyard, even though there was a special button to push for "bark." I thought that was a pretty cool test, and then I put the phone away and forgot about it...

When I was at the CoNPS Annual Conference in Trinidad last September, I met a friend who told me that iNaturalist did a great job at identifying flowers, and suggested I try that app. Since CoNPS and the Denver Botanic Gardens were both pushing iNaturalist in their citizen science programs, I thought I'd give it a try. I downloaded iNaturalist, and then I put the phone away, forgetting about it again...

Each year, Pauline and I go to her family's place on Nantucket Island in Massachusetts. I have always liked identifying what native plants I can in New England, because I lived in that area until 2003, when I moved to Colorado. In the intervening 19 years, I had become pretty rusty identifying eastern plants, except those that live in Colorado, too.

So one day, on my morning walk out on Nantucket, I took along my iPhone with iNaturalist to give it a test drive. The problem with Nantucket in October is that most of the native plants are no longer in bloom, so I have always been mostly limited to late-blooming asters.

The first shrub I came across was one with beautiful red berries. It looked so familiar. "Northern berry?" I thought. "Something about north." I turned on my phone and took a photo of the berries. iNaturalist came back with *Ilex verticillata*, winterberry holly,

which isn't found in Colorado. Of course! I knew right away it was correct. I had seen it many times before, in the olden days before 2003.

I came across another shrub with yellow berries. Again, this one looked vaguely familiar. iNaturalist was right on again: *Celastrus orbiculatus*, Oriental bittersweet, an exotic invasive species. (We would call this a noxious weed in Colorado, but fortunately it isn't found here.) Again, my memory was refreshed, and I knew it was right.

While I was in Nantucket, I also made a point of going online first and checking to make sure my final identifications were correct. My old employer, the New England Wild Flower Society (now known as the Native Plant Trust), has a terrific online plant key called "Go Botany" that I also used to verify my observations (we should have something like it in Colorado!).

So I began to realize one of the first things about iNaturalist—it is quite good at identifying plants by their fruit. I had forgotten to bring my old New England native plant bible, *Newcomb's Wildflower Guide*, with me, but, like most botanical books with dichotomous keys (Jennifer Ackerfield's *Flora of Colorado* and Weber and Wittmann's *Colorado Flora: Eastern Slope*, among them), it doesn't identify plants by their fruit. iNaturalist opened up a whole new range of plants to identify in Nantucket in October—a great way to extend my botanizing season!

iNaturalist is also a great way of overcoming "winter amnesia," that terrible process of forgetting all of the species you identified last summer and having to start all over again in the spring. I always hated getting ►



Winterberry holly (*Ilex verticillata*). © Mo Ewing

◀ into the alpine, seeing a flower that I knew I should remember, and having to plow through those lengthy family keys in Ackerfield or Weber and Wittmann to get all the way to species. With iNaturalist, you can quickly look at its recommendations and say, “Yes, that’s the one.” Then you send your observation to the cloud and do your thing for science.

Once you make an observation (photo of a plant) in iNaturalist, you share it by uploading the photo to the cloud. Then, other members can verify your identification. If enough people verify your photo, it becomes “Research Grade” and can be used by botanists for research. Another fun thing about this process is that you can find information about the person who verified your identification. Many of them provide a short bio about themselves with a photo. This is a great way to wheedle your way in with all the plant enthusiasts in your neighborhood. And one more wonderful feature of iNaturalist is that it contains lots of information about many species, such as good descriptions and photos of different phenophases.

Location data is really important if your observation is going to be used for research. With an iPhone or other smartphone, you have to opt in to the location service setting. Then, when you enter your observation, what your phone recorded as the location will be entered along with the photo. While verifying my observations in the iNaturalist cloud, I noticed—uh-oh!—there was no location on one, and the location was wrong on another. What happened? I learned that you need to leave your phone on long enough for it to get its correct GPS location from satellites. I went back, retook the photographs, and the location was very accurate.

There are other ways to enter a location with your observation, too. You can enter your own latitude/longitude coordinates, or you can choose a location based on the global map that appears when you select the “location” box in the “edit observation” page. You can also type a location name in the search box of the map to let the map services look for your site.

iNaturalist shows the location on a very high-definition aerial photo with a bubble around it. This is a great feature because after you take a photo, you can correct your location on the map before submitting your observation (maybe you walked a whole park, or just want to show an exact spot). Or you can go back to the species for a later look. You can also obscure the specimen’s exact location in sensitive cases, such as plants that may be rare, overcollected, or on private property.

Here’s another feature on the app that I love: a section called “Explore.” Select it and you can see all of the

observations that people have made in your area or around the world. Each observation is marked by a pin. Select the pin and you’ll see the plant photo, the person who took it, when it was taken, and its exact location. I found all sorts of observations of plants that I was interested in seeing, and I could use the app to go to their exact locations and find them. If a plant wasn’t in flower, the observation told me when it would be.

In Nantucket, there were a lot of people who were using iNaturalist. Some popular trails were covered with observations. But with one quick look in the “Explore” section, I could see areas, usually at the far ends of long trails, that needed observations.

My worries that ID apps would replace botanists now seem to be unfounded. On lots of species, iNaturalist could only identify the genus and make suggestions for the species. For instance, there were two goldenrods on Nantucket that were too similar for iNaturalist to make a species identification, so it suggested only the genus *Euthamia*. The goldenrods were almost identical, except *Euthamia graminifolia* (present in Colorado) has leaves that are greater than three millimeters wide and *Euthamia caroliniana* ▶



Grass-leaved goldenrod (*Euthamia graminifolia*).  
© Mo Ewing

◀ (not in Colorado) has leaves that are less than three millimeters wide. I used the “Go Botany” keys to differentiate these two species.

Something else that happens when you start to get hooked on iNaturalist—if you see something interesting that isn’t in your field of knowledge, you tend to snap a photo to see what it is. As I was walking on the Sanford Farm conservation area in Nantucket, I saw what looked like a little golf-ball-shaped mushroom that I had never seen before. I took a photo and iNaturalist identified it as genus *Lycoperdon* and gave three alternatives. Comparing it to other puffball photos, I could identify it as a peeling puffball (*Lycoperdon marginatum*), which is also found in Colorado. Two people quickly confirmed my observation. Research Grade!



Peeling puffball (*Lycoperdon marginatum*).  
© Mo Ewing

When I returned to Denver, I was curious to see what was happening in our neighborhood. Behind our house is a somewhat natural area called Prairie Park. I checked in the iNaturalist “Explore” area and found very few observations there. Then, looking at the 1½-mile section of the High Line Canal that I walk every week, I found only two or three observations. I was really surprised!

After I made just a handful of observations, they were confirmed by my friend Jennifer Ackerfield. I immediately joined the Denver EcoFlora Project, which uses iNaturalist and is run by Jennifer at the Denver Botanic Gardens. Since then, I have connected with other friends who are also participating in that project.

Now I’m totally hooked. iNaturalist is a wonderful program, great fun, educational, and it gets you outside to explore plants, even in the city.

*Mo Ewing is a retired conservation biologist who fills his leisure hours volunteering for CoNPS, the Denver Botanic Gardens, and the Colorado Natural Areas Program. His interests range from collecting mosses in New England and Colorado to studying the distribution of native plants worldwide, and studying and documenting Colorado plant communities.*

*Editor’s comments: Note that iNaturalist has many more additional features that are not covered in this article. For example, a smartphone is not required to use iNaturalist. Another option is to use a camera in the field and upload photos to iNaturalist from your computer at home. This provides the opportunity to select photos for the best resolution, crop the images, and so on.*

*It is also possible to make an observation with only a sound recording. Birds and frogs are good candidates for this option. And you can make an observation without any physical evidence at all—no photo or sound—just put in an empty box noting that you observed the plant. These observations cannot be elevated to Research Grade, but they are useful records for certain circumstances.*

*Also be aware that iNaturalist is often unable to provide species suggestions in the field because the observer may be in a place where there is no connectivity. Simply upload your observation from your photo library when you’re “back in town.”* 🌀

## 2022 Annual Photo Contest

Do you have any stunning photos of Colorado native plants you would like to share? The time is coming to submit your entries for the 2022 Annual Photo Contest!

Photos must have been taken by the CoNPS member submitting them and need to include the scientific name of the primary plant species in the photo. Please identify plants at least to genus level, preferably to species.

Each person may submit one photo for each of the five categories: CO Native Plants, CO Native Plant Landscapes, CO Native Plant Gardens, CO Native Plants and Wildlife, and Artistic Interpretation of CO Native Plants. Photos taken in any year are eligible. Entries must be previously unpublished, original material.

Please submit photos between June 24th and August 26th, 2022. Send entries to Anna Theodorakos (annatheo712@gmail.com) with “CoNPS Photo Contest” written in the subject line. If you are struggling with identifying the plant in your photo, email Anna and she can provide resources to aid in identifying. Voting will take place in-person at the CoNPS Annual Conference on September 17th.

## Plant Profile

### The Underground Life of the Sand Lily (*Leucocrinum montanum*)

By Jim Borland

Prior to their short but highly visible interlude on the face of the land, sand lilies (also known as star or prairie lilies) begin growth deep beneath the soil's surface long before the last snow.

The process begins with the growth of this year's blue-green foliage, flower stalks, and flowers atop last year's withered remains. While it may be conjectured that this new growth upon the old growth would eventually force the entire plant out of the ground, the whole of the plant is kept at its original depth by the formation of an entirely new root system consisting of contractile roots that actually pull the plant back to where it belongs each year.

The combination of fleshy storage roots and early spring moisture allows the low-growing sand lily to get its evolutionary job done long before its taller field companions are able to shade it from the sun and compete more tenaciously for the increasingly capricious summer rains.

Before this task is completed for the year, however, flowers must be fertilized, and seed must be set and distributed to ensure the star lily's continued place in the local flora for years to come.

The pollination and fertilization processes are fairly straightforward, even though the exact probable night-flying, long-tongued insect(s) have yet to be determined (an excellent project for the inquisitive). What is rather amazing is that the ovaries responsible for developing the seed are several inches underground! Normal mechanisms for seed dispersal, such as wind, water, or animal, may not apply to the sand lily. If seeds are not dispersed from the mother plant, then they are destined to germinate and grow in the worst possible position, next to a parent whose physical size and root system will surely outcompete that of a seedling trying to get a toehold on life.

Further observation, however, reveals that as the underground seedpod ripens, the stalk which bears it

lengthens, bringing the pod to within 1/4 inch or so of the ground surface. There it remains throughout the remainder of the summer and following winter months.

Upon regrowth in spring, the parent lily's new shoots often lift these now partially decayed seed pods above the ground surface where they are finally subject to dispersal by wind, water, and the actions of fauna, large and small.

Once dispersed, the seeds are then subjected to the greatest gamble in their lives. Dumb luck, fate, accident, pure chance—all play a role in determining whether a seed finds the right place to germinate, establish, and remain until it can repeat the success of its parent.

Once germinated, the seed continues the species' evolutionary advance by growing only one leaf the first year and only two leaves the following year. During this time, contractions of its developing root system pull it into its proper position in the soil. Several years pass before it can bloom and deliver its heritage onto yet another generation of star lilies to grace the land.

*Jim Borland has been fooling around with native plants for more than 40 years in private, commercial, and public venues. His home garden contains 1000s of native plants, most grown from seed at home and now 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.*

*Editor's note: Panayoti Kelaidis actually had the good fortune to observe the distribution of *L. montanum* seeds. "...one miraculous day, with a gentle breeze, I actually found a field of them where the seed was emerging and being blown about before my eyes--like magic! The wind and temperature were perfect to summon (as it were) the seed from underground..."*

<https://www.nargs.org/forum/hand-pollinating-crocus> ☞



Sand lily (*Leucocrinum montanum*). © Kelly Ambler

## The United Nations Decade on Ecosystem Restoration

By Sue Dingwell

Already in its second year, the UN resolution declaring 2021–2130 as the Decade on Ecosystem Restoration has been largely eclipsed by other events. The pandemic overshadowed public outreach plans for 2021, and the war in Ukraine is now the focus of global media attention. However, while these events are important, the long-range future of our planet is dependent on restoration of degraded ecosystems.

### What is the UN Decade on Ecosystem Restoration?

- A resolution adopted by the UN General Assembly, March 1, 2019, and led by the UN's Environment Programme and its Food and Agricultural Organization;
- A coalition of national governments, organizations, and individual citizens; and
- A program created to prevent, halt, and reverse degradation of ecosystems worldwide.

Most members of the Colorado Native Plant Society are familiar through personal experience with some of the reasons restoration has become a critical issue: certainly our ongoing, severe, and statewide drought and the imperiled condition of the Colorado River are at the forefront. We have all seen first-hand the loss of biodiversity in our state, the increase in air pollution, and the effects of extreme wildfires.

As native plant lovers, we have an opportunity and challenge to play an important role in this worldwide initiative. We know, perhaps more intimately than most, what an important—indeed, fundamental—role native plants play in keeping our ecosystems healthy, productive, and sustainable. So it is worth the effort to understand DER, which is a far-reaching resolution, and we need to support it in any way we can, both as an organization and as individual citizens who can influence the thoughts and actions of others.

Authors of the resolution had a clear understanding of the steep hurdles to overcome: financing,

implementing policy change, supporting leaders in the restoration field, and getting “boots on the ground,” among others. The website authors have developed a comprehensive site that acts as a hub—

[www.decadeonrestoration.org](http://www.decadeonrestoration.org)—a site with excellent visual appeal and simple, compelling language that can be understood by anyone. There they define the problems, suggest nature-based solutions, and consistently emphasize the correlation between ecosystems and the livelihoods of the people who inhabit them. Even the people who don't love columbines (an unconfirmed rumor I once heard) will understand why restoration must be a priority.

On the website, in addition to guides for a wide variety of restoration needs, you can find communication toolkits; ways to register projects, reports, and examples of progress; and plenty of good explanations

to share with the still-unconvinced. For a visually stunning and fun interactive experience designed for both kids and adults, take the Ecosystem Journeys: <https://www.decadeonrestoration.org/ecosystem-journeys>

Toward the end of this year, there will be a celebration and publication of projects called World Restoration Flagships. These are projects defined by the UN as the first, best, or most promising of large-scale and long-term ecosystem restorations, which must include plans for the necessary political and financial support to scale their efforts. This will be worth seeing! Will there be one from Colorado?

### Society for Ecological Restoration

One of the official partners of the Decade on Ecosystem Restoration is the Society for Ecological Restoration, an organization active in Colorado as well as around the world. SER was founded in 1988 as a global community whose mission is to bring restoration to every corner of the Earth. Focused on integrating knowledge and practice, it is actively ►





Harvesting willow poles of *Salix exigua* for restoration at Heil Valley Ranch which was extensively burned in last summer's Cal-Wood fire. © Brad Winckelmann (Boulder County Parks and Open Space).

## Final Thoughts

There really is no Planet B. How we choose to value and practice restoration in the coming decade will form its defining outcome. The UN Decade on Ecosystem Restoration is using the hashtag #Generation. You are never too old, or too young, to be a part of that generation, to be a part of the change so urgently needed to see our shared planetary ecosystem restored.

*Sue Dingwell started her native plant journey in Florida, where the revelation of what plants could do in the hot sand scrub was a transformative learning experience. She became a member of the Florida Native Plant Society and used her background in education to become a dedicated advocate of native plants and conservation. A Master Naturalist in both Florida and Virginia, Sue is currently a member of both the Virginia and Colorado Native Plant Societies.* ☞

◀ pursuing new technologies, determining and evaluating best management practices, working to mainstream ecological restoration into decision-making processes, and fostering networking among practitioners. SER members range from concerned individuals in our Colorado communities to working professionals to organizations and businesses. To learn more about these and other activities, visit the SER website: <https://www.ser.org/>

A SER webinar I attended recently was “Ecological Restoration: Where It Has Been and Where It Is Going.” This was a presentation featuring experts with decades of practice who shared their visions and experiences in restoration projects around the world followed by a free-flowing discussion that included participants who likewise were from around the world. Big takeaways included the need to:

- Bridge science and policy;
- Make restoration costs and benefits apparent to policy makers and incorporated into decision-making;
- Have people engaged at all stages of the process;
- Get restoration jobs incorporated into the economy, instead of relying on free volunteer labor; and
- Make restoration a nourishing activity, incorporate it into community rituals, inspire people toward patriotic pride in their planet.

One of the ways SER is supporting the Decade on Ecosystem Restoration is by sponsoring a MAD (Make a Difference) week, to be held June 4–11, 2022. During this week, everyone everywhere is invited to engage in hands-on activities to positively impact their local communities. It's late, but not too late, for you to engage. The city of Longmont has listed a project there. You can add a project of your own or join another's: <https://makeadifferenceweek.org/>

## The Dove of Evening By Arthur Clifford

Who can name such innocence?  
Hear its budding cry  
*Oenothera caespitosa*: The Dove of Evening  
Before the dawn to die  
Yet we have walked...Oh Lover Mine!  
Can any other paint possibility?  
Scent Heaven's face sublime?  
Together we sing in mountain halls  
*Mertensia* chime o'er waterfalls  
We've blossomed together Beloved One  
Just one day...  
One morning sun



Tufted evening primrose (*Oenothera caespitosa*).  
© Kelly Ambler

## 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. With the evolving COVID-19 situation, the status of in-person CoNPS events might change.

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.

## New Membership and Communications Coordinator



We are pleased to announce our new employee, Anne Beard. She will be filling the Membership and Communications Coordinator position. We are taking a good look at what our needs are as an organization. Our membership is growing! It is important for us to increase our efforts in communicating with

our members. CoNPS has many exciting programs, events, and activities all over the state. We have many outlets in which we communicate, including *Aquilegia*, social media outlets, the website, and the e-newsletter. Different volunteer teams manage these

roles. We want to focus our efforts on supporting these volunteer teams to streamline our efforts to deliver quality information and programming to the Society. We appreciate you, our CoNPS members! Anne, we are excited about our future together. Anne Beard grew up in a rural area north of Golden, Colorado and spent her youth exploring the hills, valleys, and fields around her home on foot and horseback. She earned a BA at CU Boulder then embarked on a career that led to years living on the east and west coasts, South America and Europe. Anne has two master's degrees from the University of California, Berkeley, including an MBA with a focus on the management of non-profit organizations. Anne has worked with a number of non-profit organizations providing strategy, fund development, and communication services. Anne is deeply committed to the mission of CoNPS and is excited to work with its members, volunteers, board, and staff in fulfilling it. 🌀

## CoNPS Society-Wide Events and News



Chocolate flower (*Berlandiera lyrata*), one of the many plants in the sale. © Liz Makings

### CoNPS Spring Native Plant Sale

PICK-UP DATE (ONE DAY ONLY)

Saturday, May 21.

Order ON-LINE at <https://conps.org/conps-spring-sale-2022/>

Many species of native wildflowers, grasses and shrubs are still available. The plants are grown by Harlequins Gardens and are pesticide-free!

This year, there are three pick-up locations –

- 1) Chatfield Farms
- 2) Lafayette
- 3) Colorado Springs

If you are from the Fort Collins/Loveland area, you are encouraged to go directly to the High Plains Environmental Center website to obtain native plants from their inventory of 120 species. HPEC is a proud supporter of CoNPS! ►



◀ **NEW** this year! We will have a good stock of plants from which the **customer** gets to pick for the inevitable substitutions. Harlequin's is doing their utmost to grow and deliver exactly what we order; however, weather cannot be ordered. So, if your order is missing a plant, you will be able to choose from among the overage of many other species! We are going for no refunds, every plant desirable, every customer happy sale. AND...the overage can be purchased during the last hour at each location.

### Many Volunteers Needed for This Sale!

Go to [conps.org](https://conps.org) calendar or event listings to sign up, or email [deniseclairewilson@gmail.com](mailto:deniseclairewilson@gmail.com)

This year, we will pull orders at Chatfield on the Thursday afternoon and Friday before the pick-up day. Wednesday at Harlequin's for the Boulder-area orders. Thursday transport plants from Harlequins to Chatfield. Saturday in all three locations loading orders for customers. **NEED:** extra helpers, drivers and trucks for transporting plants from Harlequins to Chatfield on Thursday morning, May 19. Free pizza/lunch for volunteers at noon each day!

One of many plants available at the plant sale is *Berlandiera lyrata*, the chocolate flower, a perennial with mounded, coarse, gray-green foliage, and a distinct chocolate aroma. Night-blooming flower heads have yellow rays surrounding a maroon central disk. The numerous, daisy-like blossoms bloom spring through early fall. 12-15" tall and 18-24" in width. A cold, heat, and drought-tolerant plant found in dry places in the southeastern Colorado plains on roadsides, alkali flats and slopes; does well in shallow, sandy, rocky soil. May self-seed. Deer resistant. 🌀

## Live Garden Tours in June

We will be holding three Garden Tour events on different dates in June, 2022. **Registration coming to the <https://conps.org/event-calendar-2/#!calendar> website in May.**

### Longmont/Boulder/Lafayette

**Saturday, June 4**

Tickets \$25 members/\$35 non-members

Visit four personal gardens in Longmont, and one in Louisville, then make a stop to view the plantings at Harlequins Gardens in north Boulder. **NEW!** Option to pay an extra \$10 members/\$15 non-members for a Special Educational Tour of the Arrays and Audubon Habitat Heroes Pollinator Garden at Jack's Solar Garden. Limited to 40 registrants.

### Denver

**Saturday, June 11**

Tickets \$32 members/\$42 non-members

Tickets include admission to Denver Botanic Garden's Chatfield Farms.

We have a special viewing of three Denver Botanic Gardens Horticultural Curators' Home Gardens, plus your ticket includes entry into Chatfield Farms. Mike Bone, Mike Kintgen and Dan Johnson will be showing off their home gardens. Also on the tour will be Jim Borland and his gardens containing many years of mature native plantings, and Kelly Grummons, whose landscape includes many of the cold hardy cacti which he sells.

### Fort Collins/Loveland

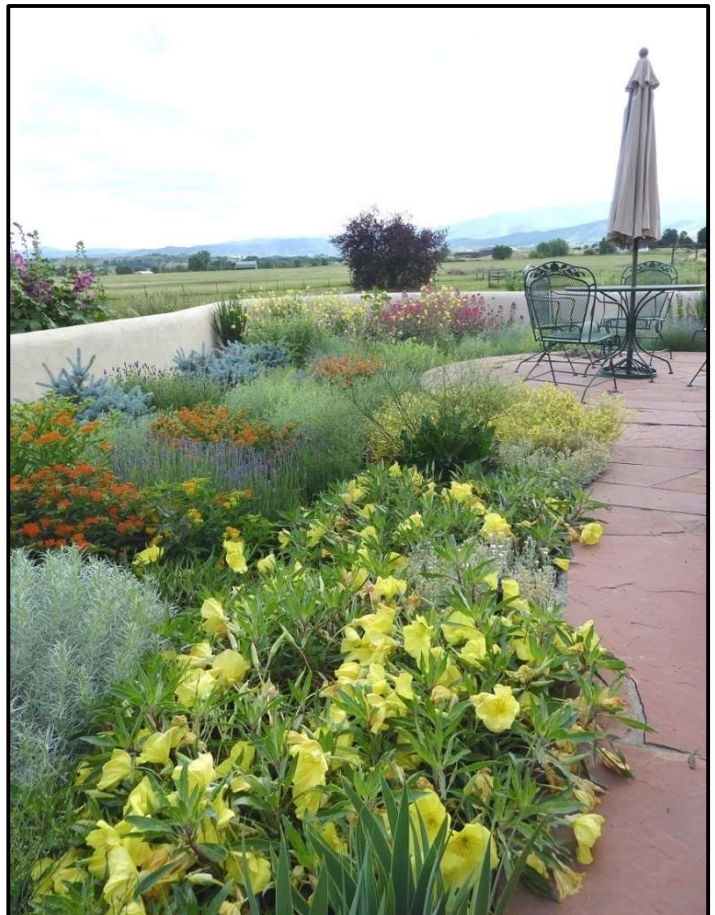
**Saturday, June 25**

Tickets \$25 members/\$35 non-members

The Fort Collins/Loveland Garden Tour has four private homes and the institutional garden of Nix Native Plant Garden, plus a final stop at High Plains Environmental Center.

## Volunteers for All Garden Tours Needed

Volunteers will work a half-day helping a host. Each volunteer receives a **FREE** ticket to view the gardens in the tour for the other half of the day. To sign up, email: [deniseclairewilson@gmail.com](mailto:deniseclairewilson@gmail.com) 🌀



Sneak Preview: Piombino garden on the Longmont tour.  
© Pam Piombino

## 2022 CoNPS Grant Recipients

Each year, CoNPS funds small grants to support field and laboratory research on the biology and natural history of Colorado native plants.

### John Marr Grant

Kathryn Dawdy, Master's student at Chicago Botanic Garden and Northwestern University; "The effects of advanced plant phenology on herbivory and plant demography." \$1000

Audrey Spencer, PhD student at University of Colorado Denver; "Clarifying the systematics and taxonomy of *Physocarpus* (Rosaceae): Implications for the origins of the flora of the Southern Rocky Mountains in Colorado." \$1000

Brendan Connolly, Master's student at Chicago Botanic Garden and Northwestern University; "Not all pollinators are created equal: Evaluating differences in pollination efficiency using a Colorado montane pollination system." \$775

Elsa Godtfredsen, Ph.D. student at Chicago Botanic Garden and Northwestern University; "Earlier Snowmelt, Earlier Flowering, and Increased Drought: New Realities of Subalpine Plant Reproduction under Climate Change." \$775

### Myrna Steinkamp Grant

Tiffany Gentry, Master's student, University of Colorado Denver; "Inferring the phylogeny of *Eutrema penlandii* to inform conservation measures and understand the biogeographical history of the Rocky Mountains." \$1000

Deannah Neupert, Ph.D. student, Miami of Ohio; "Floral production in *Mimulus gemmiparus*." \$700

Jennifer Ackerfield, Denver Botanic Gardens; Pam Smith, Colorado Natural Heritage Program; Anthony Massaro, Jefferson County Open Space; and Mit McGlaughlin, University of Northern Colorado, "Mystery of the Misidentified Mustard." \$1000

### Mission Grant

The spring 2022 Mission Grant has been awarded to two recipients who are undertaking exciting projects to support native plantings with a public education component. The first award will support the Manitou Seed Library, an educational and advocacy project to provide native seeds and encourage regional community gardens to plant native species appropriate to their locale. The Seed Library will use its own garden space to grow ecotypically appropriate seed of several native species, providing them at no cost. There will also be signage and on-site educational programming to help other regional gardens adopt similar programs. The second award will support ongoing restoration activities at Montessori Peaks Academy in Littleton. The school sits on 8.5 acres and strives to provide students (grades 3 through 6) with hands-on, outdoor education. Restoration of the school property is being completed in phases (Russian olive has been removed along the property's riparian areas and there is a pollinator garden!). The next phase is to plant native shrubs for erosion control, wildlife habitat, and additional learning opportunities for the students in their outdoor classroom. Congratulations to applicants David Woolley and Steven Splitok and their teams. Thank you for your important work! 🌀

## CoNPS Webinars

### Colorado's Native Plant Families

**Saturday, May 14, 9:00 AM–12:00 NOON**

**Presenter: Lenore Mitchell**

Join us for a lively virtual exploration of Colorado's plant families. Extensive photos along with sketches of distinguishing characteristics will enhance identifying and keying flora. While there are approximately 155 plant families in Colorado, this presentation will emphasize those with the most species, for example, Asteraceae (sunflowers), Brassicaceae (mustards), and Rosaceae (rose), along with common shrubs and some trees. This webinar is designed for beginners and intermediate amateur botanists or anyone new to our fabulous flora.

*Lenore Mitchell is a native Coloradan who has taught Basic Botany courses at DU's Olli Adult Ed Program for five years and CSU Extension's Native Plant Master Program for 16*

*years. She is also a former president of the CoNPS Denver Metro Chapter. Lenore has been a Master Gardener, a naturalist at Roxborough State Park, and a Denver Botanic Gardens hike leader for the alpenes at Mt. Goliath.*

### CoNPS Gardening with Native Plants Series: Friend or Foe? Insect Interactions with Native Plants

**Wednesday, May 25, 6:00–8:30 PM**

**Presenter: Amy Yarger**

Plants and insects share a long, complicated evolutionary history, acting sometimes as partners and sometimes as antagonists. During this webinar, Amy will discuss the intimate and sometimes unexpected relationships between plants and insects. Included are stories of plant-insect "frenemies", pollination-gone-wrong, chemical arms races, and, of course, what happens when exotic species get in ►

◀ the mix. Participants will also learn the benefits of biodiverse landscapes and the best ways to encourage productive partnerships between plants and beneficial insects.

This webinar is appropriate for beginners but designed for anyone with an interest in ecology and evolutionary biology of plants and insects.

*Amy Yarger has worked in the public horticulture field since 1996. She received a bachelor's degree in Ecology and Evolutionary Biology at the University of California, Irvine, and then went on to study plant-animal interactions at the University of Michigan. Her master's thesis covered the effects of invasive weeds on pollinator-plant relationships. Amy currently leads Butterfly Pavilion's local pollinator habitat initiatives, such as the Baseline Pollinator District and the Urban Prairies Project, which restores habitat in urban and suburban green spaces. Her work at the Butterfly Pavilion, where she has worked since 2000, touches on many of her passions: plants, insects, habitat conservation, and science education.*

### **Mark your calendars for the next CoNPS Special Speaker Series!**

#### **An Evening with Scott Hoffman-Black: A Win-Win for Insects: Nature-Based Climate Solutions Address Both Climate Change and Biodiversity Concerns**

**Thursday, July 28, 6:30–8:00 PM**

Keep an eye out for the CoNPS E-News for webinars and other programs that are constantly being added!



Are you a Native Plant Master? Please consider teaching a summer LIVE course. Take your knowledge to the next level and become a certified Native Plant Master volunteer. As a NPM volunteer, your role is to educate others at your current job or volunteer position. Anyone can take NPM courses or classes, but teaching is one of the best ways to cement your knowledge. Plus, you will help to magnify the impact of the program by bringing research-based information and personal experience about plants to new audiences.

Learn more at the Colorado State University Extension Native Plant Master website:

<https://extension.colostate.edu/topic-areas/natural-resources/native-plant-master-program/> 🌱

## **CoNPS Chapter Updates and Events**

### **Boulder Chapter**

Contact [boulderconps@gmail.com](mailto:boulderconps@gmail.com) for info.

The Boulder chapter is hosting the Annual Conference in 2022. Stay tuned for more information about volunteer engagement at the conference.

### **Metro-Denver Chapter**

Contact [metrodenverconps@gmail.com](mailto:metrodenverconps@gmail.com) for info.

**We are seeking additional Leadership Team members!** If you are interested in joining the team, please email us at [MetroDenverCoNPS@gmail.com](mailto:MetroDenverCoNPS@gmail.com). Everyone from all backgrounds is welcome, and no experience is necessary, just enthusiasm!

**Seeking volunteer field trip leaders for the 2022 season!** Please fill out the form if you are interested in leading a field trip for the 2022 season. We encourage new volunteers to apply at

[https://docs.google.com/forms/d/1gx710x6g4xrxGoSt8\\_gKxoQdVw2shajF8Rh7g12Src/edit](https://docs.google.com/forms/d/1gx710x6g4xrxGoSt8_gKxoQdVw2shajF8Rh7g12Src/edit)

#### **May 13, 8:00 AM–12:30 PM, Field Trip Green Mountain Led by Judy King**

The group will hike the Hayden Trail to a short cut to the Green Mountain Trail and back down to the parking lot.

#### **June 4, 9:00 AM–12:00 PM, Field Trip Mount Falcon Led by Denise Larson**

Join trip leader Denise Larson on a trip to learn more about plants! Mount Falcon Open Space occurs on the top of the rolling foothills just outside of Denver. Several multi-use trails meander through large montane meadows, ponderosa pine woodlands, and Douglas fir/ponderosa pine forest. Additionally, we'll observe how the vegetation has recovered from a wildfire over thirty years ago in a portion of the park. ▶

◀ **June 27, 8:00 AM–2:00 PM, Field Trip**  
**Reynolds Park**  
**Led by Kelly Ambler**

Reynolds Park contains a wide variety of habitats in a relatively small area, which results in a great diversity of wildflowers. Ecozones range from riparian to foothills to ponderosa to montane. The most unusual plant of the area is the spurless Colorado blue columbine (*Aquilegia coerulea* var. *daileyae*). The spurless form of blue columbine lacks the typical long spurs and white petals, suggesting a different pollinating scheme compared to typical blue columbines. Another favorite of the area is shooting star (*Dodecatheon pulchellum*). More than 70 species of wildflowers have been recorded in the park. Note: we have the option of extending the field trip if enough participants are interested.

**July 15, 8:00 AM–2:00 PM, Field Trip**  
**Loveland Pass Lakes**  
**Led by Kelly Ambler**

We will explore the area around the Loveland Pass Lakes, located just south of the Pass. A wide range of alpine and subalpine plants should be present. There are modest elevation changes around the Lakes. Most of the travel will be on old jeep trails. If time permits, and there is interest, we can also look for plants at Loveland Pass and/or at pullouts along US6.

## **Northern Chapter**

Contact Ann Grant at [odygrant@gmail.com](mailto:odygrant@gmail.com) for more information.

**May 14, 3:00–5:00 PM, Field Trip**  
**May 17, 30, 3:00–5:00 PM, Field Trip**  
**May 24, 3:00–5:00 PM, Field Trip**  
**Citizen Science: Phenology and Pollinator Observations**

Join citizen scientists across the nation in participating in Project Budburst to collect data that will help scientists understand and track the effects of climate change on our natural world. Contribute to a statewide data-collection effort focused on 14 Colorado native plant species or how pollinators interact with Colorado native plants.

## **Plateau Chapter**

Contact Jim Pisarowicz at [pisarowicz@alumni.hamline.edu](mailto:pisarowicz@alumni.hamline.edu) for more info.

The Plateau chapter partners with Weehawken Cultural Center to present the 2022 Weehawken wildflower workshops. Please contact Jim for more information.

## **San Luis Valley Chapter**

Contact Carol English at [slvchapterpresident@gmail.com](mailto:slvchapterpresident@gmail.com) for more info.

**July 9, 7:30 AM–5:00 PM, Field Trip**  
**Dorsey Creek**  
**Led by Carol English**

Join us for some amazing botanical adventures at Dorsey Creek in Saguache County! The site is located a few miles south of Poncha Pass (elevation 8000-9000') where we'll find *Penstemon griffinii*, *Geranium caespitosum*, needle and thread grass, several sage species, stonecrop, and so many other beautiful flower species within the sagebrush habitat. Along with the botanical views, the landscape views are lovely within the Sangre de Cristo Mountains. This is an intermediate to strenuous hike, so be prepared to move!

## **Southeast Chapter**

Contact Curt Nimz at [curtisnimz@gmail.com](mailto:curtisnimz@gmail.com) for more information.

**May 12, 9:00 AM–12:00 NOON, Plant Inventory**  
**Black Canyon Open Space, Manitou Springs**  
**Led by Curt Nimz**

We will be working to inventory the flora (trees, shrubs, grasses and flowering plants) that are found in Manitou Springs Black Canyon Open Space. The CoNPS SE Chapter is doing the plant inventory to support the Manitou Springs Pollinator District becoming certified. We will be documenting all observations with photographs and recording them on iNaturalist.

**May 17, 6:00–8:00 PM, Virtual Meeting**  
**Flora of Florissant Fossil Beds National Monument**  
**Presented by Tom Greene**

Florissant Fossil Beds National Monument was created in 1969 to preserve the incredible fossil assemblage of a lost redwood forest. The Monument recently added 280 acres, where Tom did an informal plant survey in July 2021. Tom will present a brief introduction of the Monument, its herbarium, and what he found on the new acreage last summer.

**May 20, 8:30 AM–12:00 NOON, Field Trip**  
**Spruce Mountain Open Space**  
**Led by Maggie Gaddis**

Starting at the east Trailhead we will go along the easy Meadows Trail and the Eagle Pass Trail Cutoff which will be an easy to moderate hike of 2-3 miles (round trip). The group will go at a slow pace to allow time to identify species and take photos. We should see pasqueflower (*Anemone patens*) and Rocky Mountain spring beauty (*Claytonia rosea*). Anyone who wants a longer and more strenuous hike ►

◀ can take the Eagle Pass Trail/Service Road to the top where you may find larkspur (*Delphinium nuttallianum*), blue-eyed Mary (*Collinsia parviflora*), and slender phlox (*Microsteris gracilis*).

**June 3, 8:30 AM–12:00 NOON, Field Trip**  
**Paint Mines Interpretive Park**  
**Led by Curt Nimz**

We will do an easy walk/hike along the trails in the Paint Mines Interpretive Park in eastern El Paso County to look at the early season wildflowers. The main wildflower attractions are white penstemon (*Penstemon albidus*), hedgehog cactus (*Echinocereus viridiflorus*), downy paintedcup (*Castilleja sessiliflora*), and both red and yellow whole-leaf paintbrush (*Castilleja integra*).

**June 4, 10:00 AM–2 PM, Field Trip**  
**Colorado Trail Wildflowers**  
**Led by Birgit Semsrott**

This field trip will explore our local wildflowers, shrubs and trees on this short section of the Colorado Trail. For example, there is an abundance of Canada buffalo berry (*Shepherdia canadensis*) with its rust-colored scales in this area. We will talk about identification, distribution, and medicinal uses of plants. Hopefully, we also will see the calypso orchid (*Calypso bulbosa*) in bloom.

**June 11, 10:00 AM–1:00 PM, Field Trip**  
**Florissant Fossil Beds National Monument**  
**Led by Tom Greene**

This field trip will go through wet meadows and a mixed ponderosa/fir forest of Florissant Fossil Beds National Monument. The trail is an easy to moderate hike of 3 miles (round trip). The group will go at a slow pace to allow time to identify species and take photos.

**June 15, 9:00 AM–1:00 PM, Field Trip**  
**Pikes Peak-Elk Park**  
**Led by Doris Drisgill**

This is an easy-to-moderate 2-4 mile hike over the tundra and along a trail that has some loose gravel. We should see many alpine wildflowers such as alpine dwarf columbine, *Aquilegia saximontana*, alpine forget-me-not (*Eritrichium nanum*), boreal rockjasmine (*Androsace chamaejasme*), and alpine primrose, (*Primula angustifolia*). There may be James' teleonix (*Teleonix jamesii*), but they usually flower later.

**June 16, 6:00–8:00 PM, Virtual Meeting**  
**Introduction to Pollinator Week**  
**Presented by Maggie Gaddis, Alli Schuch, and Melody Daugherty**

This meeting will present the origins and purpose of Pollinator Week along with the planned activities and

the organizations involved. The Colorado Native Plant Society is a Manitou Springs Pollinator District partner organization.

**June 24, 8:00 AM–2:00 PM, Field Trip**  
**Emerald Valley**  
**Led by Doris Drisgill**

This is an easy-to-moderate 2-4 mile hike along a gravel road and then along a trail after gate. The hike is known for the presence of yellow lady's slipper orchids (*Cypripedium parviflorum*), but we can also expect to see Colorado columbine (*Aquilegia coerulea*) and shooting stars (*Dodecatheon pulchellum*). If you look carefully, you may find a spurless columbine (*Aquilegia coerulea* var. *daileyae*) among the other columbines.

**July 13, 8:00 AM–12:00 NOON, Field Trip**  
**North Cheyenne Canon- Buffalo Creek**  
**Led by Doris Drisgill**

This will be an easy to moderate 3-4 mile hike. The first part of the hike is an easy 1 ½ miles walk along Lower Gold Camp Road (closed to cars) to the collapsed tunnel. Then the trail becomes a moderate hike along Buffalo Creek on the trail to St. Marys Falls. The wood lily (*Lilium philadelphicum*) should be flowering along with self-heal (*Prunella vulgaris*), towering lousewort (*Pedicularis procera*) and black-eyed Susan (*Rudbeckia hirta*). There may be some Colorado columbine (*Aquilegia coerulea*).

**July 23, 8:00 AM–12:00 NOON, Field Trip**  
**Women's Forest, Divide, CO**  
**Leader: David Elwonger**

This will be an easy to moderate hike of 2-4 miles out and back. The trail is lightly trafficked and goes through open meadows and beneath towering, plentiful aspen groves. But beware: Cattle roam free, so keep the furry friends on leash. Make sure you close the cattle gate. Trail 375 does make a 5.1-mile loop.

On the hike we may see Lambert's/whorled locoweed (*Oxytropis lambertii*), Gunnison mariposa lily (*Calochortus gunnisonii*) and fairy trumpet/scarlet skyrocket/scarlet gilia (*Ipomopsis aggregata*).

**July 28, 9:00 AM–12:00 NOON, Field Trip**  
**Lovell Gulch**  
**Led by David Elwonger**

This will be an easy to moderate hike of 2-4 miles out and back. The trail does make about a 6-mile loop with some difficult steep sections. The first mile is nearly level along the edge of the timber. The trail then crosses a stream and forks, where it starts the loop section of the trail. We will turn right and travel upstream along a narrow meadow. Anyone wanting a longer hike can continue to where the trail meets ▶

◀ Rampart Range Road and then loops back to the west along the ridge, offering spectacular views of Pikes Peak and Ute Pass. We should see Gunnison mariposa lily (*Calochortus gunnisonii*). Often white monkshood (*Aconitum columbianum*) can be seen along the stream.

**August 7, 8:00 AM–12:00 NOON, Field Trip  
Red Rock Canyon Open Space  
Led by Curt Nimz**

We will do an easy walk/hike (2-4 miles) along the trails in the Red Rock Canyon Open Space in Colorado Springs to look at the wildflowers. Expect to see many yellow composites such as common sunflower (*Helianthus annuus*), golden crownbeard (*Verbesina encelioides*), and hairy goldenaster (*Heterotheca villosa*). In previous years we have found birdbill dayflowers (*Commelina dianthifolia*) and the prairie goldenrod (*Solidago ptarmicoides*).

**August 10, 9:00 AM–12:00 NOON, Field Trip  
The Craggs  
Led by David Elwonger**

The Craggs are a group of rock pinnacle formations on the west side of Pikes Peak. The hike will be 2-4 miles out and back along a mostly moderate trail with some difficult places.

Wildflowers that should be present are blue/Parry's gentian (*Gentiana parryi*), rose/autumn dwarf gentian (*Gentianella acuta*), Gunnison mariposa lily (*Calochortus gunnisonii*), and nodding onion (*Allium cernuum*).

**Southwest Chapter**

Contact Amanda Kuenzi at [amandakuenzi@hotmail.com](mailto:amandakuenzi@hotmail.com) for more information.

**May 15, 8:30 AM–3:00 PM, Field Trip  
Trail Canyon, Santa Rita Park in Durango  
Led by David Temple**

David Temple will guide us as we explore plants in the nursery for an hour or so, then move to the waterfall trail, then explore pinyon-juniper habitat in the upper meadows and a couple of side slopes (time permitting). Depart the property early- to mid-afternoon. Expect easy hiking, but David can provide transportation up and down the canyon for anyone who needs assistance.

**May 21, 7:30 AM–12:00 PM, Field Trip  
Durango Nature Center  
Led by John Bregar**

The nature Center, in pinon-juniper habitat on the Florida River south of Durango, already has a plant check list; our goal is to confirm species on their list,

correct the IDs of some species, and add new species to their list. Bring footwear adequate for up to 2 miles of easy walking on uneven and loose trail. Also, bring water, sunblock, sunhat, and a snack.

**July 2, 7:00 AM to mid-afternoon, Field Trip  
West Lime Creek Trail  
Led by Sue Parks**

We will slowly hike north from Highway 550 into the West Lime Creek (trail 679) drainage looking for as many flowering species as we can find in order to build a species check list for this trail. This trail follows West Lime Creek for several miles so there is typically an abundance of wildflowers due to the variety of habitats.

**July 19, 8:00 AM–2 PM, Field Trip  
Pass Creek Trail  
Led by Travis Ward**

Hike up the Pass Creek Trail through open slopes teeming with wildflowers, then through several microhabitats in spruce-fir forest to a pond sporting wetland species, and—time and weather permitting—on through more subalpine habitat to alpine habitat. 🌀



**Save the date: September 16–17**

The Auction will be LIVE once again at our Annual Conference in Boulder this September! It's time to start imagining what you will want to donate to our important fundraiser. Yes to tools and equipment related to botanizing at home or in the field. Related books and artwork of all kinds. Maybe an experience like a night at your favorite restaurant or a stay in your vacation home. Let's think big! Contact your chapter leaders or email Sue directly with your questions or your offers!  
[sageblue892@gmail.com](mailto:sageblue892@gmail.com).

## Cross-Pollination Events

### May 13

Smithsonian Botanical Symposium  
<https://naturalhistory.si.edu/research/botany/news-and-highlights>

### May 15-22

Colorado Noxious Weed Awareness Week

### May 16-20

Society of Wetland Scientists Annual Meeting

### May 16-22

Colorado Endangered Species Week  
<https://members.sws.org/event-calendar/Details/sws-annual-meeting-2022-joint-aquatic-sciences-meeting-298764?sourceTypeld=Website>

### May 20

Endangered Species Day  
<https://www.endangered.org/campaigns/endangered-species-day/>

### May 20

World Bee Day  
<https://www.worldbeeday.org/en/>

### June 4

National Prairie Day  
<https://moprairie.org/nationalprairieday/>

### June 3-5

Wyoming Native Plant Society Annual Meeting  
[www.wynps.org/activities/](http://www.wynps.org/activities/)

### June 12

World Environment Day  
<https://www.worldenvironmentday.global/>

### June 12-16

American Society of Reclamation Sciences  
<https://www.asrs.us/2022-annual-meeting/>

### June 16-20

Eriogonum Society Annual Meeting  
<http://www.eriogonum.org>

### June 20-23

International Seed Translocation Meeting  
<https://host.uniroma3.it/eventi/IPTC2022/>

### June 20-26

National Pollinator week  
<https://www.pollinator.org/pollinator-week>

### June 23-27

Idaho NPS meeting  
<https://idahonativeplants.org/statewide-annual-meeting/>

### June 24-26

Montana Native Plant Society Annual Meeting  
<http://www.mtnativeplants.org/annual-meetings/>

### July 8-11

American Penstemon Society Annual Meeting  
<http://penstemons.org/index.php/annual-meetings>

### July 9-13

Plant Biology 2022  
<https://plantbiology.aspb.org/>

### July 16-21

North American Congress for Conservation Biology  
<https://scbnorthamerica.org/index.php/naccb-2022/>

### July 23-31

Moth week  
<https://nationalmothweek.org/>

### July 24-27

Botany Conference - Plants in the Extreme  
<https://2022.botanyconference.org/>

### July 27-28

Global Steppe Symposium  
<https://www.botanicgardens.org/education/adult-programs/global-steppe-symposium>

### August 5-7

Native Plant Society of New Mexico Annual Conference  
<https://www.npsnm.org/events>

### August 30-September 2

International Oak Society Conference  
<https://www.internationaloaksociety.org/content/10th-international-oak-society-conference-2022>

### September 19-22

Science and Management Conference  
Colorado Open Space Alliance  
<https://coloradoopenspace.org/conference> 

## Plants in the News

### Good news! The Native Pollinating Insects Protection Study Bill - SB22-199 has passed the Colorado Senate and is moving through the House!

This bill requires the Department of Natural Resources to recommend strategies to protect pollinators in the state of Colorado.

<https://www.peopleandpollinators.org/>

## Invasive plants have large impacts on water in drought-stricken southwest Colorado

Russian olives and salt cedars are using and contaminating water in Montezuma County, leading to agricultural problems.

<https://coloradosun.com/2022/05/05/invasive-species-water-contamination/>

## Smithsonian study finds more “losers” than “winners” among plants in the age of humans

In a recently published scientific paper, Kress and Krupnik classify whether a given plant species will decline or flourish in response to human-caused manipulation of the Earth’s environment (*Plants People Planet*; <https://doi.org/10.1002/ppp3.10252>). Unfortunately, but not unexpectedly, most plant species will not be able to adapt to the changes in the environment quickly enough to survive.

[https://nmnh.typepad.com/the\\_plant\\_press/2022/05/living-in-harmony-with-nature-winners-losers-and-the-convention-on-biological-diversity.html](https://nmnh.typepad.com/the_plant_press/2022/05/living-in-harmony-with-nature-winners-losers-and-the-convention-on-biological-diversity.html)

[https://nmnh.typepad.com/the\\_plant\\_press/2022/04/smithsonian-study-finds-more-losers-than-winners-among-plants-in-the-age-of-humans.html](https://nmnh.typepad.com/the_plant_press/2022/04/smithsonian-study-finds-more-losers-than-winners-among-plants-in-the-age-of-humans.html)

## Earth may have 9,200 more tree species than previously thought

A new study shows that science has underestimated the number of tree species growing on Earth by around 14 percent. More than a third of the undescribed species are most likely rare and are most likely located in South America’s tropical “hot spots” of biodiversity.

<https://www.sciencenews.org/article/tree-species-earth-biodiversity>

## Leonardo da Vinci’s rule for how trees branch was close, but wrong

It’s the surface area, not the thickness, of a tree limb that determines how it branches.

<https://www.sciencenews.org/article/leonardo-da-vinci-rule-tree-branch-wrong-limb-area-thickness>

## Dinosaur extinction changed plant evolution

Effects of missing large herbivores on food plants are still detectable today.

<https://www.sciencedaily.com/releases/2022/05/220502125356.htm>

## Invasive grasses are taking over the American West’s sea of sagebrush

Highly flammable cheatgrass and similar nonnative plants dominate one-fifth of the Great Basin.

<https://www.sciencenews.org/article/invasive-grasses-spread-wildfire-plants>

## News from Denver Botanic

### Researchers have found a new plant in Colorado’s high country: the “funky thistle”

Dr. Jennifer Ackerfield’s study documenting the unique qualities of *Cirsium funkiae* attracts mainstream media attention.

<https://coloradosun.com/2022/02/15/funky-thistle-new-species>

### Unique finds in Colorado’s flora

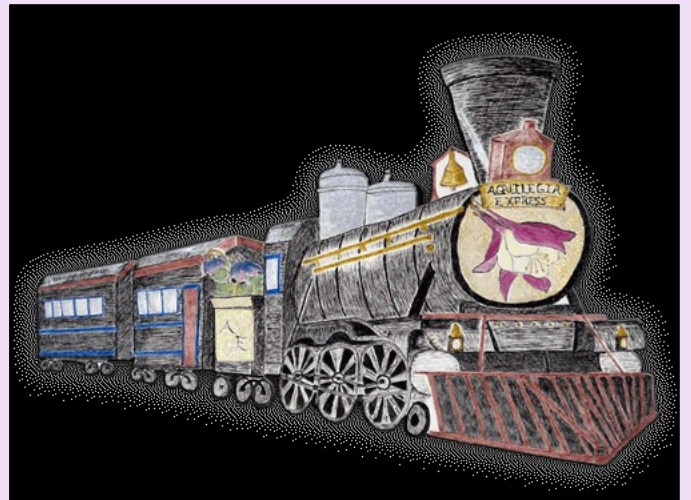
Two new species were added to the list of plants known to occur in Colorado—*Physaria nelsonii* (Nelson’s bladderpod) and *Penstemon bleaklyi* (Bleakly’s penstemon). *Physaria nelsonii* had previously only been found in Utah and Wyoming and *Penstemon bleaklyi* is a newly described species previously only known from New Mexico.

<https://www.botanicgardens.org/blog/unique-finds-colorados-flora>

### Would you like to learn more about columbines?

Check out the *Aquilegia Express* by the US Forest Service.

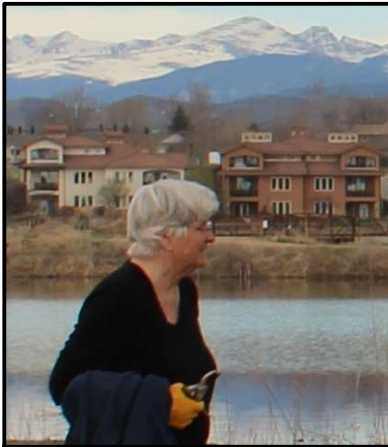
<https://www.fs.fed.us/wildflowers/beauty/columbine/s/index.shtml>





## Member Profile: Linda Smith

By Mo Ewing



Linda Smith at the beginning of establishing the River's Edge Natural Area Garden in Loveland. © Nan Cole

I first met Linda Smith in 2010, right after a board meeting when Denise Culver decided that she no longer wanted to be the CoNPS treasurer. Linda had been hired in 2008 as the CoNPS administrative coordinator, the first paid staff of CoNPS. In this capacity, she kept the books, handled the book sales, took notes at the board meetings, managed CoNPS membership on an

Excel worksheet, and answered questions on the telephone.

I was considering taking Denise's place as the CoNPS treasurer and wanted to meet Linda to see if she would be easy to work with. For me it was love at first sight, and it turned out that she has been a joy to work with for the last 12 years.

Linda did everything that needed to be done, and she always did it with graciousness and a smile. She set up our first email account, [conpsoffice@aol.com](mailto:conpsoffice@aol.com), and became the communications center for CoNPS. Her house became the storage facility for our increasingly large book-sales business. She learned how to do bookkeeping in QuickBooks, which she hated. And when I set up our new CoNPS website, she learned how to run the online bookstore, post announcements, and helped set up and manage our membership program in MembershipWorks.

Her real love, however, has always been native plants and conservation. She has been a volunteer on the Conservation Committee for years, tracking conservation issues, organizing public comment, and helping to organize seed-collection programs. She has doggedly worked on creating citizen science phenology projects, starting with the "Adopt a Trail Program," then "Monitoring Native Plants in the Garden," which morphed into our current "Budburst Colorado" program.

Not surprisingly, Linda is a wonderful artist and photographer. Her photos have won prizes in the

annual CoNPS photo contest 11 times in several different categories since 2015. She is also an accomplished plant illustrator. She has made line drawings of native plants, which have been used at CoNPS events as coloring pages for children. A dedicated native plant gardener, her home garden is filled with native plants.

Her crowning achievement, however, may be her work with the Northern Chapter in the creation of the River's Edge Natural Area Garden, which she co-led with Kathy Maher. This project was implemented in 2018 in partnership with the City of Loveland Open Lands Division. Linda was involved in the project management from start to finish. She was the principal researcher in developing the plant list for the project, which aimed to restore site-specific plant communities and habitat to support local pollinators and other wildlife. She helped draft the application that won a \$3,000 Larimer County grant to fund the project, and handled all of the expenditures, accounting, and reporting to Larimer County. And she even ferried plants from Harlequin's Gardens to the project!

Most of all, she created two lovely original paintings to be used as backdrops for two interpretive signs and was a key player in determining the message that CoNPS and the City of Loveland would convey on these signs. The signs have been incredibly effective in luring passersby in for a closer look.



That's our Linda Smith. That's the lady who has contributed so much to CoNPS, our members, and the Colorado native plant community.

**Thank you, Linda!** We will certainly miss you as the CoNPS administrative coordinator but look forward to your continued contributions to our society. 🌀

# CoNPS Membership

Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Phone \_\_\_\_\_  
 E-mail \_\_\_\_\_  
 Chapter (if known) \_\_\_\_\_

- New  Renewal
- Student \$17  Senior (65+) \$17  Individual \$25  
 Family \$35  Plant Lover \$50  Supporting \$100  
 Patron \$250  Benefactor \$500  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.

Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

**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 \$ \_\_\_\_\_

Total included: \$ \_\_\_\_\_

Please make check payable to:  
**Colorado Native Plant Society**

Send completed form and full remittance to:  
 CoNPS Office  
 PO Box 200  
 Fort Collins, CO 80522



## Thank you for sponsoring the 2021 CoNPS Annual Conference!



# Can You Identify These Spring-Blooming Bushes?



Answers (clockwise from upper left): James' waxflower (*Jamnesia americana*), Boulder raspberry (*Rubus deliciosus*), kinnikinnick (*Arctostaphylos uva-ursi*), western serviceberry (*Amelanchier alnifolia*), trumpet gooseberry (*Ribes leptanthum*), and wild plum (*Prunus americana*). © Anna B. Wilson

# Colorado Native Plant Society



P.O. Box 200  
Fort Collins, Colorado 80522  
<http://www.conps.org>

**Save the Dates!**  
**June 4, 11, and 25**  
**Summer Garden Tours**  
**Volunteers Needed!**

## **Mark Your Calendar!**

**46TH Annual CoNPS Conference, September 17–18**

***From Peaks to Prairie:***

***Biodiversity and Disturbance in Front Range Ecosystems***

The 2022 CoNPS annual meeting, hosted by the Boulder chapter, will be held at the Longmont Museum. The speakers will discuss diversity and disturbance in ecosystems, from alpine to prairie grasslands, and include:

Isabel de Silva, University of Colorado Dept  
of Ecology and Evolutionary Biology

Nancy Emery, University of Colorado Dept of  
Ecology and Evolutionary Biology

Ava Hamilton, Urban Indians of Colorado  
and Rising Voices Center for  
Indigenous and Earth Sciences

Julie Larson, USDA Agricultural Research  
Service

Sara Marshall and Laurie Gilligan, Colorado  
Natural Heritage Program

Megan Matonis, The Ember Alliance  
Christian Nunes, City of Boulder Open  
Space and Mountain Parks

Tom Veblen, University of Colorado Dept of  
Geography

Several field trips are being planned, including to the ever-popular White Rocks Nature Preserve and Golden Gate Canyon State Park.