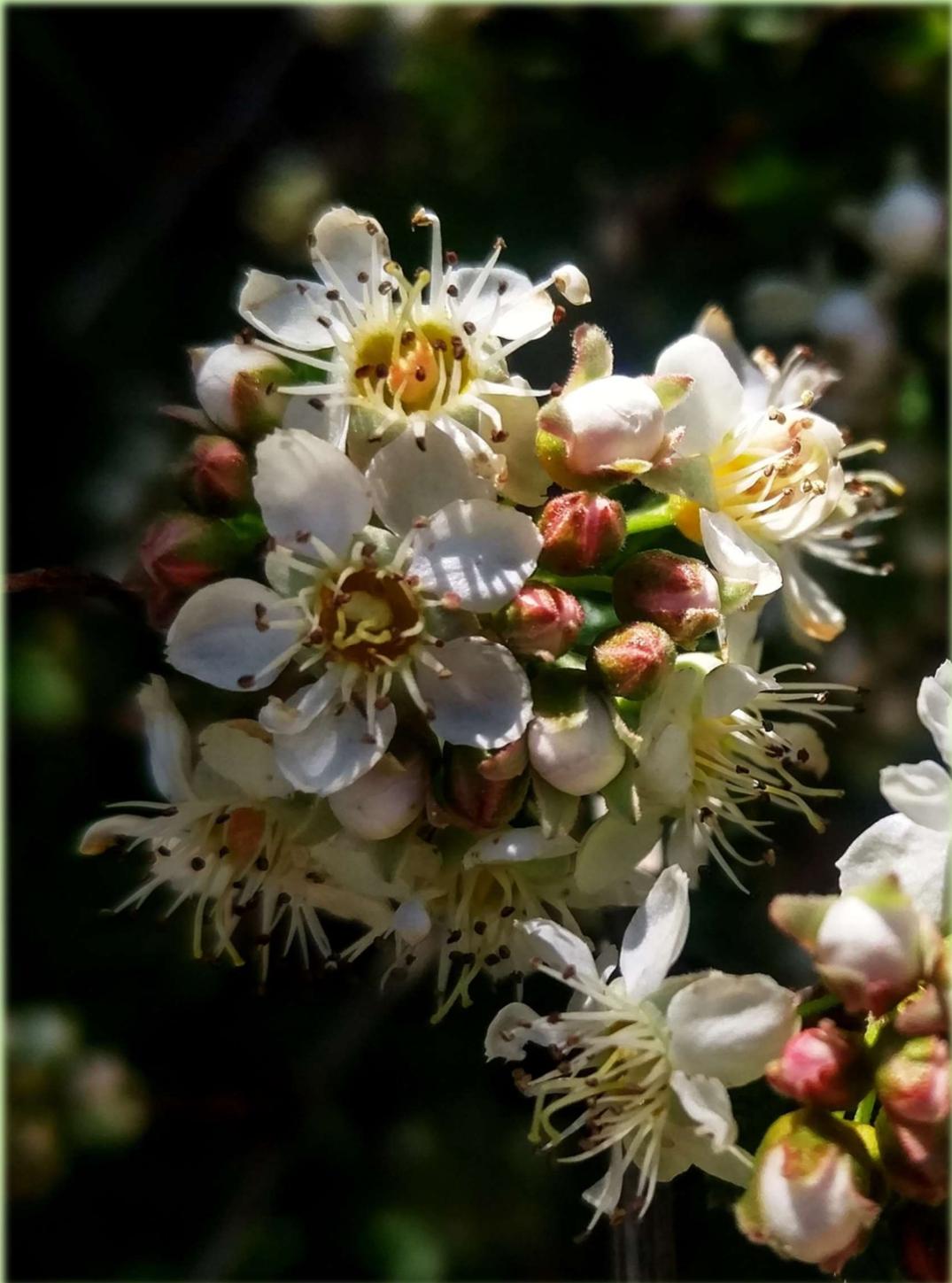


# *Aquilegia*

**Magazine of the Colorado Native Plant Society**

Volume 44 No. 1 Winter 2020





**Mountain Ninebark, *Physocarpus monogynus* (Rosaceae).** This shrub is common in elevations of 4,800-10,500', generally in partially to fully shaded areas. It may be confused with *Ribes* sp. A key characteristic of the plant is the peeling bark of the older stems, which helps with identification even in the winter. In the summer, the white flowers are arranged in corymbs, with exerted stamens. In winter, the browned flowers usually remain attached to the stems. Leaves are palmately lobed and conspicuously veined.

This is an attractive shrub for shady gardens. The flowers are a valuable source of nectar for native pollinators, particularly bees, and provide good cover for birds.

Some American Indian tribes made a pain-relieving poultice by boiling the roots and placing the warmed plant material on the affected site. KA



Map adapted from Ackerfield, J. *Flora of Colorado*, p. 726 (2015).

## Botanicum absurdum by Rob Pudim



THE CURSE OF NAMING A NEW PLANT

**PHOTO CREDITS:** FRONT COVER and PAGE 2: © Audrey Spencer; see page 11 for additional information.

*Aquilegia* uses Jennifer Ackerfield's *Flora of Colorado* (2015) as its preferred guide to plant naming conventions. Readers may also want to familiarize themselves with other guides such as *Colorado Flora*, Eastern and Western editions, by William A. Weber and Ronald C. Wittmann (2012), as well as The Biota of North America Program online guide to North American Vascular Flora (<http://www.bonap.org/>), and other resources.

# Aquilegia: Magazine of the Colorado Native Plant Society

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

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# Featured Story

## Celebrating the Bicentennial of Stephen H. Long's Expedition Part 1 of 4: An Introduction to the Voyage and Noteworthy Species from the Colorado Border to the Rockies

By Mike Kintgen and Jen Toews

*This is the first in a series of four articles about the Long Expedition to the Rocky Mountains.*

Two hundred years ago, the Front Range and eastern plains of Colorado were largely unknown to citizens of the youthful United States. In 1803, over a decade earlier, much of eastern Colorado had become US territory with the Louisiana Purchase. In the years that followed, several expeditions were sent west to explore this vast new addition to the US, most notably the Lewis and Clark expedition from 1804-1806 and the Pike expedition from 1806-1807. Of these two, only the Pike expedition entered what would become present-day Colorado.

Many books have been written about the scientific, geographic, and cultural discoveries of the Lewis and Clark expedition. Pike's expedition, which left less of a scientific record, is still covered in Colorado history courses. After Pike's visit, 13 years would pass before another US-mandated expedition would enter what would become the Centennial State. This expedition, led by Major Stephen H. Long between the years of 1819 and 1820, is lesser-known and arguably has not received due credit given its significant contributions to science and, in particular, botany. In fact, only four books have covered the Long's expedition and one of these is a compendium of all botanical work in the American west.

Long's was the first expedition to reach the southern foot of the Rocky Mountains with a trained botanist, zoologist, geologist, and two artists. These scientists and artists included Edwin James, Thomas Say, Titian Peale, and Samuel Seymour. They spent the summer of 1820 collecting specimens, writing extensive journals, and sketching and painting their way down the Platte River and along the Front Range before continuing southeast along the Arkansas River. James returned from the expedition with hundreds of herbarium specimens. More than 100 of these specimens would prove to be new to science.

The expedition started in Pittsburgh in 1819, but didn't enter Colorado until late June of 1820. The expedition passed through present-day Nebraska, Colorado,

New Mexico, the panhandle of Texas, and Oklahoma. For the sake of brevity and relevance, we will only cover the Colorado portion of the expedition.

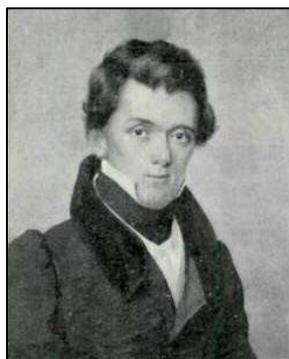
In this four-article series, we will divide the trip into four sections: the eastern plains, the Front Range, the Pikes Peak region, and the Arkansas River valley. We will also outline some of the expedition's noteworthy botanical discoveries.

To set the stage, let's meet some of the key players of the Long expedition.



**Stephen Harriman Long**, the leader of the expedition, was originally from New Hampshire and had been educated at Dartmouth College. While living in Philadelphia, he became a schoolteacher and a principal, gained some notoriety as an inventor of machinery, and did some surveying. The latter two activities brought

him to the attention of the Army Corps of Topographical Engineers. He entered West Point to teach mathematics and was sent west twice—in 1814 and 1817—to Illinois and later to Arkansas where he was instrumental in establishing Fort Smith.



**Edwin James**, the botanist and doctor of the expedition, was not Long's first choice. Long had initially chosen Dr. William Baldwin, a physician with a strong interest in botany. However, Baldwin's death from poor health in 1819 vacated a spot that James was able to fill in 1820. Like Baldwin, James had a

background in medicine. A native of Vermont, he had studied at Middlebury College and later pursued medicine along with his two brothers in Albany, New York. Prior to the expedition, James had recently joined the newly formed American Geology Society and had also informally studied botany under Amos ►

◀ Eaton and John Torrey. As a side note, Torrey's Peak in Colorado is named for John Torrey. Torrey would describe and name most of James's herbarium specimens. Only twenty-three years old in 1820, James had already published articles on both botany and geology. Due to his unique background in botany, geology, and medicine he was the person for the job, as he was not only replacing the deceased Dr. Baldwin, but also August Jessup, the geologist for the group who had left the expedition six months in.



**Thomas Say**, a zoologist, lacked a formal education, but he made up for this with his passion for collecting natural history specimens and the time he spent at Charles Wilson Peale's Museum in Philadelphia. A charter member of the Philadelphia Academy of Natural Sciences, Say

became editor of the *Journal* in 1817. That year, he also published a prospectus for *American Entomology* which proposed covering all known American insects. His interest in insects would allow him to excel in collecting and describing many new species, and ultimately would allow him to become the first American systematic entomologist.



Say's friend **Titian Ramsay Peale** was one of the artists on the expedition. Prior to the trip, he and his father Charles Wilson Peale established the United States' first natural history museum in Philadelphia. Titian had experience in taxidermy and drawing and painting. Despite being just 19 years old in

1819, Titian had proven himself by being the youngest member elected to the Academy of Natural Sciences in Philadelphia for the skill he displayed in painting insects for Say. After his election to the Academy of Natural Science, he travelled to Florida with Say and several other members of the society and proved to be an excellent wildlife artist, a dependable shot with the rifle, and skilled at preparing specimens.



**Samuel Seymour** was the official artist of the trip and painted both landscapes along the way and the Native American people the group encountered. Both Seymour and Peale's paintings of

landscapes, people, animals, insects, and plants would become some of the first images people would see of the American West. Together, these artists' drawings and paintings would capture a way of life that has largely disappeared.

The expedition left Pittsburgh on May 5, 1819, via the Ohio River in a specially designed steamboat named the *Western Engineer*. This was the first time anyone had attempted to travel the Missouri in a steamboat. Due to difficult travel up the Missouri, the expedition didn't make it as far as hoped and ended up camping for the winter of 1819 and 1820 in Engineer Cantonment just upstream from present-day Omaha.

In fact, the difficulties of the first portion of the trip changed the goal and course of the entire venture. Originally Long and his men were to ascend the Missouri River to the Yellowstone River and travel from the headwaters of the Yellowstone overland to the US-Mexican border in 1819 along the Red River and Canadian River in present-day New Mexico. While most of the party overwintered in present-day Iowa, Long returned to Washington DC to ask for more funding; there he received sharp criticism for his failure to ascend the Missouri to the mouth of the Yellowstone.

Long and James left Pittsburgh on March 31 and arrived at the winter camp in late May 1820. They needed to be at Fort Smith by early September and this gave them just three months to travel more than 1,500 miles on foot and horseback. The group averaged 15 miles a day and often 20 to make up for not traveling Sundays when they would stay camped.

Long and his party entered future Colorado on June 26, following the South Fork of the Platte. That night, they camped near present-day Julesburg. There was little interesting landscape to see, but they did take note of the animals, insects, and plants as they crossed the eastern plains of Colorado in anticipation of the first glimpse of the Rocky Mountains. It was on June 30 at 8:00 am that the party first caught sight of the mountains. By evening, Long and his men saw what they thought was Pike's high peak, but it was in fact present-day Longs Peak. It wasn't until July 6 that the men reached the South Platte's exit from the Rockies.

The western Great Plains seemed so dry to these easterners that Long reported back that they had crossed the Great American desert and that it was unsuitable for farming. Despite the dryness they encountered, the travelers found many noteworthy animals and plants perfectly adapted to this semiarid environment. Some of these plants are described on the following pages. ►



© Jen Toews

◀ **Crested prickly poppy (*Argemone polyanthemus* [Fedde] Ownbey)**

In the sand hills of Nebraska, James encountered a plant with showy, ruffled, white flowers. This species was “[a]long the Platte and Canadian rivers; abundant” (see Goodman and Lawson for all quotes). James noted in a June 20 diary entry that it was “[p]robably an

undescribed species” and referred to it as *Argemone mexicana*, but later described it as *A. alba*. The nomenclature of what was collected is mired in confusion, but ultimately *A. alba* became a synonym of *Argemone polyanthemus*. A common species of sandy soil and dry grasslands, this charismatic species was likely in bloom along the expedition’s route through northeastern Colorado and into the Front Range. A month later, as the expedition passed near present-day Rocky Ford, Colorado, James wrote about the prickly poppy again in his account.

**James’ nailwort (*Paronychia jamesii* Torr. & A.Gray)**

Another noteworthy species James encountered during the expedition was a small, branching, prostrate nailwort with inconspicuous yellow flowers. James assumed it was *Paronychia dichotoma* (now *P. canadensis*), a species that occurs farther east which had already been described. The plant he collected was, in fact, new to science; Torrey and Gray described it from James’s specimen and it now bears



© Mike Kintgen

his name. The holotype is located at New York Botanical Garden, but no location information is given on it other than “Long’s Exped. to the Rocky Mts. Dr. James.” Perhaps because the party traveled very quickly, accurate and detailed records were challenging to maintain. Found in all five states through which the expedition passed, Goodman and Lawson speculate that the collection was made on June 26, somewhere between present-day Ogallala, Nebraska, and Julesburg, Colorado. *P. jamesii* certainly could have been in bloom late in June on rocky outcroppings and in the dry grasslands of the eastern plains of Colorado.



© Cindy Newlander, Denver Botanic Gardens

**Wedge-leaf fog fruit (*Phyla cuneifolia* [Torr.] Greene)**

*Phyla cuneifolia* is a unique-looking species from the verbena family that has wedge-shaped leaves with toothed margins and globose inflorescences of pinkish-white flowers. In one of the five states of the expedition’s route, James encountered *P. cuneifolia* and made a

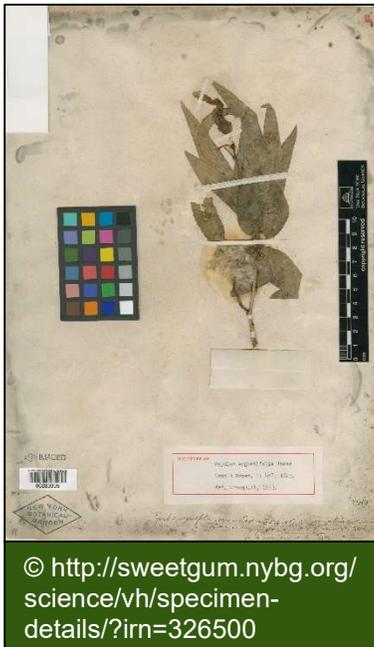
collection. It became the type specimen on which Torrey based his description, at the time under the name *Zapania cuneifolia*. No location information is listed on the herbarium sheet or in James’ diary. However, the species was likely in bloom in riparian corridors and in open prairies when Long’s party traveled from the Colorado border southwest towards what is now called the Front Range.

**Granite prickly phlox (*Linanthus pungens* (Torr.) J.M.Porter & L.A.Johnson) ▶**



© Mike Kintgen

◀ Another noteworthy species with a questionable collection date and location is *Linanthus pungens*. A shrub with linear leaves and small creamy to yellowish flowers, this phlox is common in Colorado's dry grasslands, meadows, and open forests and it would have been in bloom there in late June or early July. The location given was "Valley of the Loup Fork?" (Nebraska), which Goodman and Lawson question since the section of the Loup River the expedition traveled is far out of the range of *L. pungens*. Instead they speculate that the specimen was collected along the South Platte River, anywhere from Fort Morgan to Denver. This became the type specimen described by Torrey under the name *Cantua pungens*.



**Narrowleaf cottonwood (*Populus angustifolia* E. James)**

On July 4, 1820, after hiking 17 miles, the party stopped mid-morning on the South Platte River. The men set up camp near the north end of Henderson Island, which is several miles south of present-day Brighton. Along with Independence Day festivities (these included eating corn and drinking whiskey), James managed to

botanize in the area and likely collected the holotype for *Populus angustifolia*, which now resides at New York Botanic Garden. This species is common along streams, rivers, and floodplains in central and western Colorado.



A tree that ranges in height from 5-20 m, it is often mistaken for a willow because of its narrow leaves. Its epithet *angustifolia* reflects this.

**Bush morning-glory (*Ipomoea leptophylla* Torr.)**

A shrubby morning glory with numerous bright pink-to-purplish-red flowers, *Ipomoea leptophylla* is common

in the sandy soils of the eastern plains. According to Torrey, James collected "[i]mperfect specimens of this plant [...] in Long's expedition, but they were not described in any account of his plants." And later from Gray: "[A] striking and showy species, first collected, in Long's Expedition, by Dr. E. James, who singularly mistook it for an annual." Notes from James' diary indicate that he believed this "splendid plant" to be a new species. Based on the same diary entry, Goodman and Lawson speculate that this plant was collected June 28, when the party traveled from near present-day Crook to Logan, Colorado. However, Torrey's description of *I. leptophylla* is based on a specimen from Fremont's expedition.

**Conclusion**

Almost 200 years later, the scientific legacy of the Long expedition is noteworthy and foreshadows modern challenges in Colorado and the West. These explorers described the southern Great Plains as the Great American Desert in their journals and reports. In fact, 1820 was a year of extreme drought throughout the southern Great Plains. American society would have been wise to note these descriptions of this region and plan for a sustainable future. Instead, we have tried to harness the finite resources of rivers and aquifers to compensate for the lack of rain and periodic severe drought.

Today, most of Colorado's population lives along the exact route Long and his party traveled in 1820. Sprawling cities full of trees and irrigated lawns cover former shortgrass prairie. Reservoirs, irrigation ditches, and farming have changed the appearance of the Platte River valley north of Denver and many more cottonwoods and exotic trees line the South Platte River. It is safe to say that none of the men from the Long expedition would recognize or believe what 200 years of advancements and development have done to Eastern Colorado.

**Acknowledgements**

We would like to thank Panayoti Kelaidis, senior curator and director of outreach at the Denver Botanic Gardens, for raising awareness of the bicentennial of Stephen Long's expedition and the botanical contributions of American botanist Edwin James.

*Mike Kintgen is the curator of the alpine collection at Denver Botanic Gardens. His work has taken him across the globe to similar biomes of Colorado and the Rocky Mountain and steppes of Western North America. He greatly enjoys working with regionally native flora and learning the botanical history of Colorado.*

*Jen Toews works in the plant records department at the Denver Botanic Gardens and is a Colorado Native Plant Master® who advocates for native plants at every*

"Long Expedition ..." continued on page 10 ▶

# Featured Story

## Changes in the Colorado Alpine: The Good, the Bad, and the Ugly

By Tim Seastedt

*The following are some summary points made during a December presentation to Boulder chapter members.*

Professor John Marr, in addition to being a founding member and the first president of the board for the Colorado Native Plant Society, also created a research legacy for the alpine zones of the Colorado Front Range. His efforts have led to some of the strongest—and occasionally some of the only—findings about the land above the trees. John left us with climate stations, vegetation studies, and a partnership with the National Oceanic and Atmospheric Administration; and that sparked continuous, ongoing research that now allows us to make multiple statements about the future of one of our favorite places. Some of these are relatively benign findings, currently of academic concern, but not likely to produce “OMG” responses from stakeholders. Others are of substantial societal concern.

Here, I relate several of these from both categories. For those who want details, you'll need to read multiple articles that can be found using subject searches on the University of Colorado's Long-Term Ecological Research web site at <https://nwt.lternet.edu/publications>. As Marr's legacy now includes over 1000 research articles, this effort might take a while. To access some of the most recent articles, email the authors for a personal copy.

### I Can Promise You a Rose Garden

After a quarter century of experimental manipulations, we can state with high certainty that soil fertility controls the relative abundance of some of our favorite alpine flowering plants (Figure 1). Add appropriate amounts of plant-available nitrogen and phosphorus for decadal periods and a slow transition to a display by alpine avens (*Geum rossii*), alpine bluebell (*Mertensia laterifolia*), and sky pilot (*Polemonium viscosum*), among others, is possible. If you did this in your low-elevation garden, you would get more weeds than flowers—but, in the alpine, a place still lacking the opportunistic, nutrient-loving weeds, it's a spectacular outcome. That said, unless your alpine site contains already fertile soils (like some of those found in southwestern Colorado), no current suite of environmental drivers will likely produce this result.

Work directed by Bill Bowman has demonstrated how atmospheric nitrogen inputs affect the vegetation composition of the tundra. These treatments seemed to primarily affect a subset of the graminoid species: curly sedge (*Carex rupestris*) appearing as most sensitive. To get the forbs to increase in both relative and absolute abundance, increased phosphorus must be added with increased nitrogen, and we don't think that's going to happen under current environmental change scenarios. While phosphorus deposition from dust originating in the southwestern US is now believed to be increasing on the tundra, plant-available forms of nitrogen inputs from industrial and agricultural sources appear to be on the decline. Overall, this is a good thing, if not for the tundra, then at least for the tundra lakes and streams.

### The Vegetation is Heading Uphill

The alpine zone, like many other sites in Colorado, is showing a warming trend. Recent work by Cliff Bueno de Mesquita and ongoing studies have shown that shrubs are now found further uphill than they were 50 years ago (Figure 2). What limits tree movement uphill at Niwot Ridge may include multiple factors such as ►



Figure 1. A student measures plant species abundances and cover in a dry meadow plot treated with nitrogen and phosphorus. Dry meadows, normally dominated by sedges, slowly transform into flower gardens dominated by alpine avens. Other flowering species such as chiming bells and sky pilot become more common and robust, and a few grasses (several *Poas* and *Trisetum spicatum*) also benefit.  
© Tim Seastedt

◀ 1) the dominant winds from the west, which blow seeds downhill, and 2) dry microclimates in many of the east- and south-facing tundra areas preclude tree establishment. Among the shrubs, willows are apparent beneficiaries of climate and atmospheric chemistry changes. Meanwhile, the highest elevations of the Front Range are becoming a bit greener with colonization of herbaceous species from the lower elevation tundra regions.

What limits upward movement is the combination of summer snowfields that preclude any soil light and soils suitable for supporting vascular plant life. Ultimately, you can only go uphill until you're at the top, so this migration has both microsite and elevational limitations. Organisms such as the pika, the charismatic denizen of the alpine (described aptly by Chris Ray as a "fuzzy potato"), are showing signs of stress and apparent declines in response to these changes as well, if not at Niwot Ridge then elsewhere in the Rockies.

**The Alpine Zone, in its Present Biotic Configuration, May No Longer Help Us Mitigate Climate Warming**

Beginning in the late 1980s, scientists learned how to measure whether local sites were changing their carbon content. This meant that a single value that represented the amount of carbon contained in plants, animals, and soils could be estimated as increasing, decreasing, or remaining the same.

Russ Monson began measuring this value in the subalpine forests located just below our tundra site,

adjacent to where John Marr had established a climate station in 1951. His work and that of his students showed that a subalpine forest—one that had probably been burned about 80 years earlier—was still accumulating carbon. This is a good thing, as carbon accumulating in the community is not available to return to the atmosphere and further warm the planet. We believe that most temperate and boreal forests act to accumulate carbon until a fire occurs, when much or all of this carbon gets returned to the atmosphere.

In 2008, John Knowles added a similar carbon measurement station on to an alpine tundra site very close to many long-term plant monitoring sites (Figure 3). The results of this effort are of concern. Essentially, the results consistently report that net increases of carbon dioxide in the atmosphere are occurring at this site. While alpine areas only cover 7% of terrestrial surfaces, this finding is disconcerting at the least. What it means is that instead of helping us mitigate global warming, if this finding is representative of the alpine as a whole, the community is now contributing to greenhouse warming.

Why does this happen? Simply put, there are more microbes eating some of the stored carbon in the soil than there are plant roots shoving carbon back into the soil. Microbes have benefited by the warming. This is a finding from a single site and, more recently, a new research program sponsored by the National Ecological Observatory Network, has added its ▶

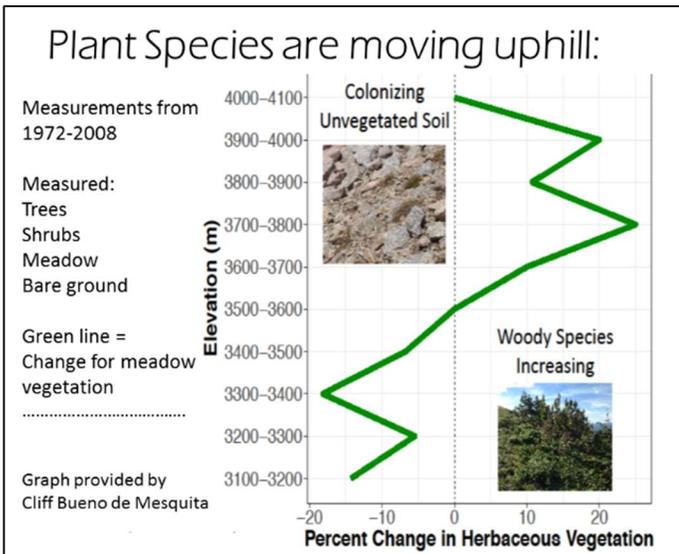


Figure 2. The relative change in alpine herbaceous cover (graminoids and forbs) as a function of elevation and time. The green line shows declines (values below 0) at lower elevations and increases (values above 0) at higher elevations based upon aerial observations and field verification of photos taken in 1997 and 2008. Reprinted from *Arctic, Antarctic and Alpine Research* 2018.

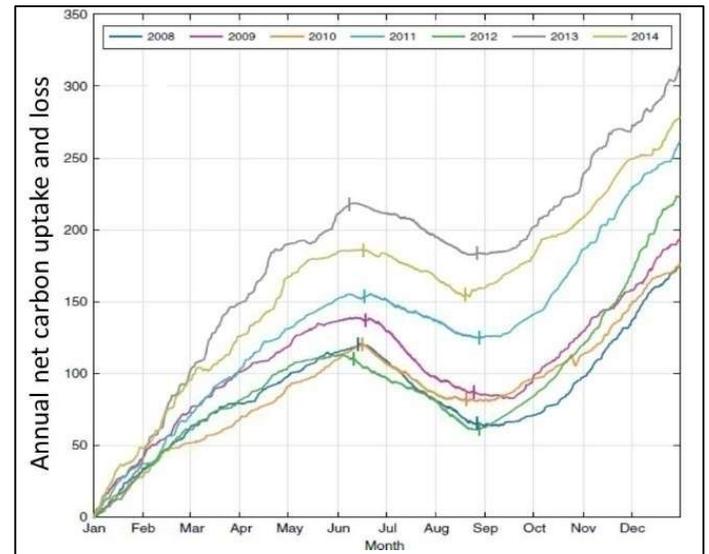


Figure 3. The cumulative net amount (losses from the tundra minus inputs to the tundra) shown for the period 2008-2014. Each year there is a net loss of carbon implying more soil decomposition than net carbon accrual from plant photosynthesis. This site may include release of "fossil carbon" that has been locked into the soil since the Pleistocene. Reprinted from *Nature Communications* 2019.



Figure 4. The NEON carbon flux tower located on Niwot Ridge. This structure is about 1000 yards from the LTER station, but measures carbon inputs and outputs from a different area of tundra. Photo from <https://www.neonscience.org/field-sites/field-sites-map/NIWO>

own measurement station to the site (Figure 4). It is possible that the Long Term Ecological Research project placed its equipment where it's receiving most of its information from a "hot spot" where carbon is being released from sources stored in the Pleistocene (very similar to the permafrost carbon in the arctic tundra that can be released by warming). The NEON site will give us a second measurement and add to our assessment of the carbon dynamics of the alpine. If this confirms the LTER numbers or even if it indicates a small contribution to the atmosphere, our choices are few. We either live with it or configure a vegetation type for the area that can remove carbon from the atmosphere.

### Conclusions

Biotic change in the alpine has been ongoing since much of the area emerged from the ice at the end of the Pleistocene, but the rate of change in both climate

and biota appears to be increasing rapidly. The story of biotic changes in the alpine regions of Colorado involve the interactions of changing duration and snow amounts with the concurrent changes in temperatures. As of now, we can find plant species that are winners and plant species that are losers as a result of these changes. The long-term prognosis is that losers will exceed winners, and our commitment to their preservation should involve immediate actions to reduce greenhouse gasses in the atmosphere.

*Tim Seastedt is a terrestrial ecologist who has studied grasslands and tundra for more than 40 years. He conducts research and participates in citizen restoration projects through his position as a scientist at the Institute of Arctic and Alpine Research, University of Colorado, Boulder.*

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◀ "Long Expedition ..." continued from page 7

opportunity. In her free time, she enjoys expanding her native plants garden, hiking to see native flora, photographing native flora, and writing.

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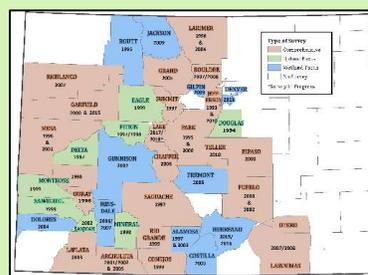
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### Rare Plant Lists by County

Wondering what kinds of rare plants occur in your county? Check out the Colorado Natural Heritage Program's county-by-county reports at <https://cnhp.colostate.edu/projects/county-surveys/> After selecting a county, you can view a detailed report that documents rare and imperiled plants, animals, and plant communities.



## Front Range *Physocarpus* and the Eastern Woodland- Prairie Element

By Audrey Spencer

This report is based on findings from the author's master's thesis, part of which has been submitted for publication in *The Journal of the Torrey Botanical Society*.

Beneath the familiar Front Range overstory of ponderosa pine, aspen, Douglas fir, and blue spruce lies a curious understory. Hiking the north flank of Green Mountain in Boulder, for example, one might notice wild sarsaparilla or beaked hazelnut; or, at lower elevations, one might notice prairie natives such as compass plant or prairie dropseed. These plants, well-known to botanists of the midwest and eastern US, may seem out of place among the semi-arid shortgrass and foothill communities of Colorado.

These eastern North American plants, dubbed the “eastern woodland-prairie element” by Weber (1965), intermingle with the flora of the Southern Rocky Mountains along the Front Range.<sup>1</sup> Comprised of eastern deciduous shrubs, eastern woodland herbs, and tallgrass prairie species, this group occupies protected mesic sites such as north-facing slopes and cool ravines. The steep transition from the High Plains to the Continental Divide results in highly localized climatic conditions that are capable of satisfying the moisture requirements of eastern woodland-prairie plants (Weber, 1965).

This group of plants shares a common distribution pattern. The center of the range occurs in eastern

North America, with isolated populations much farther west (Figure 1). Disjunct distributions are generally thought to arise from either long-distance dispersal or through vicariance, a process by which a widespread population becomes fragmented by a barrier. In 1965, Weber proposed that the western US disjunct populations of eastern North American plant species may be relicts of a previously widespread Pleistocene forest community that stretched as far west as the foothills of the Rocky Mountains before retreating back eastward during the Holocene, leaving behind isolated populations in suitable habitat (Weber, 1965). This vicariance hypothesis has been proposed by multiple botanists (Livingston 1952; Cooper 1984; Hogan 1989; and Nelson 2010), but overall, this group has received surprisingly little academic attention.

Eastern ninebark (*Physocarpus opulifolius*), a Rosaceae shrub native to eastern North America, has been ascribed to the eastern woodland-prairie group (Weber & Wittmann, 2011). There exists a discrepancy, however, between the two most recent treatments of the eastern slope flora—William Weber's and Ron Wittmann's *Colorado Flora: Eastern Slope* (2011) and Jennifer Ackerfield's *Flora of Colorado* (2015). According to Weber & Wittmann, there are two species of *Physocarpus* on the Front Range—*P. opulifolius* and *P. monogynus*—with an “intermediate” hybrid form where they co-occur. Ackerfield (2015) reports only one Front Range species—*P. monogynus*—and ascribes previous confusion to morphological variation. This sparked my curiosity: What species *do* occur here? Why are they so challenging to discern? What is the “intermediate” form noted by Weber & Wittmann?

For my master's thesis at the University of Colorado Denver, I investigated these questions by examining historical taxonomy, morphology, and geographic range for *P. monogynus*, *P. opulifolius*, and a third species, *P. intermedius* (Figure 2). Most of the 30+ taxonomic treatments that I reviewed did not assess a given taxon across its full range. Rather, the geographic scope of most treatments was restricted to a particular region or state, and authors occasionally ►

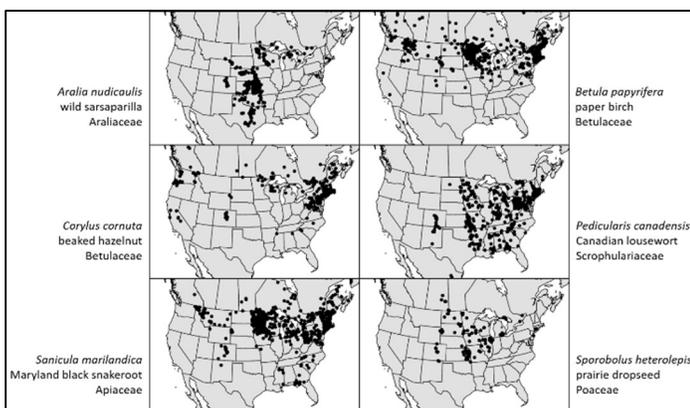


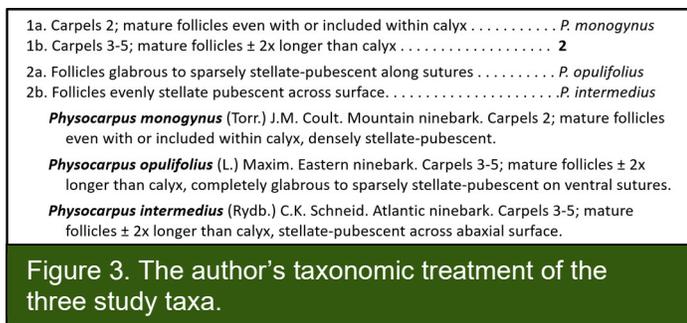
Figure 1. Geographic distribution of several eastern woodland-prairie plants found on the Front Range of Colorado. Occurrence data downloaded from [www.iDigBio.org](http://www.iDigBio.org)



Figure 2. *Physocarpus monogynus* (mountain ninebark) flowers. © Audrey Spencer

◀ published new *Physocarpus* species based on local variations in morphology. As a result, *P. intermedius* has accumulated eight taxonomic synonyms since 1901 and has been recognized at the level of species as well as variety, as *P. opulifolius* var. *intermedius* (Dignan, 2019 and Alexander, 2014).

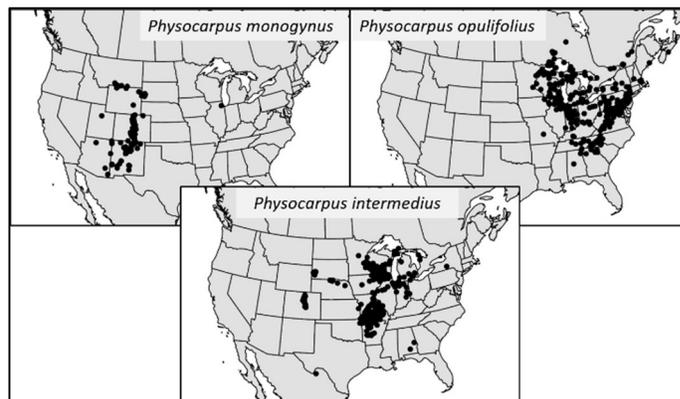
Nearly all the treatments, however, recognized follicle pubescence as the primary diagnostic trait. With Dr. Leo P. Bruederle, I examined over 580 fruiting specimens from 11 herbaria across the full range of the study taxa. The findings from this assessment confirmed that the three study taxa can be distinguished based on follicle pubescence. The mature follicles of *P. opulifolius* are glabrous or sparsely pubescent along sutures, those of *P. intermedius* are evenly pubescent across the follicle surface, and those of *P. monogynus* are very densely pubescent (Figure 3).



The geographic component of this variation was noted as early as 1896, when Per Axel Rydberg commented on the morphological difference between specimens identified as *Opulaster* (an older genus now synonymous with *Physocarpus*) *opulifolius* from Colorado in comparison to those from the eastern US. He described the western specimens as having permanently pubescent follicles, while the eastern plants had “smooth and shining” glabrous follicles (Rydberg, 1896). Five years later, Rydberg (1901) named the pubescent western form *O. intermedius*. Aven Nelson also noted the difference between Rocky Mountain and eastern United States *O. opulifolius* specimens. Shortly after Rydberg published *O. intermedius*, Nelson (1902) described a new species—*O. ramaleyi*—which bears close resemblance to Rydberg’s description of *O. intermedius*. In a footnote, Nelson stated, “This is *O. opulifolius* probably, in so far as Rocky Mountain specimens have been so named. It is not the *O. opulifolius* ... of the eastern United States.”

Based on the labels of those specimens examined for this study (see Dignan 2019 for a complete list), *P. monogynus* occurs on steep rocky slopes and ledges of ravines and drainages at approximately 4,500 to 10,500 feet elevation in the Central and Southern Rocky Mountains. *Physocarpus opulifolius* occurs on moist wooded shorelines at approximately 50 to 5,000 feet elevation and does not occur naturally west of Lake

Superior. *Physocarpus intermedius* occurs on rocky wooded slopes and bluffs along riverbanks at approximately 500-7,500 feet elevation and tends to occupy drier sites than *P. opulifolius*. Its range extends from the Great Lakes and Driftless Area south to the Interior Highlands of Missouri and Arkansas (the Ozark and Ouchita Mountains) with several disjunct populations to the west in the Sand Hills of Nebraska, the Black Hills of South Dakota, the Front Range of Colorado, and the Sierra Madre Oriental of northeastern Mexico (Figure 4). *Physocarpus intermedius* overlaps with *P. opulifolius* in the Great Lakes region and with *P. monogynus* in the Front Range and Black Hills. These range overlaps correspond with intermediate, possibly hybrid, morphologies.



**Figure 4. Geographic distributions of the three study taxa. Occurrence data from [www.iDigBio.org](http://www.iDigBio.org)**

My findings partially agreed—and partially disagreed—with both Weber & Wittmann (2011) and Ackerfield (2015). *Physocarpus opulifolius* does not occur in Colorado, as Ackerfield concludes. Rather, the two species of *Physocarpus* on the Front Range are *P. monogynus* and *P. intermedius*, but there does appear to be evidence supporting hybridization between these two taxa where they co-occur, as observed by Weber & Wittmann (2011). Finally, although the alleged member of the eastern woodland-prairie element, *P. opulifolius*, does not occur in the western United States, *P. intermedius* does appear to be a member of this group.

**Conclusion**

The eastern woodland-prairie element is an important and charismatic component of the Colorado flora. Many of these remarkable plants are considered sensitive or at-risk and are tracked by the Colorado Natural Heritage Program. So, on your next Range hike, keep a keen eye out for eastern species like *Lilium philadelphicum* (wood lily), *Pedicularis canadensis* (Canadian lousewort), *Aralia nudicaulis* (wild sarsaparilla), and my personal favorite, *Physocarpus intermedius*.

“*Physocarpus* ...” continued on page 26 ▶

## A Coreopsis Lookalike: Greenthread (*Thelesperma filifolium*)

By Jim Borland

Wildflower seed mixes for the Great Plains almost always have at least one species of *Coreopsis* in them even though none prove reliably persistent without supplemental irrigation anywhere in the shortgrass prairie region. The species that should be in those seed mixes is the *Coreopsis* lookalike greenthread (*Thelesperma filifolium*).

Whether it is called greenthread, threadleaf thelesperma or by its other equally inelegant names gray greenthread, fineleaf thelesperma, or nippleweed, this species is superior to any *Coreopsis* in its ability to thrive in an area receiving only 12 to 20 inches of precipitation annually. This, along with the other dozen or so American species, derives its name *Thelesperma* from *thele*, meaning nipple, plus *sperma*, meaning seed, in reference to the conical projection on the achenes or cypsela of some species.

This species is native to the plains, mesas, valleys, and hills of eastern Colorado, southern South Dakota, eastern Wyoming to the Oklahoma panhandle, Texas, New Mexico and south to Mexico. This 8- to 30-inch tall plant has been variously described as an annual, biennial, or perennial. Flowering stems may be single or several, simple or branched, each ending with an eight-petaled, 1- to 2-inch wide yellow or golden flower. The disk flowers are yellow to reddish brown.

The bloom period from mid-May through August is extensive, especially if supported by sufficient moisture.

All *Thelesperma* species native to the US are noted for their very narrow or fine foliage, some pinnately divided.

The easiest propagation method is by seed, which is a narrow 1/16- to 1/8-inch long green to black achene that requires no special pretreatment for germination.

Further growth is uncomplicated, much like that of its close relative *Coreopsis*. Bloom from seed can be anticipated by the second year, with some arriving during the first. Judging by the plant's habit, which includes simple or branched roots, crown division may also be possible.

Native soils are typically rocky, sandy, or gravelly, but good crops have been grown in clay soils in Denver if supplemental irrigation is either held to a minimum or denied completely. The entire native range of the species encompasses cold hardiness zones 7b (10 to 5°F) to 4b (-20 to -25°F).



Greenthread rightfully belongs in a wildflower seed mix. It can also be used as a full sun dryland perennial taking the place of the more common and higher water consuming *Coreopsis* species.

*Jim has been fooling around with native plants for more than 40 years in private, commercial and public venues. His home garden contains thousands of native plants, most grown*

*from seed at home and 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.* ☺



A field of greenthread (*Thelesperma filifolium*) along the Arkansas River. © Linda Smith



# Restoration Roundup

## From High Desert Scrub to Colorado Native Plant Garden

By Judy Kennedy

When we moved to Glade Park, Colorado in 1982, the land we purchased was covered in sagebrush and rabbitbrush, with Utah junipers on the back of the acreage. At one time, the entire place had been covered with the junipers, but during the depression, the owners decided to grow dry-land beans and removed all the trees except those on the back portion—an area that is steeply sloped and rocky. Our particular area of Glade Park is at 7,000 feet elevation and there was no irrigation water. Once the house was built and the entire area fenced—we had horses, donkey, and cattle—we mowed all the acreage and planted it to a mixture of dry-land alfalfa and crested wheat.

I was working for a nursery and greenhouse during my last year of college in Boulder, so I was able to purchase plants cheaply. We carted blue spruce, some evergreen shrubs, and aspen over the mountains. Because we gathered whatever water we could accumulate, all those plants survived. However, most of the area around the house could have best been described as “mowed weeds.” That is, until we discovered the amazing adaptability of native cactus and succulents. As members of the Chinle Cactus and Succulent Society in Grand Junction, we were able learn about these plants and get cuttings from other members to use at our home.

A Glade Park contractor with a backhoe installed four different cactus “berms” and dug out a cactus

“canyon” for us. Thanks to the Bureau of Land Management’s policies that allow plants and rocks to be taken from certain areas by buying inexpensive permits, our cactus and succulent areas now include raised beds of agave, yucca, Mormon tea, and cliff rose.

In 1990, the Glade Park Pipeline Water Users Association formed, and we began to get water from Pinyon Mesa. Irrigation was still very unpredictable because the original wooden pipe was still in use and the other parts were rusted steel. The pipeline was often out of service for repairs. All the work that had to be done on the pipeline was a volunteer effort, but gradually the worst portions are being replaced with PVC.

The water supply continued to be iffy, but we tried drought-resistant buffalo grass for a yard and brought in more natives like Mexican (Maxmillian’s) sunflower, yarrow, manzanita, buffaloberry, common sunflower, Woods rose, and apache plume. Also, my husband, a carpentry whiz, built nest boxes for the bluebirds, mason bees, and bats.

Fast forward to 2018, I attended the Master Gardener Annual Conference in Steamboat Springs and when I heard a speaker extolling the virtues of crevice gardens, I was sure that would be the icing on the cake for our still developing yard. I generally have more enthusiasm than good sense, however I arranged to have four more berms built and started gathering more rocks and plants. Super! Except I soon had lots more plants like lupine, cone flower, blue flax, fleabane, primrose, desert 4 o’clock, penstemon, and mules’ ears than I had rocks. Still, I decided I ►



Before Judy’s garden project, her property was covered with Utah juniper, sagebrush, and rabbitbrush.  
© Judy Kennedy



One of Judy’s cactus berms. © Judy Kennedy



Figure 3. Cholla cactus (*Cylindropuntia* sp.) in one of Judy's rock gardens. © Judy Kennedy

◀ liked it. So, we ended up with rock gardens instead of crevice gardens.

I applied for the Native Plant Garden certification from CoNPS in 2019 and the committee's only request was that I plant a cool-season grass to earn a gold-level certificate. So, I planted Indian rice grass in a bed of a blue fescue cultivar.

I didn't realize what a long but satisfying journey this had been until I began to write this article, but it's done (well—maybe) and I'm glad. It only took thirty-seven years!

*Judy Kennedy is a member of the Plateau chapter; a CSU Master Gardener, and a Colorado Native Plant Master® who lives in Glade Park, CO. Glade Park is located right above Colorado National Monument where she and her husband Dave do most of their hiking.* ☺



## CoNPS Certified Native Plant Gardens

The CoNPS Certified Native Plant Garden program was developed to help promote the use of native plants and raise awareness of the benefits gained when using native plants in the landscape. There are three levels of certification: Bronze, Silver, and Gold. The Gold level is awarded to gardens that meet the highest level of criteria. Learn more about the program on the CoNPS website at <https://conps.org/conps-certified-native-plant-garden/>

As of 2019 year-end, 17 CoNPS members have had their yards or gardens (as well as public gardens) certified. Twelve have been certified at the Gold level and five have been certified at the Bronze level. For an application and criteria, send an email to [conpsgarden@gmail.com](mailto:conpsgarden@gmail.com). CoNPS also needs a new volunteer to help administer the program. If this sounds like an opportunity for your talents, use the same email to communicate your interest in helping lead this activity. ☺



# Research and Reports

## Prelude to a Spritz: Characterization of a Riparian Cottonwood Forest Prior to Flooding by the Chatfield Storage Reallocation Project

By Ashley Purcell and Erin K. Bissell

CoNPS annually funds grants to support field and laboratory research as part of its John W. Marr and Myrna P. Steinkamp grant programs. Reporting on projects is a requirement of all grant recipients. In this issue, we are pleased to feature this one by Ashley Purcell and Erin K. Bissell.

Chatfield Reservoir, in Littleton, CO, provides municipal drinking water, recreation, and flood control to the Denver metropolitan area. The Chatfield Storage Reallocation Project, proposed by the Army Corps of Engineers, is designed to increase water storage capacity in the reservoir. The proposed changes will add up to 12 feet to water level fluctuations along the South Platte River and Plum Creek riparian corridors upstream of the reservoir. This will affect an estimated 562 acres of shoreline habitat that includes willow stands and cottonwood forests (2014). Environmental mitigation efforts spearheaded by the Chatfield Reservoir Mitigation Company (CRMC) began in Fall 2017. In anticipation of predicted changes in the flooding regime, the CRMC selectively removed living trees, dead snags, and large woody debris from native cottonwood forest communities in the South Platte River floodplain during the winter and spring seasons of 2018-2019 (Chatfield Storage Reallocation Project 2017). The cottonwood forest habitat most directly affected by the

reallocation and mitigation plan is managed by the Colorado Parks and Wildlife as part of Chatfield State Park.

The riparian cottonwood forests located upstream of the reservoir along the South Platte River and Plum Creek include two distinct age classes: younger stands in dense formation and more widely spaced older legacy trees (Figure 1). The younger stands are found closer to the reservoir shoreline, while older legacy trees are more common further upstream (Figure 2). It is likely that the younger stands were established after construction of Chatfield Dam was completed in 1975. The purpose of this study is to measure how cottonwood forest structure (tree diameter, canopy cover, tree and shrub density, and ground cover) differs between stand and legacy sites. Characterizing vegetative differences in these forest types will also be used to understand how native fauna, particularly residential and migratory birds, utilize the riparian habitat. Since both plant and animal diversity are known indicators of overall health and stability of an ecosystem (Hautier, et al. 2015), it is important to compare data on forest community ►



Figure 1. Shania McCain collecting canopy cover data at a legacy forest site near the South Platte River. Note the dense stand of *Toxicodendron rydbergii* (poison ivy) in the foreground. This location represents one of the five replicates from Site 4 that was dropped from the BACI study design in 2017 but was included in the analyses presented here. © Kayla Starr



Figure 2. *Populus deltoides* (plains cottonwood) trees in a stand forest site near Plum Creek. Flooding in the foreground was due to beaver dam activity in the creek. © Kayla Starr

◀ structure before and after implementation of the reallocation project in order to assess its impact.

Vegetation surveys were conducted from 2016-2018 using a modified BBIRD protocol developed by researchers at the Montana Cooperative Wildlife Research Unit (Martin, et al 1997). The BBIRD protocol is a standardized field method for monitoring nesting success, productivity, and habitat of non-game birds. We chose this method of data collection because the vegetative surveys reported here were conducted in conjunction with surveys of bird diversity. Each survey replicate was centered around a focal cottonwood tree or stand, where canopy cover was also estimated. We recorded the size of the focal tree (diameter at breast height and height) as well as that of its nearest neighbor tree, sapling, and shrub. Shrub and sapling species found within a 5-m radius (78.5 m<sup>2</sup> area) around the focal tree were identified and counted. Ground cover composition (percentage of forb, grass, tree, shrub, bare ground, and organic

litter) was estimated in four 1-m diameter circular plots (0.785 m<sup>2</sup> area) located 5-m from the focal tree in the cardinal directions and then averaged across the four plots. Finally, the tree species and number of trees, snags, and large woody debris were counted within an 11.3-m radius (401.15 m<sup>2</sup> area) of the focal tree.

In 2016, data were collected at four sites in Chatfield State Park. Five replicates located along the South Platte River (Figure 3: Site 1) and five along Plum Creek (Figure 3: Site 2) contain younger stand trees, while older legacy trees are typical of five replicates at each of two sites located along the South Platte River (Figure 3: Sites 3 and 4). Care was taken to locate replicates at least 100-m from each other to avoid overlap in observations for bird surveys. Other factors that affected site selection were density of *Toxicodendron rydbergii* (poison ivy) surrounding potential focal trees, proximity to stream channels, and features of the terrain that might prevent reliable accessibility to focal trees and the sampling area. These are the data analyzed in this report.

In 2017, the sampling locations were adjusted to accommodate a Before, After, Impact and Control (BACI) study design in order to better compare diversity before and after implementation of the reallocation plan (Underwood 1992). Three control replicates were added at a site located on Deer Creek at Denver Botanic Gardens – Chatfield Farm, which are similar to the riparian habitat found within Chatfield State Park. After 2017, we reduced the number of impact replicates at Chatfield State Park to five stand (Site 1) and five legacy (Site 3) trees, all located along the South Platte River. In 2018, we added three more control replicates at a site located on Bear Creek in Bear Creek Lake Park. The before and control data collected from 2016-2018 will allow us to assess the impacts of increased flooding as well as the removal of live trees, snags, and woody debris on the forest community after implementation of the reallocation plan and the associated mitigation effort.

To evaluate differences in community structure between stand and legacy sites before implementation of the Reallocation Project, we pooled data collected from stand replicates (Sites 1 and 2) and compared them to pooled data collected from legacy replicates (Sites 3 and 4). We used t-tests to compare tree size, canopy and ground cover, and distance to nearest neighbor tree, shrub, and sapling as well as total number of individuals between stand and legacy sites. We also estimated the average age of trees by multiplying mean DBH by a growth factor of 2, the forestry standard for plains cottonwood trees (Purcell 2018). We did not include data collected from control sites in these analyses. ▶



Figure 3: Map of field sites at Chatfield State Park produced by Erik Kater. Sites 1 and 2 each include five stand replicates; Sites 3 and 4 each include five legacy replicates.

◀ In addition to *Populus deltoides* (plains cottonwood), *P. angustifolia* (narrowleaf cottonwood), and *P. x acuminata* (lance-leaf cottonwood) trees, we observed a variety of trees and shrubs at the sites, including *Acer negundo* (boxelder), *Salix exigua* (coyote willow), *Symphoricarpos occidentalis* (western snowberry), *Rosa arkansana* (prairie rose), *Prunus virginiana* (chokecherry) and *Toxicodendron rydbergii* (poison ivy). Common herbaceous species included natives such as *Asclepias speciosa* (showy milkweed), *Apocynum cannabinum* (hemp dogbane), and *Erigeron canadensis* (Canada horseweed), as well as invasive species such as *Cirsium arvense* (Canada thistle), *Cynoglossum officinale* (hound's tongue), and *Euphorbia esula* (leafy spurge). Invasive grasses, such as *Bromus inermis* (smooth brome) and *Bromus tectorum* (cheatgrass), dominated over native grasses.

We observed important differences in the forest community structure between the two age classes (Table 1). Based on estimates calculated from DBH values, which were significantly different between sites, the average age of stand focal trees is 32.84 years while that of legacy focal trees is 86.14 years.

| Site Characteristics         | Legacy Sites  | Stand Sites   | p-value |
|------------------------------|---------------|---------------|---------|
| DBH (cm)                     | 109.4 ± 9.20  | 41.71 ± 5.12  | <0.001  |
| # Small Trees                | 18.22 ± 10.78 | 8.15 ± 5.86   | 0.025   |
| Distance to Nearest Tree (m) | 4.89 ± 1.32   | 1.23 ± 0.23   | 0.024   |
| % Canopy Cover               | 85.05 ± 1.63  | 93.1 ± 1.67   | 0.0033  |
| % Bare Ground                | 2.50 ± 1.50   | 29.55 ± 10.19 | 0.027   |

Table 1: Summary of t-tests results for variables that were significantly different between stand and legacy sites.

Both estimates are consistent with site history, given completion of the dam construction project in 1975.

We observed a significantly greater number of small (<38 cm DBH) trees and shorter distances to nearest neighbor trees in stand than in legacy sites. This is not surprising considering that stand forests are defined as dense homogenous communities of small trees, while legacy forests are more heterogeneous with more widely spaced large (>38 cm DBH) trees. We also found significant differences in both canopy cover (Figure 4) and bare ground cover (Figure 5) between the stand and legacy sites. The lower density of trees in the legacy sites corresponds with lower canopy cover and bare ground estimates. One possible explanation for these observations is the open canopy at legacy forest sites allows more light to penetrate to the forest floor, resulting in greater understory growth and organic biomass accumulation than in the younger, more dense stand forest sites.

It is important to consider differences in forest composition between the two age classes before implementation of the reallocation plan because the sites may have different responses to changes in the flooding regime. Potential effects of flooding on cottonwood tree mortality depend on the timing and duration of flooding as well as tree age (Braatne, et al. 1996). The mitigation efforts include thinning of forests in both age classes, which, alongside periodic inundation by higher floodwaters, may reduce competition and facilitate greater recruitment of cottonwood seedlings (Scott, et al. 1997). These unpredictable changes in forest structure may have a significant impact on birds that rely on riparian habitat in the park for residential nesting sites or migratory stopover points.

To understand the impact of increased water retention in this riparian system, we will continue to conduct vegetation surveys for the purpose of analyzing community composition before and after flooding ►

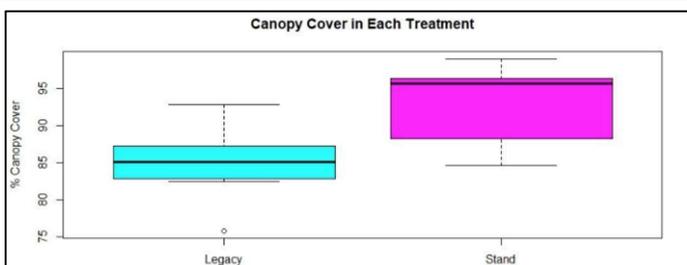


Figure 4: A box-and-whisker plot comparing percent canopy cover between legacy and stand sites. The boxes represent values falling within one standard deviation of the mean, the bands inside the boxes are the median. Whiskers show the lowest and highest data points within the 1.5 interquartile range (IQR) and circles represent data points that lie outside the 1.5 IQR.

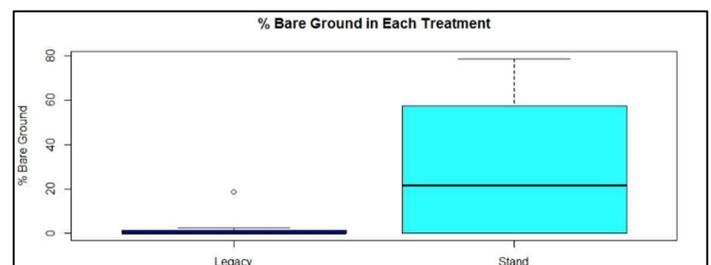


Figure 5: A box-and-whisker plot comparing percent bare ground between legacy and stand sites. The boxes represent values falling within one standard deviation of the mean, the bands inside the boxes are the median. Whiskers show the lowest and highest data points within the 1.5 interquartile range (IQR) and circles represent data points that lie outside the 1.5 IQR.

◀ events. We will also assess the effects of the reallocation project and associated mitigation efforts at Chatfield State Park by comparing them to two analogous control sites located at Deer Creek and Bear Creek. By making comparisons with multiple control sites, we will be better able determine which changes are due to the reallocation project and not just regional or seasonal differences among sites.

In 2019, we had our first season of post-reallocation data collection. At first look, the sites at Chatfield State Park have been modified dramatically, with fewer trees and less woody debris observed in both age classes. In addition to the changes associated with mitigation efforts, the 2019 season was characterized by a late snow melt and unusually high floodwaters that were amplified at the South Platte River sites by increased water retention associated with the reallocation project. We are currently analyzing the data collected in 2019 and plan to continue conducting surveys in the future. We also aim to conduct more comprehensive floristic surveys to further assess differences in the understory species between impact and control sites.

We would like to thank the Colorado Native Plant Society for providing financial support for this project through a John W. Marr fund research grant. We could not have completed this work without the field assistance of several former and current Metropolitan State University undergraduate students: Shania McCain, Kayla Starr, and Trevor Starr. Erik Kater produced the map showing replicates at each of the four site locations. J.P. deLong, a former undergraduate, and Dr. Nels Grevsted, a current faculty member at MSU Denver provided help with the statistical analyses. The report was improved by reviews from Shania McCain and Colette Ramey, also an undergraduate at MSU Denver. Finally, we appreciate the cooperation of the administrations at Bear Creek Lake Park, Chatfield State Park, and Denver Botanic Gardens at Chatfield Farm for allowing ongoing access to these sites as part of a long-term monitoring project.

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## Mark Your Calendar for the CoNPS Front Range Plant Sales

**April 24 & 25:** (in partnership with North American Rock Garden Society)

**Location:** Jeffco Fairgrounds; 15200 W 6th Ave, Golden, CO

Pesticide-free native plants will be available by growers from the High Plains Environmental Center and Harlequin Gardens.

Friday evening sales are for CoNPS and NARGS MEMBERS ONLY. Sale continues on Saturday for members and the general public.

**April 26:** at the High Plains Environmental Center

**Location:** 2698 Bluestem Willow Dr Loveland, CO

**Time:** 9:00 AM to 4:00 PM

**May 9:** at Harlequin Gardens

**Location:** 4795 North 26th St • Boulder, CO

**Time:** 9:00 AM to 5:00 PM

# Research and Reports

## Documenting the Insect and Microbial Communities that Utilize Gambel Oak (*Quercus gambelii* Nutt.) to Inform Conservation Management

By Rachael Sitz and Melissa Schreiner

Gambel oak (*Quercus gambelii*) is one of the few oak species native to Colorado, and it provides numerous ecological and social benefits. Ecologically, Gambel oak improves soil stabilization and water retention, and is critical to the success of many animal species by providing both food and shelter (Leidolf et al. 2000). Culturally, these oak stands offer recreational opportunities, and are historically important to indigenous peoples (Dunmire and Tierney 1997). Although Gambel oak is widespread, much of the land it occupies is unprotected, and demands for pasture and urban development render this species vulnerable to removal (Harper et al. 1985; Colorado State University Extension).

### Introduction

We know that Gambel oak woodlands are threatened by human encroachment, but very little effort has gone toward understanding the biological risks Gambel oak faces. Due to our global economy, invasive insects and microbes are an increasing threat (Liebhold et al. 2012). One disease complex that could pose a risk to Gambel oak is drippy blight disease of red oaks which was recently described in Boulder and Denver (Sitz et al. 2018). After several years of successive branch dieback, red oak trees are being removed. In many cases, infected trees act as reservoirs of pests and pathogens that can invade adjacent forests and further spread or introduce disease. Therefore, an important step in our research was to determine if there may be spread of “drippy” diseases from urban to natural areas by screening for this disease complex in native Gambel oak stands.

Gambel oak was ideal for screening for the drippy blight pathogen, as it can be found in close proximity to municipalities containing infected trees. In this project, we not only screened for invasive pests and pathogens, but also surveyed the diversity of arthropods and microbes present on Gambel oak in the Southeastern portion of the Front Range. Our survey results show a wide range of microfauna present in Gambel oak stands. To highlight one of Gambel oak’s ecological roles, this article summarizes the arthropods and microbes found during our survey and provides further information about several key organisms.

### Survey Locations

Survey sites were located on the Palmer Divide, an elevated peninsula just eastward of the Front Range, and included Castlewood Canyon State Park, Dawson Butte Ranch Open Space, and Gateway Mesa Natural Area (Figure 1A-C). This area was named after William Jackson Palmer, the founder of Colorado Springs, and divides the drainages of the Platte and Arkansas rivers. Furthermore, it is an extension of the Black Forest which contains foothills, ponderosa pines and shrub lands with large stands of Gambel oak. Arthropods and microbes were collected once at each location in June, July, and August. Arthropods were sampled using sweep nets, beating sheets, and Lindgren funnel traps. Specimens were identified at Colorado State University, with arthropods being identified with the support of the C.P. Gillette Museum of Arthropod Diversity. A reference collection of arthropods found during these surveys has been deposited with this museum.



Figure 1A-C. Survey locations include (A) Castlewood Canyon State Park, (B) Dawson Butte Ranch Open Space, and (C) Gateway Mesa Natural Area.

### Arthropod Diversity

In our survey, we identified a total of 543 individual arthropods representing 124 species. These insects displayed a wide array of life histories and represent 57 families in 10 insect orders. Approximately half of the arthropods sampled were feeding on Gambel oak, while the other half were predators or simply taking advantage of Gambel oak habitat. Overall, this suggests the ecological importance of Gambel oak to the surrounding community has been previously underestimated.

**Plant Feeding Arthropods:** One species of spittlebug, named for the protective spittle they create around their bodies (Figures 2A and 2B), feeds primarily on Gambel oak. Similarly, several of the ►

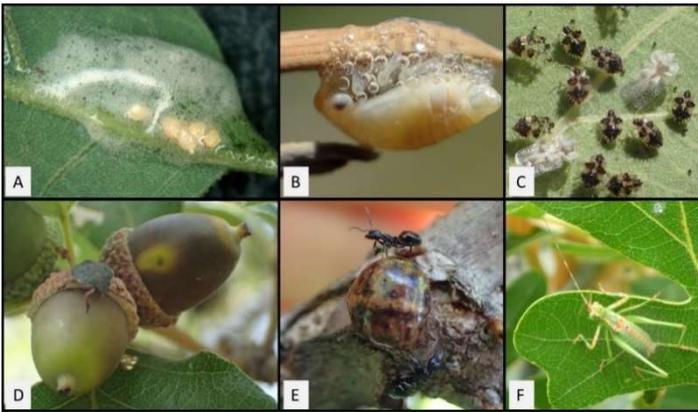


Figure 2. Arthropods found on Gambel oak. (A) immature spittle bugs (*Clastoptera* spp.) encased in protective spittle (photo ©Whitney Cranshaw), (B) an exposed immature spittlebug, (C) adult and immature stages of lace bug (*Corythucha arcuate*), (D) stink bug piercing an acorn, (E) adult kermes scale (*Allokermes gillettei*) insect tended by ants, and (F) immature tree cricket (*Oecanthus* sp.).

◀ other insects found during the course of this survey mainly feed on Gambel oak including adults of the Gambel oak borer (*Agrilus quercicola*) (Sever et al. 2012) and a leaf mining fly (*Agromyza* sp.) where immatures were observed in serpentine mines on oak leaves and the adults were found in the sweep net samples. The most common tree hopper (*Cyrtolobus limus*) was found abundantly at each collection site in the study, but other species of tree hoppers were also collected. Notably, our state insect, the Colorado hairstreak (*Hypaurotis crysalus*), also develops on Gambel oak (Colorado Plant Database), though it was not observed during the course of this survey.

Three species of adult seed feeding weevils (*Carculio* sp.) were found on the foliage, and larval stages were found developing inside of discolored acorns. Approximately 25% of the acorns at the three sites were discolored, a symptom suggesting they were host to developing larvae. We observed several other symptoms indicative of insect damage. Oak tatters, characterized by tattered leaves and a flush of new leaves during the summer months, was observed at

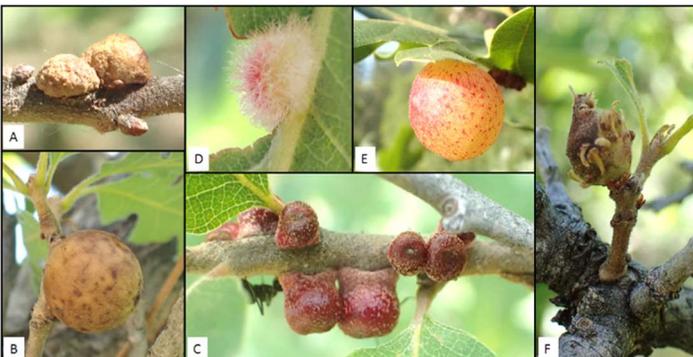


Figure 3. Gall formations induced by gall wasps (Hymenoptera: Cynipidae) found on stem (A-C), leaf (D-E), and bud (F) tissues.

Gateway Mesa. It likely resulted from a sawfly infestation early in the season. The symptoms of oak leafrollers (*Archips semiferrana*) were observed (Harper et al. 1985; USU Extension). Gambel oaks also support a wide array of gall-forming wasps (Figures 3A-F), and seven species were observed during the course of this survey, as well as mite-induced blister galls.

**Predatory Feeding Arthropods:** Gambel oak was also found to support many beneficial, predatory arthropods. Just under 30% of all insects collected in these surveys were true bugs in the order Hemiptera, some of which prey on a wide variety of other arthropods, especially larval forms of moths/butterflies and beetles. Two species of assassin bugs were found at each location (Figures 4 A-C). Other insect predators included beetles, flies (Figure 4F), hunting wasps (Figure 4G), lacewings, and thrips. Almost half of the predatory arthropods collected from the oak canopy were spiders and included species from four different families—Salticidae (Figure 4D), Araneidae (Figure 4E), Thomisidae, and Philodromidae. Daddy long legs were also collected frequently (Phalangidae family).

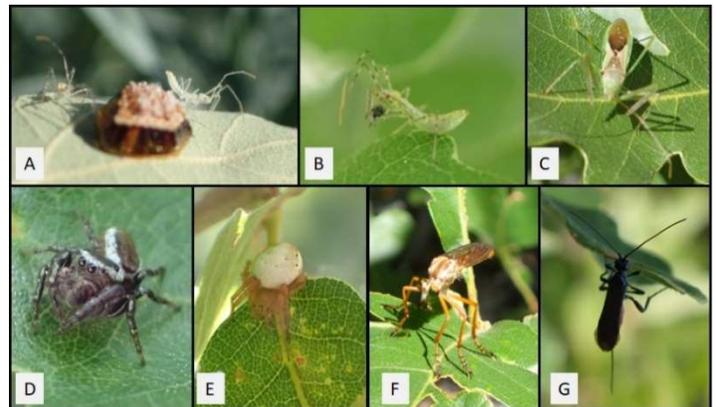


Figure 4. Examples of the predatory arthropods found on Gambel oak. Multiple life stages of *Zelus luridus* assassin bugs were found, including: (A) immatures emerging from an egg case, (B) an exposed immature feeding on prey, and (C) an adult awaiting prey on a Gambel oak leaf. Other predators included (D) jumping spiders (*Eris* sp.), (E) orb weavers, (F) robber flies (*Diogmites* sp.), and (G) hunting wasps.

### Microbial Diversity

Current understanding of the microbial diversity in Gambel oak stands is limited to a handful of studies (Preszler et al. 1996; Harper et al. 1985; Hawksworth and Mielke 1962) and the Forestry Images Database. Of this documented diversity, six fungal pathogens as well as one bacterial pathogen are known. In line with these studies, we observed all but one of the previously documented microbial pathogens. Powdery mildew was not observed because it typically occurs in the fall. The microbes present display a wide array ▶

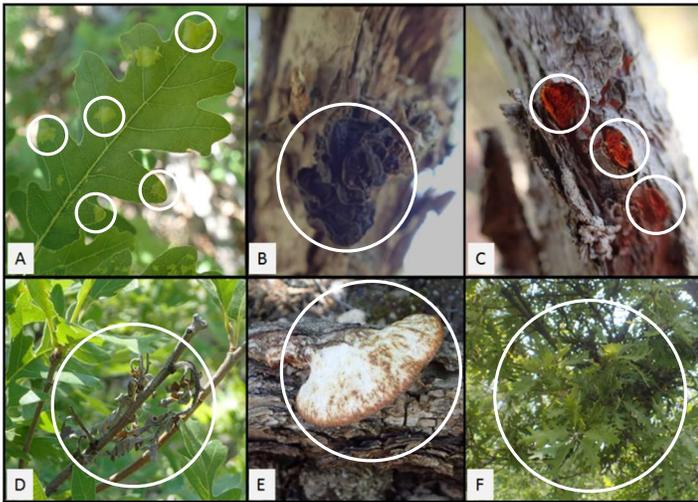


Figure 5. Fungal pathogens of Gambel oak. (A) Early-stage development of oak leaf blister caused by *Taphrina caerulescense*, infection sites are circled. (B) Fruiting bodies morphologically identified as *Exidia nigricans*, a wood decay fungus found on dead Gambel oak branches. (C) Pustules on dead branches caused by the pathogen *Endothia singularis*. (D) symptoms caused by an unknown shoot blight (E) fruiting bodies of the heart rot fungus *Polyporus dryophilus*. (F) witch's broom caused by the fungus *Articularia quercina*.

◀ of life histories and vary in their effect on the host plant. We observed fungal pathogens that caused branch cankers, heart rot or wood decay, witch's brooms, leaf spots, and shoot blight (Fig 5A-F). The bacterial pathogens caused oozing and aborted acorns as well as gall formations (Fig 6A-C).



Figure 6. Bacterial pathogens of Gambel oak. Acorn caps infected with the 'drippy' bacterium *Lonsdalea quercina* which can appear (A) clear and frothy or (B) pigmented and viscous. (C) Trunk growths from the crown gall bacterium (*Agrobacterium tumefaciens*).

However, several of the microbes we discovered were not previously known to occur on Gambel oak, including the 'drippy' pathogen *Lonsdalea quercina* (Fig 6A-B), the fungal causal agent of a wood decay *Exidia nigricans* (Fig 5B), an unknown shoot blight fungus (Fig 5D), and a handful of leaf spots (not pictured). *Lonsdalea quercina* is also involved in drippy blight disease of red oak in adjacent Colorado municipalities. Additionally, this bacterium is the culprit of a less problematic disease-causing dripping acorns on natural and urban plantings of live oaks in California's Coastal Range (Hildenbrand and Schroth

1967). This is the first time this bacterial pathogen was documented causing dripping acorns on Gambel oak (Fig 6A and 6B). In both of the previously documented 'drippy' diseases, wounds from plant-feeding insects are primary sites of bacterial infections. Therefore, it is likely that the dripping acorns symptoms observed in Gambel oak were initiated by insect wounding. Several acorn wounds were observed in this study including the feeding damage by a piercing/sucking stink bug (Fig 2D) and egg laying or feeding wounds caused by acorn weevils. We also looked for branch wounds and found several instances of egg laying wounds caused by the Putnam cicada (*Platypedia putnami*) and feeding wounds caused by a kermes scale insect (Fig 2E). Unlike drippy blight diseased red oaks, Gambel oak branch wound sites were not colonized by the bacterium.

### Conclusion

In our survey, we found that Gambel oak consistently supported a wide variety of arthropods and microbes. This was especially striking toward the end of summer, when Gambel oak stands were green islands amidst golden grasses and cracked soils that appeared largely devoid of insects. Although Gambel oak is widespread within the region, we saw how threatened this species was due to growing demands for urban development. Therefore, increasing awareness of the food and shelter Gambel oak woodlands provide should be prioritized. The species diversity observed during the course of our survey shows that the risks of removal are high, and will hopefully be considered in future cost-benefit analyses. Gambel oak is integral to the healthy functioning of our local ecosystems, and conserving these woodlands will preserve the arthropod and microbial diversity that they support.

*The authors thank personnel at Gateway Mesa Open Space, Dawson Butte Ranch Open Space, and Castlewood Canyon State Park for allowing us to collect specimens and survey including Barbara Spagnuolo, Michael Butterfield, and Thomas Duff respectively as well as Meg Halford with the Colorado State Forest Service. Collaborators integral to this project include Dr. Whitney Cranshaw, Dr. Jane Stewart, Dr. Ian Pearse, Hope Raymond, Dr. Jorge Ibarra Caballero, Dr. Boris Kondratieff, Tristan Kubik, Andrew Miller, and Sarah Painter. Funding was provided by the Colorado Native Plant Society Marr Grant, Colorado State University Agricultural Experiment Station, and the US Geological Survey.*

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## Earthly Bride

By Arthur Clifford

Snow baptizes the face of the maiden  
In crystalline white she is laden  
Comforter of gems each unique  
Muted silk that does not speak  
Bridal veil without compare  
Conceals the gift waiting there  
Unwrapped free spring arrives to lift  
The promise from her silent lip  
Creatures heed the Siren's call  
A ballet of summer that sleeps in fall  
The harvest of the season now is in  
Alas...  
The veil shall fall again



Snow crystals. © Kelly Ambler

## CoNPS Strategic Plan 2020-2025



On February 8, 2020, the CoNPS Board of Directors approved the new Strategic Plan. Please thank the Strategic Planning Committee Board Members—Christina Alba, Erica Cooper, and Ann Grant, for their efforts, time commitment, and

expertise devoted to developing and presenting this Plan.

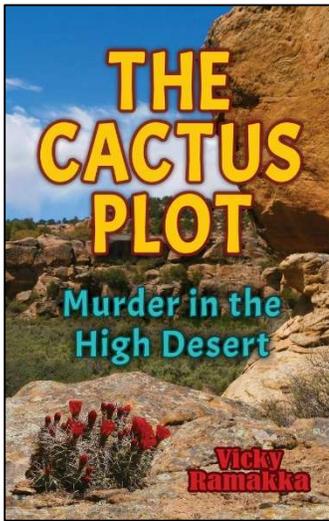
The Strategic Plan can be accessed at  
[https://conps.org/wp-content/uploads/2020/02/CoNPS\\_StrategicPlan\\_FINAL.pdf](https://conps.org/wp-content/uploads/2020/02/CoNPS_StrategicPlan_FINAL.pdf)

# Media Reviews

## ***The Cactus Plot: Murder in the High Desert* by Vicky Ramakka**

Reviewed by Shirley Nilson

".... *Could it be? No other fishhook cactus has flowers of such fushia.*" Millie, a recent college graduate, is spending her summer as a BLM seasonal botanist inventorying endangered plants in the New Mexico's Colorado Southeastern Plateau. Her discovery of a rare San Juan cactus steers her career path into



solving murders, illegal plant exportation, and even a blooming romance. Plants are her specialty, however. As a reader of this book, you will be exposed to the historic Navaho culture, colorful desert fauna and flora, and the powerful influence of oil and gas exploration on public lands.

I enjoyed Millie's vast knowledge and description of native plants and trees and the realistic setting of

New Mexico's creatures, characters, sunsets, storms and rough terrain—all of which make this fiction book believable.

Millie drives a dilapidated four-wheel drive vehicle on dirt roads cut through high desert terrain without hesitation. I find this astonishing ability somewhat unlikely, since she is an inexperienced city girl from New Jersey, and this is her first time out west. Regardless, I enjoyed this book tremendously and felt like I was right there alongside her throughout this savory novel.

This book is for any native plant enthusiast, murder mystery fan, pet lover, or supporter of the great southwestern outdoors. I anxiously await Vicky Ramakka's next tale!

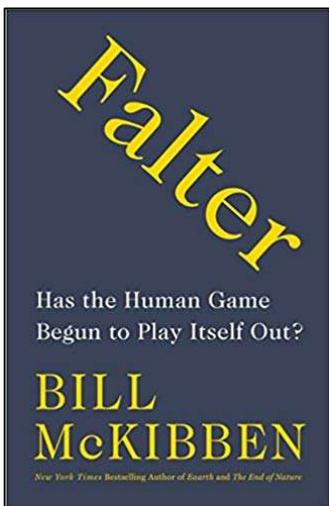
*Shirley Nilson is an equipment operator for the city of Grand Junction's parks & recreation horticulture division. She is an active member of the Plateau chapter and is a Native Plant Master®. She lives in Fruita, where she enjoys gardening, paddle boarding, and spending time with her husband, teenage son, three dogs and three cats.* ☺

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## ***Falter: Has the Human Game Begun to Play Itself Out?* by Bill McKibben**

Reviewed by Jack Carter

I do not know how many of the members of the Colorado Native Plant Society are familiar with the name Bill McKibben. For those who are, I would like to remind you to look for a copy of his new book. For those who have never read any of his books or significant papers, this is an introduction to a name you will want to keep in mind and come to know. McKibben was born in about 1960, so he is much younger than I. But when I first read his book *End of Nature* (1990) I was hooked.



Over my 50 years of teaching general botany, I was insistent that students read at least one book outside of the class text that might or might not relate to plants, but should relate to science and make the connection between science and society. Reading the book, and writing a short report only counted for about ten percent of their final grade, but occasionally a student would identify this reading as a significant part of what they appreciated about the course. They were also invited to locate a book not on my three shelves in the classroom, and bring it to my attention for consideration. Students who were that interested often located books of special interest to my objectives.

*The End of Nature* was a book often selected by the students, and even today I can recommend that book as one that will make a difference in the way we see the world that surrounds us. McKibben's books provide the most important connection among ►

◀ science and society that I have ever read. He is a namedropper *par excellence*—of people and places that fill the stage of nature and have great respect for the natural world. At the same time, readers will learn the names of people who have little respect for all life that surrounds us, and who would destroy this world for a dollar.

Over the years, McKibben has helped me to learn who the good guys are and who the bad guys are. He wants us all to walk softly over the land and to move slowly so we don't frighten other living things, such as when we protect a pond or a bird's nest. As we treat other living things, so we treat other *Homo sapiens*. Kindness and caring for life, wherever it may be, is the name of the game.

McKibben is religious, having taught for many years at Middlebury College, and he makes the connections among such scholars as Thoreau and Muir. He expresses a God in the order and goodness of nature, which I seldom considered, but would never condemn. I personally have come to understand that the lives of so many people—be they Jews, Christians, Muslims, Buddhists, or atheists—can be taught to recognize the need to protect the only Earth available to us.

In his most recent book *Falter, Has the Human Game Begun to Play Itself Out?*, McKibben brings together in 18 relatively short chapters plus an epilogue, a number of paths we might follow, some good and some not so good. Each chapter brings us back to the title question of the book. It presents a social and political history that describes through his observations and interpretations just how we got to where we are today. For decades, scientists have described their findings concerning life and the living species, but many economists and politicians have presented a different story. Humankind has had a great deal of trouble considering any knowledge that pertains to the distant future, and the lives of future generations, our children and grandchildren. At the same time, we tend to live right at the tip of our noses. If the new idea will not make us rich, why bother?

For me, chapters 8-10 in a part of the book titled *Leverage*, describe a lost sense of dignity by so many people, and reminded me of a bible course I completed about my sophomore year in college. It was taught by a professor who had a PhD in history. I recall that as we studied the New Testament, the teacher brought in several outside readings. These were written by a woman, Ayn Rand, and they brought to our attention a very different perspective. Rand expressed the idea that government is bad, selfishness is good.

The ideas of "I'll get mine" or "individualism" are the central themes of Rand, and "conservation" and

"helping living systems" are presented as unthinkable. Fortunately, a group of extremely intelligent women, including Rachel Carson, Jane Jacobs, Betty Friedan, and Jane Goodall, all saw the world as a holistic system, and turned our attention towards another drummer in the 1950s.

Although McKibben makes clear how much trouble we are in, he later expresses some thoughts we may wish to consider in our battle to offer resistance to some of the thoughtless technologies that surround us to better understand the concept of limits. Can we come to understand the power of the Koch brothers and the fossil fuel industry, and defeat them in their money-first attitude? And can we move as soon as humanly possible to use the sun as our source of energy? We know how powerful the sun is, and it is all ours.

I encourage members of CoNPS to consider this book. We are a group of people who believe in caring for all living systems, the natural world, and every species contained therein. It is time for us to take charge in our efforts to protect Planet Earth.

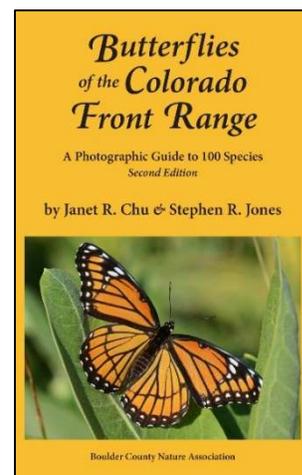
*Jack Carter is author of three books: Trees and Shrubs of Colorado, Trees and Shrubs of New Mexico, and Common Southwestern Native Plants. He is a former botany professor and journal editor. He and his wife Martha are also the 2019 recipients of the CoNPS Lifetime Achievement Award. You can contact Jack at [apacheplume29@gmail.com](mailto:apacheplume29@gmail.com).* 🌿



## ID Butterflies that Appear in Your Photos of Native Plants

The Boulder County Nature Association recently published the second edition of *Butterflies of the Colorado Front Range* as an e-book. The printed version will be available in early 2020.

This photographic guide to 120 species is written by Jan Chu and Steve Jones. Both the e-book and

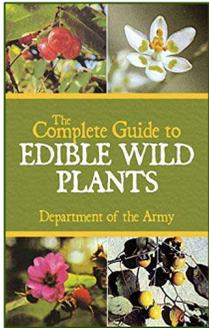


printed version feature full color photos of each butterfly species, descriptions of male and female butterflies, habitat, host plants, and lookalikes.

The book also provides information on how to attract butterflies to your gardens and preserve their sensitive habitats. The book also complements the <http://www.coloradofrontrangebutterflies.com> website.

## Relevant Reading

Looking for more to read? Below are links to articles of interest to the native plant-loving community.



### Eat Your Weeds?

Turning invasive plants into food is a trending topic. In an October 3, 2019, digital edition of *Saveur* magazine, author Marie Viljoen suggests that farmers might consider harvesting common weeds like burdock, chickweed, dandelion, and watercress. Check it out at <https://www.saveur.com/invasive-edible-weeds/>

Learn more using *The Complete Guide to Edible Wild Plants*, by the U.S. Department of the Army. Goodreads gives it 4.5/5 stars.

### Other Resources of Interest

Cool Science Radio spoke with Dr. David Inouye, a research ecologist at the Rocky Mountain Biological Laboratory. Listen to “How Bumblebees, Hummingbirds, and Their Food Source React to Climate Change at High Altitudes” here:

<https://www.kpcw.org/post/how-bumblebees-hummingbirds-and-their-food-source-react-climate-change-high-altitude#stream/0>

Check out this free online version of *Bee Basics: Learn About Our Native Bees* [https://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb1143636.pdf](https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1143636.pdf)

Learn about other plants that attract adult Monarch Butterflies <https://www.nwf.org/Garden-for-Wildlife/About/Native-Plants/Monarch-Nectar-Guides>

“Charles Darwin’s Grandfather Was Famous for His Poems About Plant Sex.” Erasmus Darwin’s poetics influenced his grandson’s vision of nature. <https://www.smithsonianmag.com/smart-news/charles-darwins-grandfather-was-famous-his-poems-about-plant-sex-180967517/>

“Artist Reveals How to Draw Perfect Flowers in 3 Simple Steps.” <https://mymodernmet.com/how-to-draw-a-flower-kate-kyehyun-park/>

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◀ “*Physocarpus* ...” continued from page 12

Audrey Spencer graduated with a master-of-science degree in environmental science from the University of Colorado Denver in May 2019, where she began working with her mentor and co-author, Dr. Leo P. Bruederle. She specializes in field botany, taxonomy, and collections management. She is currently considering the next step in her career. Contact her at [audrey.v.spencer@gmail.com](mailto:audrey.v.spencer@gmail.com) or via her website at [audreydignan.com](http://audreydignan.com).

### Endnotes

1. Weber was not the first to notice the disjunct populations of eastern woodland-prairie plants in the American West. According to Weber & Wittmann (2011) this group was first noted by 19th-century botanist Edwin James, but I have not been able to find any of James’s writings on the subject.
2. J Ackerfield. 2015. *Flora of Colorado*. BRIT Press, Fort Worth, TX.
3. I refer to the intermedius taxon at the species level, following *Flora of North America North of Mexico* (2014).

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# News and Announcements

## Ackerfield Named Head Curator of DBG Natural History Collections

Effective February 3, Jennifer Ackerfield joined Denver Botanic Gardens as its head curator of its natural history collections. Among other duties, Jennifer will—

- Direct Kathryn Kalmbach vascular plant herbarium, the Sam Mitchel herbarium of fungi, collection of arthropods, and the biorepository;
- Oversee the growth and curation of both the physical and digital natural history and biorepository collections;
- Develop new research projects that complement and enhance existing DBG research and write grant proposals to support these new projects; and
- Coordinate and lead collections-focused fieldwork, including but not limited to managing crews.



### A Note from Jennifer about Her Move

The Charles Maurer Herbarium at Colorado State University has been not only my place of employment, but my refuge and my passion for the last 21 years. It seems like just yesterday that I began working in the herbarium as the collections manager. I started in 1998, while pursuing my master's degree in botany. Over the years, I have directed the growth of the herbarium by 42 percent, engaged with the general public through outreach opportunities, mentored and taught thousands of undergraduate and graduate students, written the *Flora of Colorado*, and all with the utmost joy that only comes from pursuing one's passions every single day.

At the time I began working in the herbarium, I was under the supervision of Dr. Jun Wen, who was also my graduate advisor. My main duties then were general upkeep of the herbarium, processing collections, and assisting visitors with the collections. Over the years, my duties in the herbarium became more involved, and several years ago I was appointed

assistant curator in recognition of my additional accomplishments and activities.

I have always strongly believed that, as scientists, we need to engage with the general public to communicate the results of our research in meaningful ways. We must be able to disseminate scientific advances in a way that not only informs but also encourage public interest in the scientific process. Consequently, I have always included public outreach as one of my foci while working in the herbarium. Shortly after I began working in the herbarium, I added an outreach component through the establishment of the Friends of the Herbarium. For the Friends, I led wildflower hikes and sent out a newsletter every six months detailing our progress in the herbarium and highlighting interesting aspects of the flora of Colorado.

I also created outreach opportunities that increased engagement with the local community by leading workshops, talks, and field trips for the Colorado Native Plant Society, Crested Butte Wildflower Festival, and Master Gardener classes. I also promoted the importance of natural history collections through speaking engagements. I even initiated citizen science programs (such as Team Thistle!) to engage the local community with science.

One of my most rewarding endeavors at CSU has been mentoring and educating the next generation of botanists and researchers. I am passionate about student success, creating an inclusive community of students, and providing opportunities for all students to pursue their academic goals. I began the herbarium student internship program shortly after starting my position, assisting undergraduate students in learning collection management techniques. In addition, I began teaching the Plant Identification course in 2003. Over the last 21 years, I have mentored approximately 200 student interns and taught over 2,200 students how to identify plants. Many of these students have gone on to pursue careers and higher education in botany and natural resources, and I am proud to call many of them my colleagues as well as my friends.

I began writing the *Flora of Colorado* in 2004. I saw students in my Plant Identification class struggling to use the available dichotomous keys and thought that there must be a better way. Through the process of writing the *Flora*, I verified nearly every specimen from Colorado in the herbarium and corrected the misidentification of approximately 4500 specimens, resulting in one of the best-curated collections of botanical specimens in the Rocky Mountains. ►

◀ When I began in 1998, the herbarium had approximately 60,000 total collections, 40,000 of which were databased. Together with curator Mark Simmons, I have overseen the acquisition of the Forestry and Range Science Herbarium at CSU (2018, approximately 10,000 specimens) and the Miriam Denham collection (2015, approximately 15,000 specimens). I have mentored and trained graduate students in floristic inventories and participated in several BioBlitzes across the state. I have personally made collections of approximately 5,000 specimens from Colorado and the surrounding states, mostly concentrating in areas that had not previously been surveyed, as well as targeting specific taxonomic groups.

As of 2019, the herbarium consists of over 104,000 specimens, ALL of which are databased AND imaged! This is thanks in large part to a National Science Foundation grant that I was awarded in 2012 to database and image the entire collection. This amounts to growth of approximately 2,100 specimens each year for the last 21 years!

Over the years, I have worked closely with affiliates such as the Colorado Natural Heritage Program, US Forest Service, Bureau of Land Management, and several national parks including Mesa Verde National Park and Rocky Mountain National Park. I have collaborated with curators at other institutions such as the University of Northern Colorado, Denver Botanic Gardens, Rocky Mountain Herbarium, CU Boulder, Colorado College, and Mesa State. And, last but not least, I have identified and verified countless specimens for graduate students, researchers, and the general public.

I am fortunate that I was able to pursue a PhD while also working in the herbarium. In 1998, when Jun Wen asked me what I wanted to study for my master's thesis, I told her *Cirsium* (thistles). I had always been fascinated by the alpine thistles, and through field observations had noted much morphological variation within species that seemed unaccounted for. However, Jun responded adamantly "No!" to my choice of study genus—and she was right to do so. I would not have been able to obtain adequate data in 1998. Instead, I studied the systematics and evolution of *Hedera* (English ivy). So, when I began pursuing my PhD in 2014, I decided to finally take up the study of the systematics and evolution of *Cirsium*, a project that I like to call "a prickly puzzle."

Anyone who has tried to key out a thistle can tell you that it is also one of the most taxonomically challenging groups in Colorado. In addition, thistles provide a fantastic system to study the drivers of

diversification and speciation within the aster family, because they are an example of a recently radiating group in North America. My ongoing research aims to meet several objectives. First, to clarify phylogenetic and taxonomic relationships within the thistles using traditional as well as cutting-edge, next-generation sequencing technology. Second, to quantify the effects of abiotic and biotic factors influencing diversification of the thistles by incorporating geology, habitat, and trait evolution into diversification models. Last, to investigate the modes and patterns of speciation on high elevation mountain tops by completing a phylogeographic history of the alpine thistles. Through this process, I discovered at least five new species of thistles in western North America! I also advocate for native thistles during my speaking engagements, destigmatizing their unfortunate misrepresentation as weedy, invasive plants.

While in pursuit of my PhD, I serendipitously met a worldwide Asteraceae expert and my future mentor, Dr. Vicki Funk. Vicki was a senior curator at the Smithsonian National Museum of Natural History, and she immediately took me under her wing. Her guidance, mentorship, and support made my work on *Cirsium* possible. She believed in me like no one else. I even completed a pre-doctoral fellowship at the Smithsonian under Vicki's guidance. Unfortunately, Vicki passed away shortly after I accepted the curator position at DBG. The best tribute to Vicki that I can think of is to continue our research on *Cirsium* and Asteraceae, continue to be involved in the botanical community, continue to mentor students, and of course to always have fun in the pursuit of all things botany!

I am excited to begin this new position as head curator of natural history collections at the Denver Botanic Gardens. I am excited to have the resources available at the Gardens to accomplish my research and outreach goals. Most of all, I am excited to be part of an amazing team. Together, we will achieve great things!

Professor Mark Simmons, my PhD advisor, will continue serving as curator of the Charles Maurer Herbarium Collection. Alaina Krakowiak, a CSU master's student working on *Clematis*, will work together with Mark and me to reorganize the herbarium during the spring 2020 semester such that genera are arranged within families according to the Angiosperm Phylogeny Group classification, which I use in the *Flora of Colorado*. Mark looks forward to continuing my legacy at the herbarium while making further improvements to both collections and facilities that will be possible given Charles Maurer's generous endowment. ☺

# Chapter Events

(Please check the Events Calendar at <https://CoNPS.org> for updated information and registration.)

## Boulder Chapter

### March 10: “Reforestation Ponderosa Pine After Fire”

Presenter: Teresa Chapman

Location: Boulder Rural Fire Protection, 6230 Lookout Rd, Boulder, CO 80301

Time: 6:30–8:30 PM

Forested fire refugia (trees that survive fires) are important resources that provide seed sources for post-fire regeneration and ecosystem recovery. An evaluation was conducted of the characteristics of forested fire refugia within 23 fires in ponderosa pine (*Pinus ponderosa*)-dominated forests of the Colorado Front Range from 1996-2013 using high resolution aerial imagery. Findings included results that may have critical concerns for the current and future management of ponderosa pine forests in Colorado.

*Teresa Chapman is a Doctorate candidate in the geography department at the University of Colorado and is the GIS manager at the Colorado chapter of The Nature Conservancy. Her research interests in forest ecology are currently focused on mechanisms and patterns of forest recovery in Colorado following major disturbance events.*

## Metro-Denver Chapter

Chapter meetings are generally held on the second Tuesday of the month at the Denver Botanic Gardens.

### March 6-8: “Gardening Expo “

Location: 52nd & Garfield, Arvada

Echter’s Garden Center will be hosting a three-day gardening event featuring presentations, vendors, and garden-related groups. Our chapter will host a booth.

### March 10: “Colorado Wildflower Slide Show and Tips for Improving Photography”

Presenter: Bruce Tohill

Location: DBG Plant Society Building

Time: 6:30–9:00 PM

### April 18: “Earth Day Celebration”

Location: Cherokee Ranch & Castle, 6113 Daniel’s Park Rd, Sedalia.

Time: 11:00 AM to 2:00 PM

Cherokee Ranch and Castle invites the community to the Castle to learn about green and sustainable efforts from local Douglas County organizations and resources. Explore current trends in energy and water conservation, wildlife, landscape practices, recycling and green home care. They will also feature a Kids corner with a story and craft to take home. Learn some helpful tips and practices to adopt in your own

efforts towards a better Earth. CoNPS will host a booth at this event. Guided hikes will be offered, which require advance registration.

<https://cherokeeranch.org/events-and-programs.html>

### April 14: “Highline Canal Bioblitz Results and Ecology Report”

Presenter: Christine Alba, Phd

Location: DBG Plant Society Building

Time: 6:30–9:00 PM

## Northern Chapter

Northern Chapter Meetings are held at the Foothills Activity Center, 241 E Foothills Pkwy, Fort Collins, CO. Social begins at 6:30 pm, presentation at 7:15 pm. The chapter leadership team encourages members to arrive at 6:00 pm to help plan future chapter events. Light snacks, a beverage, plates, cups, and napkins are supplied by the chapter. Other goodies are always welcome. Parking is across the street in a parking garage or in a nearby lot (both are free). If persons from other chapters wish to make announcements, please notify the winter meetings team leader at [odygrant@gmail.com](mailto:odygrant@gmail.com)

### March 3: “Colorado Plant Conservation”

Presenter: Susan S. Panjabi, Colorado Natural Heritage Program

### and “The Volunteer Experience at WRV”

Presenter: Annemarie Fussell, Wildlands Restoration Volunteers

Susan Panjabi is a research associate and field botanist with the Colorado Natural Heritage Program at CSU. CNHP conducts plant, animal, and invertebrate surveys and tracks rare species in Colorado. Susan will speak on rare plants and their ecosystems.

Annemarie Fussell is a field trip coordinator and leader at Wildlands Restoration Volunteers. WRV leads field trips for trail maintenance and construction, seed collection, native plant restoration, and other ecological events. Annemarie will speak about some of their successful projects and about the volunteer experience at WRV and how the organization recruits, motivates, and rewards volunteers

### April 7: “Trees of Fort Collins”

Presenter: Renee Galleano-Popp, author

### and “Upcoming Workshops and Member Survey Results”

Presenter: Kathy Okon, CoNPS Workshop Coordinator

Renee Galeano-Popp is a Northern chapter member, a botanist, and a retired forest ecologist. She will ►

◀ present and discuss her new book *Trees of Fort Collins*. Books will be available for sale and will be signed by the author.

Kathy Okon is the CoNPS workshop coordinator.

### May 7: Season Kickoff at Odell's

Join the chapter to see photos from past hikes, learn about the spring and summer field trips, and more. Drink tickets, snacks, and door prizes! Open to members and nonmembers.

## Plateau Chapter

### April 22: "Native Plant Walk"

Presenter: Dr. Stephen Stern and Colorado West Land Trust

Location: Three Sisters Park adjacent to the Lunch Loops Trail System. Monument Drive, Grand Junction  
Time: 5:30 to 7:30 PM

Dr. Stern is on the faculty of Colorado Mesa University. He teaches many subjects including biology, plant systematics, principles of biology, taxonomy of grasses, plant identification, tropical field biology, and various research and internship classes. He is curator of the Walter Almond Kelley Herbarium at CMU.

### June 3: "An Early Season Wildflower Walk"

Presenter: Mary Menz

Location: Black Canyon of the Gunnison  
Time: 9:00 AM

Meet us at the visitor center at 9:00 am for an early season wildflower walk on the Oak Leaf Trail.

### June 14: "Photographing Native Plants"

Presenter: Jim Pisarowicz

Location: Montrose Botanical Gardens, 1800 Pavilion Dr., Montrose, CO 81401  
Time: 11:00 AM and 1:00 PM

Join Plateau chapter co-president Jim Pisarowicz on a short garden tour to share photography tips at 11:00 am and 1:00 pm. His photography also will be shown in a continuously running slideshow on the grounds.

Multiple other tours and demonstrations will be featured during this event, including plein air artists, local musicians, talks on native grasses, and tours of the new rose and sensory garden. CoNPS will also have booth at the event. The Montrose Botanical Gardens was formerly covered with sagebrush, tumbleweed, and cactus. Now it's a world-class must-visit destination in the high desert of Montrose County.

## Southeast Chapter

At our meetings, members share a meal. Please bring a food item to share.

In 2019, we reinvigorated our chapter with the commencement of monthly meetings. It's amazing what a little food and good conversation can create!

Our monthly meetings are regularly attended by 6-15 people who have amazing local knowledge and enthusiasm about our local geography and flora. This synergy gave rise to 32 events listed in the SE in 2019. Three partnerships arose that contributed to our chapter activities and regional botanical collegiality. These include Friends of Cheyenne Mountain State Park, Rocky Mountain Field Institute Citizen Science Program, and Florissant Fossil Beds National Monument.

In 2020, the Southeast Chapter will:

- Host informative botanical hikes in the southeast region;
- Gather for social learning via monthly meetings;
- Germinate native seeds and rear native plants for gardens and open space revegetation; and



One of the wildflowers featured in Curt's presentation was the birdbill dayflower (*Commelina dianthifolia*), a plant found in just seven Colorado counties.

- Partner with botanical colleagues at academic institutions, non-profit organizations, and governmental agencies.

At our February meeting, CoNPS member Curt Nimz gave an excellent slideshow of the flora of Red Rock Canyon Open Space. All are welcome at our chapter meetings. Please check out our chapter page for more information:

<https://conps.org/about-us/chapters/southeast-chapter/>

### March 11: "Native Plant Seeding"

Presenter: Various

Location: 1911 N. Tejon St., Colorado Springs.  
Time: 6:00 to 8:00 PM

Please RSVP to [ecocitycoloradosprings@gmail.com](mailto:ecocitycoloradosprings@gmail.com). Bring the seeds from the bottoms of your pockets! If you don't have any, no worries. Native seed, soil, and recycled containers will be provided. Please make a \$5 donation to cover these supplies.

### March 15: "Rocky Mountain Field Institute Citizen Science Revegetation Botany"

Presenter: Maggie Gaddis

Location: Garden of the Gods Trading Post, 324 Beckers Ln, Manitou Springs.  
Time: 10 AM to 2:00 PM

Please RSVP to [ecocitycoloradosprings@gmail.com](mailto:ecocitycoloradosprings@gmail.com). We are on our way to the American Association of Geographers conference and the High Altitude Revegetation Society for Ecological Restoration ►

◀ conference. Come hear our talk and see our poster. Then we will go for a hike to see what's emerging in the Garden.

## Southwest Chapter

### February 27: "Geology, Navajo Ethnobotany, and Rare Plants of the Four Corners Region"

Presenter: Arnold Clifford.

Location: Lyceum Room, Center of Southwest Studies, Fort Lewis College, Durango

Time: 6:30 PM

Clifford is an expert on the flora of the Navajo Nation and surrounding area and an ethnobotanist. He

started learning about plants at the age of nine from his grandmother, who taught him about the holy Navajo plant world. Western scientific botany is an extension of that learning process for Arnold. He will address plants of the San Juan basin, from low-elevation deserts to the alpine tundra, including the underlying geologic features. Arnold is a member of the Navajo tribe. He studied geology at Fort Lewis College and is a co-author of the *Flora of the Four Corners Region*. He has discovered a multitude of new plant species, and has several species named for him, such as *Aliciella cliffordii*. ☞

## CoNPS Workshops

### Introduction to Colorado Wildflowers from Plains to Peaks

March 7: 10:00 AM to 1:00 PM

Location: Ford-Warren Branch Library, Denver

Presenter: Mo Ewing

Become acquainted with the wonderful world of Colorado wildflowers and get started on developing skills to identify different species found in the Denver area. In the first section, we will discuss how plants are named and identified, review basic plant morphology, and look at the characteristics of the 13 most common plant families. After a break, we will take a virtual tour of the most common plants seen around Denver (including the foothills, montane, subalpine, and alpine) and identify some of the most wonderful places to hike and the wildflowers you are likely to find there.

Mo Ewing is a retired plant ecologist with a MS degree in conservation biology from Antioch New England, NH. He is a CoNPS board member and chairman of the conservation committee. Mo also volunteers at the Denver Botanic Gardens Herbarium and the Colorado Natural Areas Program. Previously, Mo was the land stewardship director at Colorado Open Lands, a state-wide land trust. His interests range from mapping native plant communities to developing an interactive key to the moss genera of Colorado.

### Gardening with Native Plants Series—Part 1 The Influence of Soil Properties on Successful Landscaping with Colorado Native Plants

March 14: 9:00 AM to 3:00 PM

Location: Boulder Rural Fire Protection District (Gunbarrel area)

Presenter: Jean Reeder

This workshop is designed to help homeowners understand the importance of soil properties in trying to successfully grow native plants in their landscapes. The presentation will start with a discussion of the ecological relationship between soil properties and

where native plants naturally grow. Next, we will discuss the concept of developing soil savvy: learning what you need to know about your own soil's properties before making decisions on plant selection and management (irrigation, fertilizer, amendments, etc.). The class will end with a discussion of how to use soil testing for making plant selection decisions and as a landscape management tool. Participants will practice on examples of real soil test data to interpret soil test reports and make plant selection and management decisions.

This class will be helpful to all levels of plant lovers. Please note: This workshop is a PowerPoint presentation (no field or lab work).

Jean is a PhD soil ecologist who worked 30+ years for the USDA Agricultural Research Service conducting research studies on soil properties, primarily in shortgrass steppe and mixed-grass prairie ecosystems. Since retiring, she works as a consultant to the CSU Soil Testing Lab, and as a soils instructor for the Denver Botanic Gardens, the Gardens on Spring Creek in Fort Collins, and Front Range Community College.

### Gardening with Native Plants Series—Part II Wildscaping 101—Native Plants for Birds

March 21: 1:00-3:30 PM

Location: Audubon Center at Chatfield, Littleton

Presenter: Kate Hogan

Are you passionate about native plants and want to learn more about the ecological connections between Colorado native plants and bird life? Join the presenter for an engaging and exciting workshop on ways to diversify the kinds of birds found in your neighborhood or your own backyard using a variety of food groups provided by our native plants. Participants will review the newly created Native Plants for Birds handout that was designed in partnership between Denver Audubon, CoNPS, Audubon Rockies, and CSU Extension. ►

◀ This workshop is designed for all skill levels. Participants will review some of the science behind the essential need for native plants in our landscape, and we will have Audubon volunteers who are also Native Plant Masters® and Master Gardeners to help answer in-depth questions.

Outdoor portion: The Audubon Nature Center is home to five mixed native/non-native xeriscape gardens and boasts a bird list of 278 bird species. The trails surrounding the buildings are fairly level terrain, but long pants and sturdy hiking boots are recommended.

Kate Hogan has worked in the field of ecology for more than 20 years. She holds a bachelor's degree in natural science and biology from the University of Puget Sound and a master's degree in nonprofit management from Regis University. For the last five years, Kate has worked at Denver Audubon as the community outreach coordinator, where she creates strategic partnerships that help fulfill the organization's mission to "inspire actions to protect birds, other wildlife, and their habitats through education, conservation, and research." She presents outreach programs throughout the Denver metro area and manages the Audubon Center at Chatfield, providing engaging public programs and events for visitors who desire a deeper connection to nature.

### **Gardening with Native Plants Series—Part 3 Establishing a Native Plant Landscape from Start to Finish**

May 17: 9:00 AM to 2:00 PM

Location: Jim Borland's Home, Denver

Presenter: Jim Borland

Gain some hands-on experience with planting, transplanting, seed gathering, seed sowing, pruning, mulching, watering, and fertilizing, as well as discussing terms such as "seed scarification" and "stratification. Attendees will also hear about plant and seed availability for a number of species.

This workshop is designed for beginning through advanced plant enthusiasts who wish to have some of their beliefs about native plants challenged. This is not rocket science, nor is it written in stone.

Jim Borland has been growing, studying, and writing about native plants in greenhouses, nurseries, at Denver Botanic Gardens, and home landscapes for more than 40 years.

*Workshops and field seminars are continuously being added to the CoNPS calendar, so keep an eye out on the CoNPS website and CoNPS E-News for additional programs.* 🌀

## **Learn About Colorado's Native Plants**

### **DBG Offers Certificate in Rocky Mountain Gardening**

Denver Botanic Gardens is offering a certificate program for its new Rocky Mountain Gardening program. While the program focuses on gardens and horticulture, some of the courses such as Colorado Ecosystems, can be of help to people interested in understanding native plant communities found in the state. Instructors for the program are DBG staff members, authorities in the green industry, and other regional experts in horticulture and natural sciences. Classes can be taken individually or as part of the certificate program

For more information, visit the DBG website at <https://www.botanicgardens.org/education/adult-programs/rocky-mountain-gardening>

### **HPEC Offers Workshop Series**

High Plains Environmental Center is offering four Saturday workshops: Restoring Native Open Spaces (February 22), Botany for Beginners (March 21), Landscape Design with Native Plants (April 11), and Ethnobotany (June 13). HPEC is located in Loveland. Visit <https://suburbitat.org/> for more information.

### **CSU Extension Offers Native Plant Master® Courses**



Colorado State University Extension offices around the state offer courses to develop skills in identifying native plants using family

features and a botanical key. Each course typically takes place during three half-days in the field over three-week period, with an exam at the last session. During the outdoor field sessions, participants learn common and scientific names, ecological relationships and human uses of 40 to 50 plants.

For more information, visit

<http://conativeplantmaster.colostate.edu/>

## Cross-Pollination Events



Rufous Hummingbird and Rocky Mountain bee plant (*Cleome serrulata*) © Tom Koerner/USFWS

### Audubon Rockies Offers Habitat Hero Workshops

The Habitat Hero program provides people, businesses, and cities with the resources to create bird habitats in their own communities. By planting bird-friendly gardens with native plants, not only are we creating more beautiful and water-efficient communities; we're connecting people to nature. Learn how you can conserve birds through native gardening. For more information, visit <https://rockies.audubon.org/habitat-hero>



### 14th Annual Western Landscape Symposium

March 14, 2020  
9:00 AM to 3:30 PM  
Pueblo Community College  
Pueblo, CO

Advance registration required at [www.2020WLS.eventbrite.com](http://www.2020WLS.eventbrite.com)

The Western Landscape Symposium is an educational forum to promote the creation of appealing and sustainable landscapes in southeastern Colorado, incorporating water wise garden practices and plants adapted to local climate and soil conditions.

This year's keynote address is presented by Panayoti Kelaidis "Gentle Conquest—The First Scientific Expedition to Pueblo and the Rockies." Other topics include drip irrigation, plant propagation, medical plants, buffalograss lawns, Plant Select program and plants, and creating sustainable landscapes. 🌀

## Other Events

February 20-23  
Colorado Environmental Film Festival  
<https://ceff.net/>

February 22  
High Plains Environmental Center Workshop  
<http://suburbitat.org/workshop-series-pt-1-restoring-native-open-spaces/>

February 25-27  
Colorado Plateau Native Plant Program (CPNPP) Annual Meeting  
<https://chapter.ser.org/rockymountains/event/colorado-plateau-native-plant-program-2020-annual-meeting/>

February 26-28  
Land and Water Summit  
Albuquerque, NM  
<https://landandwatersummit.org/-/I9Nytw=EjqVdeDvZzh16Sx-/>

February 29  
2020 Habitat Hero: Rethinking Wyoming Landscaping  
Cheyenne, WY  
<https://www.brownpapertickets.com/event/4463444?emci=d35caf79-8844-ea11-a1cc-00155d03b1e8&emdi=15f00324-0249-ea11-a1cc-00155d03b1e8&ceid=792270>

March 3-6  
Certified Interpretive Guide Training Course  
Littleton, CO  
[https://www.interpnet.com/nai/nai/\\_events/Event\\_Display.aspx?EventKey=CIG030320W](https://www.interpnet.com/nai/nai/_events/Event_Display.aspx?EventKey=CIG030320W)

March 20  
American Penstemon Society Special Programs  
Application deadline  
<https://penstemons.org/index.php/society/22-grants>

April 8-9  
Montana Plant Conservation Conference  
Bozeman, MT  
<https://www.mtnativeplants.org/conservation-conference/>

April 22  
Earth Day – 50<sup>th</sup> Anniversary



May 7-9  
National Meeting of the Center for Plant Conservation  
Denver, CO  
<https://saveplants.org/events/>

May 7-9  
Denver Botanic Gardens Annual Plant Sale  
<https://www.botanicgardens.org/events/special-events/spring-plant-sale>

May 15  
Endangered Species Day  
<https://www.endangered.org/campaigns/endangered-species-day/> 🌀

# CoNPS Membership

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

**CHAPTERS:** Boulder, Metro-Denver, Northern (Ft. Collins-Greeley), Plateau (Grand Junction & West Slope), 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* newsletter, published quarterly.

The 36-page, full color electronic publication arrives by PDF in member email boxes in March, 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.

- 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 newsletter, *Aquilegia*, \$20

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

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

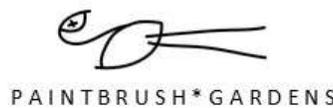
Please make check payable to:  
**Colorado Native Plant Society**

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

You may also join online at <https://conps.org/about-us/committees/join-us/>



## Thank you to our Annual Conference Sponsors!



# Can You ID these Seedheads?



**Answers** (clockwise from top left): Pasqueflower (*Anemone patens*, Ranunculaceae family), alpine avens (*Geum rossii*, Rosaceae family), western virgin's bower (*Clematis ligusticifolia*, Ranunculaceae family), mountain dryad (*Dryas octopetala*, Rosaceae family), cut-leaf anemone (*Anemone multifida*, Ranunculaceae family), prairie smoke (*Geum triflorum*, Rosaceae family). © Kelly Ambler



# Colorado Native Plant Society

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

## Save the Date!

The **2020 CoNPS Annual Conference** is September 18-20 at the American Mountaineering Center in Golden, CO. This year's theme is: "**Peaks to Prairies—Plants in a Land of Extremes**"

More details coming soon!

## Front Range Plant Sales

See page 19 for details.

## Denver Botanic Gardens EcoFlora Project and City Nature Challenge

Two citizen science initiatives slated for April will kick-off the Denver Botanic Garden's new EcoFlora Project. The program is designed to engage members of the community in protecting and preserving Denver's native plant species and assemble new observations on the City's flora to better inform policy decisions about management and conservation. The program also allows participants to have fun and enjoy the beauty of the City while contributing to a meaningful database of photographic observations. The DBG program is being modeled after a similar iNaturalist project launched by the New York Botanic Gardens. That program has already identified a new *Solidago* species and the rediscovery of two *Solidago* species not seen in more than 100 years.

CoNPS is a partner in this program. If you're interested in participating in this community science effort, contact Lenore Mitchell of the Denver Metro chapter at [zap979sar@icloud.com](mailto:zap979sar@icloud.com). She will keep interested individuals abreast of the program and its launch. It's expected that both the Denver Metro and Boulder chapters will host field trips using the iNaturalist app to document observations. DBG will also be hosting workshops on how to participate (dates to be determined).

The first EcoFlora project will coincide with the City Nature Challenge in April when the three Colorado areas (Denver plus Boulder County, Fort Collins, and Colorado Springs) will compete with more than 150 other cities to determine which city has the most citizen science nature observations. Visit <http://citynaturechallenge.org/city-list-2020/> and <https://www.wild.org/naturechallenge/> for more details.

