

Aquilegia

Newsletter of the Colorado Native Plant Society

Volume 42 No. 5 Fall 2018





This issue of *Aquilegia* features the winners of the annual photo contest. All 2018 entries were on display at the Annual Conference in September where attendees voted on their favorites.

Congratulations to all winning photographers in four categories! First place winners with photographs featured on the cover (clockwise from upper left) include Michael Aubrey (Native Plant: *Dodecatheon pulchellum*, shooting star); Bruce Tohill (Landscape: *Castilleja* spp., paintbrushes), Carol McGowan (Wildlife: American goldfinch and prairie sunflowers), and Sue Keefer (Artistic: *Asclepias* sp., milkweed seed). First place winners earned a \$50 prize.

Second place winners on this page include Vicki Ward (Native Plant: *Echinocereus triglochidiatus*, claret cup cactus) and Carol McGowan (Landscape: Ice Lake).

Botanicum absurdum by Rob Pudim



The other two second place photo contest winners are featured on the back cover and include Michael Aubrey (Wildlife: *Calochortus gunnisonii*, mariposa lily) and Laurie Paulik (Artistic: *Apocynum cannabinum*, hemp dogbane seeds). See the inside of the back cover for all third place winners. All photos are copyrighted by the photographers mentioned and used with permission.

Aquilegia: Newsletter 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

Colorado Rare Plant Symposium: The Year in Review

By Lisa Tasker

Fort Collins saw 80 botanists and members of the Rare Plant Technical Committee attend the 15th Annual Colorado Rare Plant Symposium, Friday, September 14. Each fall, this meeting of botanical minds is hosted by the Colorado Natural Heritage Program and held in conjunction with the Colorado Native Plant Society Annual Meeting. Dina Clark, collections manager at the CU Herbarium, provided herbarium specimens of northeast Colorado rare species—the emphasis of this year’s symposium—and presenters encouraged participants to share their relevant observations while learning the latest efforts to conserve Colorado’s rare plants.

A cross-section of passionate botanists, both professional and amateur, are attracted to this meeting each year due to a common interest in conservation of Colorado’s rare plants. CNHP team leader and botanist Jill Handwerk expertly started out the day with data and photos of rare species with this year’s focus on northeast Colorado. Jill later reviewed Colorado’s lengthy list of critically imperiled (G1) and federally listed plants along with current conservation efforts. CNHP senior botanist Susan Panjabi presented a new working list of plants of potential conservation interest across Colorado’s eastern plains. She is looking for feedback, including additions or deletions to the list. Contact her at susan.panjabi@colostate.edu if you’d like to review or comment on the list.



Pagosa skyrocket, *Ipomopsis polyantha*.
© Jill Handwerk

Through a demonstration on SEINet, Steve Olson, botanist for the Pike and San Isabel National Forests and Cimarron and Comanche National Grasslands, revealed some challenges and subsequent suggestions for navigating SEINet data. He discussed a project during which he analyzed the distribution of plants of the entire Pike/San Isabel/Comanche Grassland using SEINet. He investigated over 200 quads and discovered data gaps and other issues such as common species not being documented. He had a list of suggestions to consider in future SEINet queries and data entries.

Repeated this year was an afternoon review of United States Forest Service and Bureau of Land Management sensitive species led by Tyler Johnson and Carol Dawson, respectively. Changes to the USFS Sensitive Species List are underway as the Regional Forester Sensitive Species List is being phased out and a Species of Conservation Concern list will now be created. The former list contained species with a downward population trend or trend of heading towards federal listing and included species that only had to be suspected of occurring on USFS land. ►



Attendees listen as Jill Handwerk reviewed Colorado’s list of critically imperiled and federally-listed plants. © Jim Piscarowicz

◀ The new Species of Conservation Concern lists will be based on the new USFS Sensitive Species Concept and each forest entity will have its own list. To be a Species of Conservation Concern a plant must be native, known to occur on USFS land, be ranked as G1 or G2 by NatureServe, and have substantial concern regarding its persistence. Also considered, as written into the USFS manual, are four “indicators of substantial concern” including climate change, declining trend in population or habitat, restricted range (disjunct or endemic), and low population on the forest unit. Tyler stated a species does not have to have all four indicators to be considered a Species of Conservation Concern and emphasized the flexibility he sees in this new process. The existing USFS Sensitive Species List will continue to be updated for forests not currently undergoing revision to their management plans.

Carol Dawson announced plans to update the BLM Sensitive Species list with its field offices in the coming year. The Sensitive Plant Species List is one the BLM must be proactive about regarding conservation; and Carol reminded attendees that there are specific criteria for species making the list, noting it was last updated in 2015. She reviewed the status of the latest survey and monitoring data for the BLM Sensitive Species including accounts of negative data and opportunities for future research.

Botanists with the Denver Botanic Gardens provided a wonderful overview of on-going projects at the Gardens. Michelle DePrenger-Levin presented results of demographic monitoring for *Astragalus microcymbus*, *Eriogonum brandegeei*, and *Sclerocactus glaucus*. Overall trends appear stable for *Astragalus microcymbus* and *Sclerocactus glaucus*, but *Eriogonum brandegeei* appears to be in decline since 2011. Alexandra Seglias discussed the successes and pitfalls in seed collection of our rare plant species for genetic preservation.

Notable discoveries this year included *Anemone virginiana* var. *cylindroidea* (tall thimbleweed) found by Audrey Boag, with assistance from Irene Weber, on Jefferson County Open Space; and *Campanula aparinoides* (bedstraw bellflower) found on a Douglas County Open Space, by Elizabeth Taylor, Barb Harbach, and Cathy Fischer, all volunteer Colorado Native Plant Masters® conducting a botanical inventory of the site. Several new occurrences of Colorado’s federally listed and candidate species were

also reported including: *Astragalus microcymbus* (skiff milkvetch) in Gunnison County, *Sclerocactus glaucus* (Colorado hookless cactus) near Cameo on the west slope, and *Eriogonum brandegeei* (Brandeggee’s wild buckwheat) near Salida.

Attendees also reported on numerous other observations of rare plant species within the state. The finding of new populations of rare plants every year reminds us that more treasure is yet to be discovered out there on our beautiful Colorado landscapes.



***Anemone virginiana* var. *cylindroidea*, also called tall thimbleweed.**
© Audrey Boag

For more information:

All the information from this meeting as well as previous symposia is available online at the Colorado State University, Colorado Natural Heritage Program website: www.cnhp.colostate.edu.

The Rare Plant Symposium is open to anyone with an interest in the rare plants of Colorado. For more information contact Jill Handwerk at jill.handwerk@colostate.edu and check the CoNPS website (www.conps.org) for details as they become available about next year’s symposium.

Lisa Tasker is a botanist for CNHP, and works primarily on Western Slope projects. She likes to boast about being a member of CoNPS since 1992. She feels beyond fortunate to be connected to both of these amazing organizations.

*Editor’s note: The Winter issue of Aquilegia will feature a species profile and story by Elizabeth Taylor about the rediscovery of Campanula aparinoides (bedstraw bellflower) mentioned in this summary of the Rare Plant Symposium. **

Featured Story

This issue of *Aquilegia* features synopses of the annual Colorado Rare Plant Symposium and the CoNPS Annual Conference (thank you to our reporters!), as well as regular features and columns you've come to enjoy.

This issue also highlights the life and work of two members of our community: that of Dr. William A. Weber as he celebrates his 100th birthday and a member profile of Norma Grigs, one of Weber's lab assistants in the late 1940s.

We're also pleased to announce that this issue reintroduces research reports by past recipients of the CoNPS Mryna P. Steinkamp and John W. Marr annual grant funding programs. The important work of grantees' master degree, PhD, and post-doctorate studies are both thought-provoking and critical to the increased understanding of Colorado's native plants. MM

Annual Conference: Here's What You Missed

By Kelly Ambler

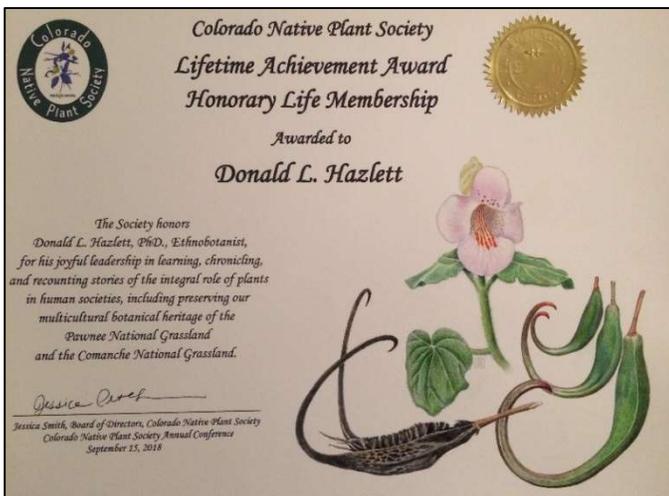
On Saturday, September 15, Northern Chapter president Hugh Mackay welcomed attendees to the 2018 CoNPS Conference. The theme "Knowledge, Advocacy, and Change" evoked graduate research projects, presentations on citizen science endeavors, discussions of novel applications of botanical sciences, and opportunities for furthering the awareness and uses of native plants. In addition, attendees learned about the current status of the Colorado Native Plant Society and plans for updating its governing strategic plan.

A special treat was the presentation of two awards. Don Hazlett was presented a lifetime achievement award (accepted on his behalf by Phil Phalen) for Don's efforts in "preserving our multicultural botanical heritage of the Pawnee National Grassland and the Comanche National Grassland." The plaque featured a beautiful botanical illustration by Carolyn Crawford of devil's claw (*Proboscidea* sp.), which is one of Don's favorite plants.

A Certificate of Appreciation was presented to Jack and Martha Carter for their generosity to CoNPS and its membership. The day ended with a panel discussion by four of the six chapter presidents, who gave us an overview of each chapter's accomplishments and challenges faced over the past year.

Many attendees also attended the Rare Plant Symposium on Friday, after which they finished the day by gathering for an informal dinner at El Burrito Restaurant.

The bookstore was open Friday and Saturday (thank you, Pat Murphy and Denise Wilson) and was an active scene at every break. There was also a highly successful silent auction, which had many desirable items donated by generous CoNPS members. The annual conference weekend was topped off by five field trips in the Fort Collins area. If you were unable to attend this year's conference, presentations and field trips are summarized on the following pages in the order they occurred at the conference. We strongly encourage all members to get the whole story by attending next year's conference. See you then! ▶



Don Hazelet's lifetime achievement award featured original artwork of devil's claw *Proboscidea* sp. by Carolyn Crawford.



Authors Jack and Martha Carter receive a certificate of appreciate from CoNPS for their generosity to the society over the years.
© Jan Gorski

What Affects Species Richness in Colorado's Alpine Tundra? A Look at Precipitation Gradients and Substrate pH

Presenter: Mike Kintgen
Reported by David Julie

Mike Kintgen described an alpine botanical study that he performed as part of his master's degree work in environmental biology from Regis University and for which he received a John Marr Research Grant from CoNPS in 2017. An earlier study by M. Ferreyra and colleagues in Nahuel Huapi National Park in the Patagonia region of Argentina found greater species diversity in drier alpine sites than in wetter alpine sites. Research in the Swiss Alps found greater species diversity in alpine substrates with a higher pH (less acidic) than in alpine substrates with a lower pH (more acidic). No comparable studies had been performed in North America.

At nine alpine locations in northern and central Colorado, Mike selected 10x10 meter study sites at 12,000 feet elevation in a fell field, dry meadow, or pseudo fell field. Fell fields occur on alpine ridges and do not receive runoff from other areas, so the vegetation must be supported by precipitation that falls onto the site. Pseudo fell fields, a new designation that Mike suggested, have similar characteristics and vegetation but do not occur on ridges. Mike randomly placed 10 square meter plots within each study site and identified and recorded all of the species of vascular plants within each plot. Mike also tabulated a species list for each of the nine study sites and gathered a total of 180 herbarium specimens from them.

Mike used 50-year average precipitation data from PRISM to estimate the annual precipitation at each site. The driest site, Guanella Pass, receives 16.7 inches annually. The wettest site, Flattop Mountain in the Mount Zirkel Wilderness, receives 76.4 inches. Mike collected substrate samples which he used to determine pH. Values ranged from 5.05 at Loveland Pass to 7.05 at Mandall Pass.

In contrast to the study in Argentina, Mike consistently found greater species diversity in wetter sites than in drier sites. As in the research in the Swiss Alps, Mike found greater species diversity in sites with a higher pH than in sites with a lower pH. Note that the sites ranged from acidic to neutral. Not one of the sites was alkaline.

The most frequently observed species were: *Minuartia obtusiloba*, *Paronychia pulvinata*, *Arenaria fendleri*, *Oreoxis alpina*, and *Trifolium dasyphyllum*. Plant families with the most observed species were Poaceae, Asteraceae, Caryophyllaceae, Fabaceae, and Cyperaceae.

You can read Mike's complete study paper at <https://epublications.regis.edu/theses/851>.

Forensic Botany

Presenters: Pam Smith and Crystal Strouse
Reported by Pat Butler

Pam Smith and Crystal Strouse described their work with "NecroSearch," an organization that helps law enforcement and private citizens find dead bodies to solve cold cases. Botany has rarely been used in law enforcement because investigators have not had the skill to identify and collect botanical evidence, but NecroSearch is pioneering this work. By identifying plants associated with a crime scene, victim, or other persons of interest, botanists can use herbarium specimens to describe distributions and help locate a region where a crime was committed or help associate plant materials with a suspect or victim.



Pam and Crystal discussed several well-known cases, some dating back as much as 100 years, that were solved in part by using botanical information. For example, the first use of any botanical evidence in a trial was the Lindberg baby kidnapping case. The kidnapers used a ladder they had constructed from four species of wood identical to boards in the kidnapper's house and that evidence was used to

convict them. The bones of a woman missing in Gunnison County in 1974 were located five years later when a botanist matched plant parts found with the victim's hair braids found near Kebler Pass. The plant parts helped investigators pinpoint the elevation, orientation, and habitat to narrow the search for her bones, which led to the conviction of the perpetrator.

In the first use of plant DNA evidence, the killer of a victim in Arizona was convicted when seed pods of a palo verde tree (*Parkinsonia* sp.) found near the victim's body were also found on the killer's truck and DNA analysis confirmed they were from the same plant. Botanical evidence is also being used to attempt to locate the remains of Russian Czar Nicholas's uncle who was killed in 1918.

Pam and Crystal concluded their informative and engaging presentation with the observation that "the best witness to a crime might just be a plant," saying that plants are reliable, credible, unbiased, and often overlooked in crime scene investigation. Kelly Ambler noted that "Crystal and Pam used humor throughout their presentation to diffuse the tension that might have been caused by the morbid matter of their subject." ►

The 2018 State of the Colorado Native Plant Society

Presenter's name: Jessica Smith
Reported by David Julie

Jessica provided a whirlwind summary of CoNPS initiatives, activities, and accomplishments. The Society now has 1100 members, up 24% in the last three years. Jessica cited three highly-productive employees for that increase: Linda Smith, Jennifer Boussetot, and Lauren Kurtz. She also thanked the talented volunteer staff of *Aquilegia* newsletter including Mary Menz, Kelly Ambler, Nan Daniels, and Rob Pudim.

During 2018, the society offered 21 programs, 60 field trips, and 9 workshops. With partners the High Plains Environmental Center and Harlequin's Gardens, the society held plant sales in the spring and fall. The Northern Chapter partnered with Audubon Rockies to host a garden tour. The Metro-Denver and Boulder Chapters also held garden tours. The Plateau and Metro-Denver Chapters each organized special chapter celebrations. Thanks to Pat Murphy, book sales contribute significantly to CoNPS revenue and to everyone's knowledge and enjoyment.

Jessica reviewed the accomplishments of each of the committees, including two new initiatives by the horticulture committee. BethAnne Bane launched a CoNPS certification program for native plant gardens and Ann Grant and Linda Smith launched a program for gardeners to report their experiences with native plants in gardens.

In 2018, CoNPS awarded two Myrna P. Steinkamp grants and seven John W. Marr grants for research on Colorado native plants. Mission grants funded student prizes at a regional science fair, establishment of a native plant and environmental concerns club at Legend High School, and printing of a *Colorado Reader* issue that focuses on native plants.

Jack and Martha Carter donated to CoNPS the right to publish the 3rd edition of *Common Southwestern Native Plants*, which they wrote with Donna Stevens and Jennifer Boussetot. The Terra Foundation generously paid to print 3000 copies. The Carters also donated approximately 1000 copies of their *Trees and Shrubs of Colorado* book to the Society.

The board updated the CoNPS bylaws to allow officer positions, like president, to be performed by an operating committee rather than by one individual. The members of the operating committee expressed gratitude for Jessica's outstanding leadership.

Crop Wild Relatives: A Colorado Perspective

Presenter: Stephanie Greene
Reported by K. Lynn Beckrich

Stephanie Greene's talk "Crop Wild Relatives: A Colorado Perspective" brought local insight to a global issue: how we can increase genetic diversity in domesticated crops that have lost genetic diversity through selective breeding for specific traits. Increasing genetic diversity is essential to expanding the range of climates and soil types tolerable to domesticated plants as well as improving crop resilience to pests, pathogens, and climate change in pre-existing agricultural landscapes.

Fortunately, wild varieties of domesticated crops, or crop wild relatives, can still be found in many parts of the world, often growing comfortably in more varied and extreme environments than their domesticated relatives with whom they may still interbreed. An inventory published in 2013 by a team of researchers, including Greene, identified 4600 crop wild relatives in the US. alone, 250 of which are particularly valuable to agricultural research for their ability to readily hybridize with domesticated berries, stone fruits,

grains, and squashes. Colorado alone has ten families of plants which can hybridize relatively easily with their domesticated cousins.

While controlled breeding of CWRs with their domesticated relatives

offers an organic method to increase genetic diversity, sequencing of CWR genomes also offers the potential to more directly develop specific traits relating to pest or climate resilience or even nutritional quality through the use of modern gene-editing tools. However, documentation and conservation of CWRs is overdue and, on a global level, many wild varieties of domesticated crops are threatened or even extinct in the wild because of land conversion for development, farming, and changing climates.

To counteract these threats, Greene calls for comprehensive conservation by preserving species' natural habitat, storing specimens in gene banks, and creating collaborative inventories and genetic databases for researchers. Find more information on CWRs at <https://crops.org/crop-wild-relative>.

Colin K. Khoury, Stephanie Greene, John Wiersema, Nigel Maxted, Andy Jarvis, and Paul C. Struik. 2013. An Inventory of Crop Wild Relatives of the United States. *Crop Science* 53:1496–1508. ►

Fortunately, wild varieties of domesticated crops, or crop wild relatives, can still be found in many parts of the world. . . .

Strategic Planning

Presenter's name: Ann M. Grant

Reported by David Julie

Board members Ann Grant and Christina Alba, Boulder Chapter president Erica Cooper, and CoNPS administrative coordinator Linda Smith volunteered in 2017 to update the CoNPS strategic plan.

Their objectives included:

- Making the plan's goals current;
- Assigning implementation responsibilities for goals to board members, committees, and chapters; and
- Periodically assessing progress in achieving goals.

The strategic plan group uses the CoNPS mission statement as the foundation for formulating goals and strategies for achieving the goals. Its goals include:

- Supporting the growth of new scientific knowledge;
- Sharing scientific knowledge to generate appreciation of native plants and habitats;
- Supporting conservation of native plants and habitats; and
- Fostering organizational sustainability.

Additions to existing CoNPS strategies and actions include:

- Further publicizing research findings by recipients of Marr, Steinkamp, and mission grants;
- Undertaking a new scientific focus such as plant and pollinator interrelationships and phenology;
- Championing for-credit and continuing education classes about native plants;
- Collaborating with other organizations in conservation advocacy;
- Facilitating communication among chapters and between the board, committees, and chapters; and
- Investigating the feasibility of hiring an executive director for CoNPS.

Ann provided a printed copy of her slides to each attendee.

Botany and Citizen Science

Presenter: Jennifer Ackerfield

Reported by Pat Butler

Jennifer Ackerfield described the increasingly popular use of "citizen scientists," wherein non-expert members of the public gather data and record information to contribute to scientific research. For example, astronomy projects by laypeople have helped scientists to categorize new galaxies.

Her personal citizen science project, "Team Thistle," enlisted more than 15 Coloradans who collected about 70 samples of thistles growing above 11,000 feet for her research to determine how many species of "Rocky Mountain Thistle" actually exist. Her project allows volunteers to post their collection and observation data on the iNaturalist website, which also provides users opportunities to report observations on a range of flora and fauna. She mentioned several other websites available to view or



contribute botanical observations: Notes from Nature (created by herbaria), Smithsonian (transcribing historical field notes), Field Museum, Xerces Society, Nature's Notebook, and Project Budburst. The latter two track phenology and flowering times.

Jennifer will analyze the genetics of her specimens early next year under a fellowship at the Smithsonian Institution in Washington, DC. Currently, she thinks there are at least four species arising from distinct parental lines as opposed to the prevailing theory that these different plants are variants that have radiated from one central progenitor, *Cirsium scopulorum*. Two (*C. hesperium* and *C. eriocephalum*) have been described as varieties of *Cirsium eatonii*, but two others, one from southern Colorado and one from the Mosquito Range, have not yet been described. To the extent that these high altitude species are genetically different but appear similar, she suspects there has been morphological convergence due to habitat and weather similarities at high altitude—a question she hopes to explore further in her research.

Botany and Ecocities: Increasing Ecosystem Services in Our Urban Greenspaces

Presenter: Maggie Gaddis

Reported by Nan H. Daniels

Maggie Gaddis is completing her PhD research at the University of the Rockies while currently teaching biology at two universities and operating her business Ecocity Partners to provide landscape education, restoration, gardening, and research services in both wild and home landscapes. Converging ideas from gardening and her earlier ecological restoration discovery that non-native species threaten biodiversity, she described her Ecocity work in Colorado Springs to show how citizen scientists can restore landscapes for ecosystem and habitat health by gathering seed; by collecting scientific data to monitor ecological parameters in public lands, such as urban forests, and gardens; and by teaching the community about sustainable gardening and living practices.

Key to her approach are the convictions that plants perform ecosystem services such as anchoring soil, preventing erosion, and holding water in the rooting zone. Additionally, microscale brownfields in the home yard and community areas can be improved with appropriate plantings. ►

◀ Maggie's suggestions for growing native plants on a home property include selecting natives for pollination by native pollinators, genetic preservation, and native edibles such as quinoa and amaranth. She stresses starting seed from verified native plants. In a typical city or suburban yard, one can find room to start natives in a small unused spot, perhaps in the back yard. In time, one backyard can develop to produce annual and perennial veggies, fruits, grains, as well as sustain nine chickens, two beehives, and alpines for a rock garden! In economical, low water native gardens, mulch reduces water loss, controls weeds, and maintains a lower soil temperature. Native grass species require very little water and provide appropriate forage for native birds and invertebrates, so say hello to buffalo grass sod from plugs. In the Q&A period, the answer to when to seed native plants was just before a good early snowfall!

For additional information on Maggie's research in ecological restoration and citizen science and her work with such organizations as Rocky Mountain Field Institute, see her website: <https://ecocity.partners>.

A Gunnison County Floristic Inventory

Presenter: Madeline Maher
Reported by Ann M. Grant

Maddie Maher spoke on the topic of her master's thesis. Through connections with Jennifer Ackerfield, Maddie was able to spend two summers performing a floristic inventory of 3000 acres of private land, a former ranch owned by the Maurer family in Gunnison County. Also surveyed were about 1850 acres of adjacent BLM land with a grazing easement. The general area contains the Cimarron Fault and has volcanic substrates. The area ranged in elevation from 8,250 to 10,000 feet. Previous work in the area had been done by Melanie Arnett in 1999, but only one of Maddie's 41 survey areas duplicated Melanie's work. Habitats surveyed included marsh, sagebrush meadows, dry mesa, grassland, talus slope, spruce-fir forest, and riparian areas. Sites ranged over 5000



Pyrola picta © Maddie Maher

acres, from 8800-10,000+ feet in the submontane to subalpine zones.

She made 605 collections, and the final species checklist for the area represents 10% of Colorado's floristic diversity. Some highlights ranged from bracken ferns over her head to a tiny *Selaginella* discovered later in a photograph. Maddie presented examples of *Artemisia tridentata* ssp. *vaseyana*, which can be identified back in the lab as it fluoresces under UV light.

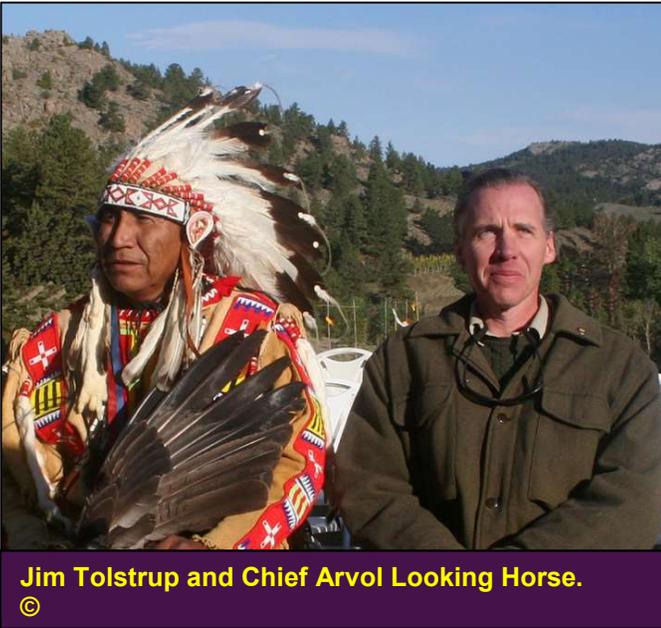
Four state-rare species were collected, *Pyrola picta*, *Iliamna rivularis*, *Draba rectifruca*, and *Trifolium kingii*, as well as two county firsts (*Pyrola picta* and *Trifolium kingii*) and 30 plant communities of conservation concern, including riparian willow carrs, sedge-dominated communities, and swamp forests. She ended her presentation by enumerating threats to that area, including climate change with accompanying insects and noxious weeds.

Pejuta Ki Le – Native Plants Through the Lens of Lakota Culture

Presenter: Jim Tolstrup
Reported Nan H. Daniels

Drawing on 40 years of native plant experience, including his current role as executive director for High Plains Environmental Center in Loveland, Jim Tolstrup presented a view of native plants from an indigenous perspective and shared information about the uses of plants for food, ceremony, and medicine. Jim is a founder and past president of Cankatola Ti Ospaye, a nonprofit that provides material assistance to Lakota elders. In his studies, Jim was adopted by a Lakota family and has particularly studied the Lakota culture as given by a famous healer and holy man, Black Elk (1863-1950). During the presentation, Jim read Black Elk's famous first vision, when as an ill 9-year-old he came to see the total connectivity of the universe. For more information, see *Black Elk Speaks* (as told to John G. Neihardt), Bison Books, 2004 (originally published in 1932).

With the backdrop of the Medicine Wheel at the developing HPEC Plains Ethnobotany Garden, Jim opened by reading a sacred song, noting that in Lakota, language and culture are co-defined in a world view. Jim studied Lakota names, which come from a strong and persistent traditional culture, with an overarching ethic of respecting plants and animals and good documentation (although some plants have been misidentified by non-Native botanists). The Lakota have had strong ties to Colorado and Larimer County. Many Lakota plant names are taken from the seasons, connected with astrological positions of the moon, signaling time for specific rituals and plant use, and the seasonal winds. While noting the iconic Pte (the bison, *Bison bison*), a major source for food, ►



Jim Tolstrup and Chief Arvol Looking Horse.
©

◀ tools, and shelter, Jim gave as a major plant food the Timpisila (*Psoralea esculenta*), a prairie turnip, which is dug young, then braided and dried. He listed several dozen other plants and their uses as food, pot herbs, tea, digestion, for smoking, hygiene, fevers/colds, women's illnesses, paints and dyes, construction materials, and thread and fibers for weaving. Plants are thus used for food, daily use items, ceremony, and medicine. In the healing cycle, it is tradition to contemplate in one's heart the prayer to conserve them.

Going Political for What You Believe In

Presenter: Denise Wilson
Reported by Kelly Ambler

Denise Wilson provided attendees with an update on the Botany Bill and other ways members can help plant conservation efforts. Various versions of the Botany Bill have been introduced into the US Congress over the years, but have not yet been passed. The current versions are HR1054 in the House and S3240 in the Senate. "These bills are not going to go away," said Wilson.

The Botany Bill is designed to improve plant conservation by combating "plant blindness" in the following ways:

- Hire more botanists at all levels of the federal government and ensure that vacancies get filled;
- Provide funds to forgive education loans for botany-related degrees;
- Require the use of native plants for Department of Interior and Department of Transportation projects;
- Ensure that plants are included in all government-sponsored conservation projects; and
- Provide funds for US Fish & Wildlife grants for plant conservation.

What can you do?

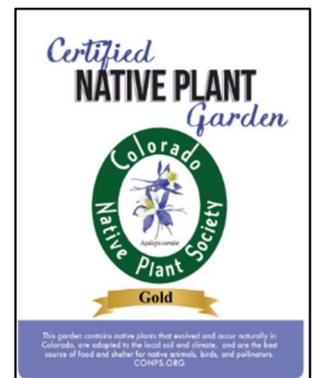
- Vote!
- Write to your congressional representatives and include information about who you are, what you do, and why plant-related matters are important to you;
- Educate family, peers, and others about "plant blindness;" and
- Volunteer with organizations such as Denver Botanic Gardens, Colorado Natural Heritage Program, and city or county open spaces, as well as national organizations like the Nature Conservancy and others.

CoNPS Certified Native Plant Garden

Presenter: BethAnne Bane
Reported by Kelly Ambler

BethAnne Bane described the launch of a new CoNPS program: certification of landscaping as a "Native Plant Garden." This program will be available to both members and non-members. A garden can be certified at the bronze, silver, or gold level. The bronze level has the least number of requirements for certification, whereas the gold level has the most stringent requirements. Details on the exact requirements will be posted on the CoNPS website soon.

Certification will include a metal 9x12 inch plaque that can be displayed in a garden. A nominal fee will be required with the application to fund the appropriate program level plaque. BethAnne said an entire property does not need to have native plants to qualify.



Why certify a garden?

- Many members already qualify for one of the certification levels; and
- Advertising the use of native plants helps raise awareness of the benefit of using native plants in landscaping projects.

Why CoNPS Certification?

- This certification program will differ from other certifications such as those sponsored by Audubon or National Wildlife Federation;
- The level of certification can change if a garden or landscaping improves to meet higher criteria of the next level; and
- Photos of a garden may be featured in *Aquilegia* or on the CoNPS website.

In conclusion, BethAnne encouraged members to become application reviewers or to join the committee for this new program. Be the first on your block to have a CoNPS certified native plant garden! ✨

Sunday Field Trips Were Highlights of the Weekend's Events

Devil's Backbone

Leader: Laurie Paulik

Reported by Laurie Paulik

Every footstep kicked up swells of dusty, red soil as we started our trek at Larimer County's Devil's Backbone Open Space. Our small group left the parking lot at 7:30 am on a day like most have been this summer: hot and dry. We were quickly within view of the Devil's Backbone, a remnant of vertically tilted Dakota sandstone, as it stood strong and stark against the crystal blue sky. The Backbone remained visible from most of the trail and good views were afforded as we climbed the gently sloping hills.

It is the time of year when asters, grasses, and chenopods rule this local foothills trail, mixing native and invasive species in a shrubland/grassland dominated overhead by mountain mahogany (*Cercocarpus montanus*), three-leaf sumac (*Rhus trilobata*), wax currant (*Ribes cereum*), and rabbitbrush (*Ericameria nauseosa*). Because the trail is heavily used year-round, invasive species also abound and tumbleweed (*Salsola tragus*), *Kochia scoparia*, pigweeds (*Amaranthus* spp.), and ragweeds (*Ambrosia* spp.) had muscled themselves onto the edges of the path, often obscuring the natives.

The herbaceous understory included a sea of skeletonized alyssum, smooth brome, and cheatgrasses, small bunches of curled blue grama (*Bouteloua gracilis*), fruiting yuccas (*Yucca glauca*), prickly pear cactus, and the stiff stalks of side-oats grama (*Bouteloua curtipendula*), wheatgrasses (*Elymus* spp.) and needle-and-thread grasses (*Hesperostipa* spp.).



Field trip attendees pose in front of the Devil's Backbone Open Space interpretive sign.
© Laurie Paulik

As we rounded the first turn we saw fading gayfeather (*Liatris punctata*) with a few splotches of purple and pink still visible and the occasional *Heterotheca* sp. What was a hillside dotted with brilliant yellow mounds of snakeweed in summer, *Gutierrezia sarothrae*, is now a mustard-brown landscape. Four *Artemisia* spp., i.e., *A. frigida*, *A. campestris*, *A. ludoviciana*, and especially *A. dracuncululus*, were interspersed with the snakeweed, as were the tangled furry tongues of winterfat (*Krascheninnikovia lanata*) and the airy jumbles of *Eriogonum effusum*.

A short path allowed us a peek over to the west side of the Backbone to view the far mountains before we continued on to the Keyhole—a main feature (yet another “hole” in the rock). As we descended the trail and turned to the north, we saw a nice stand of *Symphyotrichum falcatum* and *S. ericoides* (prairie aster). In a small drainage (usually the only visible water along the trail) were several *Lobelia siphilitica* plants—very uncommon and starkly blue and lush compared to the dried hillsides nearby.

At the Hunter's Loop junction, we backtracked to where the lower trail of the Wild Loop carries hikers back to the trailhead. To the east we saw the waste piles (now small hills) left from the gypsum mining. We saw little flora except for *Psoralea tenuiflorum*, several tansy asters (*Dieteria bigelovii*), *Helianthus petiolaris*, and *H. pumilus*. Shade was provided by *Populus tremuloides*, *Acer negundo*, and *Prunus americana*. At the far south end of the trail we saw the remains of the old factory that produced bricks from the fire clay discovered by Alfred Wild.

On our return via car we saw large stems of *Andropogon gerardii*, which contrasted with the smaller *Schizachyrium scoparium* seen along the trail.

Lory State Park (Substitute for Hewlett Gulch)

Leader: Jennifer Ackerfield

Reported by Sue Dingwell

Often the most interesting things you learn on a field trip are not at all what you expected to learn, and this was certainly true of the Hewlett Gulch field trip at this year's meeting. On the day before the event, a nearby fire caused Hewlett Gulch to be closed. Our intrepid conference planners quickly rose to the challenge and went on a scouting reconnaissance for a suitable replacement. Lory State Park proved a worthy substitute with the advantage of being near the conference center. New to Colorado, I selected this trip thinking that spending time with the author of the *Flora of Colorado* might be a good investment in plant ID skills. That proved to be true. ►



Attendees of the Lory State Park field trip take a closer look at the rabbitbrush (*Chrysothamnus sp.*) in full bloom. © Sue Dingwell

◀ Lory State Park is 2,492 acres in the foothills adjacent to Horsetooth Reservoir. It features a variety of rock formations with some exposed sedimentary layers carved by streams into steep canyons. “Follow the geology,” said Jennifer, “if you want to find rare plants.” We did follow the geology, wandering up a narrow gulch that delivered a plentiful reward of plants, some still blooming, some with seed heads present, and many that inspired discussion and debate.

Jennifer’s relaxed style of sharing, combined with her deep knowledge, meant there was new information for both the advanced plant ecologists and the less experienced among us. We started and ended the walk with our heads literally stuck in clumps of rabbitbrush (*Chrysothamnus sp.*), which was in splendiferous bloom and attracting pollinators like a super magnet. Newbies were encouraged to enjoy the fragrance and the entomologists present provided help with insect ID. A huge bee turned out to be one of our natives, a *Bombus huntii* queen, designated survivor of winter, and utilizing rabbitbrush to stoke fuel reserves she would need to start a new colony in the spring.

A variety of fall fruits dangling from overhead branches in the gulch gave the opportunity for a few taste tests. Golden currants, American plums, grapes, and ground cherries were among the sampled native bounty. Delicious when ripe, ground cherry, (*Physalis hispida*), belongs to the nightshade family Solanacea. In an interesting aside, Jennifer mentioned hearing from a Florida citrus grower that he was considering ground cherry as a possible replacement crop for oranges, which are currently under serious threat from an unstoppable virus known as greening.

Goldenrods, asters, snakeweed, and liatris were all still sporting a few blooms. Seed heads of milkweed, clematis, meadow-rue, and ninebark added architectural interest. We noted the less common

cactus variety of *Opuntia*, *O. polyacantha*, with its needles more closely spaced than the *O. macrorhiza* species. A small sampling of a big trip; just one more benefit of attending the CoNPS annual meeting!

Landscaping with Native Plants

Leaders: Ann Grant and Jim Tolstrup
Reported by Ariana Gloria

This fieldtrip was a tour of two native plant gardens, one in Fort Collins (at the Nix Native Plant Garden) and one in Loveland (at the High Plains Environmental Center). Ann Grant, master naturalist with the City of Fort Collins and a Colorado Native Plant Master, led the tour at the Nix Native Plant Garden.

Ann provided to all attendees a plant species list that served as a great reference during the tour. Ann introduced each plant and provided interesting tidbits about it, as well as information related to its availability and use in native plant gardening. Most everyone had a favorite plant in that garden, and it was amazing to see such variety in plant size and shape, flower and leaf color, and pollinators this time of year. At the end of summer, there were some beautiful shrubs and forbs that had seeds ready to harvest for later planting. With permission to harvest, we did.



Ann Grant led a tour of the City of Fort Collins Nix Native Plant Garden before attendees headed to the High Plains Environmental Center in Loveland. © Ariana Gloria

Next, we all went over to the High Plains Environmental Center in Loveland to learn from its director, Jim Tolstrup, about landscaping with native plants in different challenging places. Jim gave attendees a historic overview of the center and its significance to the community in inspiring environmental consciousness and ethic. The center’s mission is building and nurturing a relationship among its surrounding homeowners, developers, and all the different ecosystems there by way of community engagement and education. From Jim, we learned about the barn owls that are on site for the purpose of life-cycle observations, the demonstration garden, ►



Fall-blooming sunflowers were a highlight at the High Plains Environmental Center. © Ariana Gloria

◀ the ethnobotanical garden (used as a pow-wow area for schools), the “woods” area where kids can just be kids in nature without constraint, the community garden plots, and the bee hives that are kept on site.

I attended this field trip out of my love for plants and so did my Dad, but he was more interested in learning specifically about how to change our Kentucky bluegrass lawn back home into a native plant garden. He and I came away with a lot of inspiration, knowledge, and encouragement about landscaping with native plants.

Red Mountain Open Space

Leader: Ronda Koski

Reported by Jan Gorski

Eleven intrepid attendees chose the field trip to the Red Mountain Open Space near Wellington. Leader Ronda Koski scurried around trying to herd all the “cats” so we could get on the road to the hike.



Field trip attendees pose for a photo at Red Mountain Open Space. © Jan Gorski

Carpools were arranged, and one car was left at a local school near RMOS, where a yard sale and quilt show were just setting up. A few yard sale gems were found and donations to the community were made.

A short ride to the RMOS parking lot from the Buckeye school revealed the beauty of the area. Red cliffs with amazing geology and wide open spaces abound. The group gathered at the trailhead to Bent Rock and after a little botanizing in the parking lot, we headed up the trail. There was a lot of *Krascheninnikovia lanata* (winterfat) in fruit which is very valuable to the livestock. Several stream crossings yielded many aquatic species.

Not much was blooming, but Ronda was well versed in the plants of the area. The temperature was warm, and the wind was welcome. It is interesting to note that RMOS abuts the Soapstone Prairie Natural Area, which is rich with archaeological history. The group saw approximately 25 different native plant species. One of interest to many of us was the night-blooming *Mentzelia multiflora*. On the drive back to Fort Collins the group was lucky to see a large bull elk traipsing across the meadows.

Soapstone Prairie Natural Area

Leader: Crystal Strouse

Reported by Kelly Ambler

Crystal Strouse, a botanist with the City of Fort Collins Natural Areas, led the field trip to an area of the Soapstone Prairie Natural Area that is not usually open to the public. Also present was City of Fort Collins Natural Areas Wildlife Biologist Aran Meyer. This area contains rare plants, rare plant communities, and animals and birds not commonly found throughout the rest of the state. There are also many sites of significant cultural value. A place that many of us may know is the Lindenmeier Archaeological Site, where some of the first solid scientific data was found showing human presence in North America dating back more than 10,000 years ago.

One of the rare plant communities we passed through on the drive in was dominated by four-winged saltbrush (*Atriplex canescens*) and blue grama (*Bouteloua gracilis*). Part of the value of this open space is the relatively low occurrence of noxious weeds.

After entering the off-limits portion of the Prairie, we parked at the mouth of Cedar Canyon and continued on foot. A highlight of the trip was being able to add a new plant species to Crystal’s list, namely, *Aliciella pinnatifida*, or sticky gilia. Specimens ranged from 6” to almost 2 feet, and its small white blossoms were at the end of spreading branches. A distinctive feature was the presence of prominent blue anthers. ►



Hairstreak butterfly on *Penstemon virgatus* var. *asa-grayii*. © Kelly Ambler

◀ As indicated by its name, the leaves were quite feathery in appearance.

While most plants were going into dormancy, several plants were still flowering, such as *Penstemon virgatus* var. *asa-grayii*, the color vibrant against the surrounding gravel. Other flowering plants included *Ericameria nauseosa* (rabbitbrush), *Eriogonum brevicaulis* var. *brevicaule* (shortstem buckwheat), *Gutierrezia sarothrae* (broom snakeweed), *Liatris punctata*, *Polanisia dodecandra* (clammyweed), and *Senecio spartioides* (broom ragwort). Blazingstar plants (*Mentzelia nuda*) were covered with their characteristic seed pods, but also several flower buds waiting to open in the late afternoon. Scorpion weed (*Phacelia* sp.) was past bloom, but plenty of the interesting dried inflorescence coils were present. It was evident that gumweed (*Grindelia squarrosa*) had also bloomed prolifically earlier in the season.

Our trip ended just as the canyon started to narrow and a small rivulet of water rose up from the sand before disappearing back into the sand after several meters. Much to our surprise, we found willowherb (*Epilobium*), speedwell (*Veronica*), and stinging nettle (*Urtica dioica*) at this site.

We were also lucky enough to see several interesting animals making the ecosystem feel more complete: bison (a genetically pure stock that was re-introduced to this Natural Area), a golden eagle flying low, a harrier hawk, ravens, several pronghorn antelope, mule deer, and several birds identified by ear. ✨

Hide and Seek of Seasons

by Arthur Clifford

The season now rests quiet
its head laid down in rust
The tongue of heat it spoke with
lies dry in Autumn's dust
The swimming hole is silent
no children there at play
The winding dream of Winter
stalks fields of mounded hay
And soon the yellow Aspen
will fade to clouded grey
The twilight arrives early
as Summer slips away
Hummingbirds now quickly
fly to places South
When Winter stirs in slumber
and opens up her mouth
The final breath of Summer
held now in shadows long
Plays hide and seek with Autumn...
Till Winter sings her song.

Arthur Clifford is a member of the Metro-Denver chapter. As a child, he spent many hours with grandparents who gave him a sense of home and of nature in the florist shop and greenhouse on their farm. He and his wife of thirty-five years live on a small acreage west of Sedalia, where he germinates Colorado native plants in his greenhouse.

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Aspen leaf. © Kelly Ambler, Pennsylvania Mountain, October 2018

Featured Story

Appreciating 100 Years of a Remarkable Life William A. Weber and the People Who Influenced Him

by Jan Loechell Turner

Dr. William A. Weber is a Colorado legend. He is professor emeritus of University of Colorado Boulder and former curator of the University of Colorado Museum Herbarium. He is an expert on lichens, bryophytes, and the flora of Colorado. He is also a fellow of the Linnean Society of London and is the recipient of a number of awards and honors. His publications are numerous and, in Colorado, he is probably best known for his classic field guides *Colorado Flora: Eastern Slope*, fourth edition (2012) and *Colorado Flora: Western Slope*, fourth edition (2012), both co-authored with Ronald C. Wittmann.

Bill Weber celebrates his 100th birthday in November. In September, I interviewed him to learn what he is thinking about after almost 100 years of life and 65+ years of botanical experience. When I arrived at his apartment, I found him working on a crossword puzzle. We walked to the backyard of the retirement community where he lives and sat next to a peaceful pond filled with water lilies. Bill wanted to talk about a couple of the people who influenced him early in his life. He is still a lively conversationalist.

Bill has lived a charmed life. He seemed to be at the right place at the right time to make the most remarkable connections with famous scientists. He feels very lucky that there were so many incredible people who influenced him. Often, it took a length of time to have links from the past appear in the present.

Two especially important influences in his life were his cousin "Brownie" (entomologist F. Brown Martin) and R.S. Williams, a collector of lichens, mosses, and

vascular plants and a New York birder. Recently, Bill discovered an interesting link between his mentor Mr. Williams and Dr. Toby Spribille, a young friend who recently made a revolutionary discovery in the field of lichenology. Another strange link to the past occurred this year when Bill received a bryology award named after "the mean old woman" Elizabeth Britton who chased him out of the New York Botanical Garden when he was a youngster.

Brownie and his Microscope

William "Bill" Alfred Weber was born November 16, 1918 in New York City. He was the son of a reserved pharmacist who didn't communicate much with his son. As a young boy in the Bronx, Bill spent much time inside the fourth floor apartment where his family lived. He had an enlarged heart and a systolic murmur, thus he was not allowed to participate in the strenuous activities that most children enjoyed. Instead, he played inside with Lincoln logs and toy soldiers. His family owned *The Book of Knowledge*, which was something like an encyclopedia but also contained games, puzzles, and pictures, and Bill spent many hours reading the set of books.

Always a collector, Bill walked on the sidewalk and collected bands from cigars that he would paste in a black notebook. Few people owned cars when Bill was young, but when Bill did see a car, he would note the color and state of the license plate on his list. During his childhood, the streets of the Bronx were always active and moving, alive with people calling out the name of the products they were selling. ►



Bill Weber, the early years. Photos used by permission of the William A. Weber website williamaweber.com

◀ The Weber's apartment was just a couple of blocks from Bronx Park and the New York Botanical Garden.

When Bill was four years old, his teenage cousin "Brownie" (F. Martin Brown, 1903-1993) came over with a single-tube German microscope and taught him to raise microorganisms in water and view them with the microscope. Bill said that Brownie didn't graduate from college because he was too bright for that. Actually, Brownie attended Columbia University for three years and left to accept a job as assistant in entomology at the American Museum of Natural History in New York.

Bill spent much time at the Brown's house, where the walls were filled with nature magazines. The family learned how to bind magazines and bound their volumes of *National Geographic*. Brownie was interested in butterflies and knew people at the Bronx Zoo and the American Natural History Museum. He was one of the people who inspired Bill to become a naturalist.

Brownie was married when he was in New York and taught at a private school in Connecticut before he was recruited to teach at the Fountain Valley School District in Colorado. He spent the rest of his career in Colorado Springs, where he was a well-known entomologist. Little did the young Bill Weber know that he would also spend much of his life living and working in Colorado.

Mr. Williams and the Birds

In Bronx Park, a couple of gentlemen would walk through the park early in the morning carrying opera glasses. One of them, renowned plant collector R.S. Williams, would let Bill use his binoculars through which Bill saw his first (and last) prothonotary warbler, a yellow bird with grey wings and tail. Thus, through the influence of Mr. Williams, Bill became a birder and his desire to become a naturalist grew even stronger. Bill founded a birding club called Sialis with some of the other younger birders. The name of the club was a play on words. *Sialia sialis* is the scientific name for



William Weber (second from left) poses with other members of the Sialis Bird Club, a group he founded in New York City in the 1930s.
© W.A. Weber collection

the Eastern Bluebird but Bill pointed out that it also sounds like the German "Sehe alles," a play on words meaning "I see everything." Influenced by Williams, Bill wanted to attend Cornell University because of its ornithology program, but during the Great Depression Bill could not afford to attend.

A Plant Encounter with Elizabeth Britton

One day, while going through the New York Botanical Garden, Bill picked a skunk cabbage leaf to take to school for show and tell. A woman with a long, fancy dress and parasol rushed up to him and reprimanded him for picking the leaf. She was a terrifying woman and he never saw her again, but later learned that she was Elizabeth Gertrude (Knight) Britton, a noted bryologist and the wife of Nathaniel Lord Britton, the co-founder and director of the New York Botanical Garden and author or co-author of numerous books and publications including *The Illustrated Flora of the Northern United States, Canada, and the British Possessions*.

Eventually, Bill's father went broke, so the family moved to Manhattan, where they had relatives who could help them. Their next-door neighbor worked at the American Museum of Natural History, which was across the street from their apartment. On Saturdays, she would take Bill with her to the museum and he would observe specimens being mounted. She was the editor of *Novitates*, a publication of the American Natural History Museum.

Bill was also introduced to the Latin language by his older sister, who would walk through the apartment memorizing Latin. After listening to his sister repeating Cicero's oration in Latin, Bill memorized it. He could repeat it in Latin, but he never learned what it said until recently.

Coming Full Circle: Surprising Connections

Not too many years ago, Bill received a request from a young man who wanted him to identify some lichens and mosses he had collected in Montana. That collector was Toby Spribille, the only child of a German family who first settled in Fort Collins and then moved to Montana. Toby eventually returned to Europe and earned a PhD in lichenology at the University of Graz, Austria, in 2011.

In 2016, Bill learned that Toby Spribille received the Aino Henssen Award from the International Association for Lichenology. It is awarded to early researchers no more than five years after receiving their doctorate degrees. According to the Henssen Award Committee, Toby received it for the "number, impact, and breadth of his publications" (Schmitt, p.7) since receiving his PhD in 2011. Toby made the news in 2016 when he, as a postdoctoral student in the McCutcheon Lab at the University of Montana ▶

◀ with a team of biologists, discovered that many common macrolichens are composed of not just two symbiotic partners—a photosynthetic partner (algae or cyanobacteria) and a single fungus (usually an ascomycete)—but there can be a third partner, specific basidiomycete yeasts that live in the cortex of the macrolichen (Spribille *et al.* 2016 *Science*. 353:488-92).

After learning of Toby's award, Bill contacted him to congratulate him and learned something quite amazing. Toby had been inspired to go into lichenology by papers he read at a library in Montana by R. S. (Robert Statham) Williams—the very the same Williams who loaned Bill the binoculars at the Bronx Park and encouraged him to become a birder and naturalist. Williams was a research assistant in bryology at the NYBG and had spent earlier years collecting plants, lichens, and mosses in Montana. Bill felt that somehow the circle had been completed. Both he and Toby were influenced by the same man.

Weber's Notebooks Come Home

As a young birder in New York, Bill kept detailed notes on all the birds he observed. After Bill was married, he learned that Cornell University was building a collection about the beginning of bird watching in New York City and they asked people to send them their birding notebooks. Bill obliged and sent his notebooks to Cornell and assumed he would never see them again. He later learned that the project at Cornell had been scrapped. Just a couple of years ago, he received a letter from a fellow who had retired from the University of Connecticut and was writing about birding in New York at that time. Miraculously, he sent Bill's notebooks back to him!

The Naturalist Exhibit at Norlin Library

In 2014, Weber was named a "CU Legend" by the University of Colorado Libraries. An exhibit was displayed in the Science Library within Norlin Library called "The Naturalist: Honoring the Life and Work of William A. Weber." Over three large walls, posters with photos and text illustrate Weber's life, showing the evolution of the young boy—who enjoyed collecting and categorizing and who was fascinated by nature and science—into the naturalist, botanist, and scholar he became. "The Naturalist" is still on exhibit in Norlin Library.

Weber Thrice Honored

This year, in addition to receiving the prestigious Archarius Medal from the International Association of Lichenology (IAL), Bill also received The Chicita Culberson Award for Lifetime Achievement in Lichenology and the Elizabeth Britton Award for Lifetime Achievement in Bryology, the latter two from the American Bryological and Lichenological Society.



Left to right: Frank Bungartz (collections manager of lichens, Arizona State University) presented Weber the Archarius Medal from the International Association of Lichenology, Doug Ladd (president of the American Bryological and Lichenological Society presented two ABLs awards), Bill Weber, Heather Harris (Weber's daughter), Tim Hogan (collections manager of botany at COLO Herbarium), and Erin Tripp (curator of botany at COLO Herbarium). © Heidi Alina

The Britton Award was named after the same woman who chased him out of the NYBG after he took the sample of skunk cabbage leaf and who was assisted in the NYBG Bryology Department by R.S. Williams!

WilliamAWeber.com

Bill's grandson, Ragnar Müller Wille, created a website (<http://williamaweber.com>) honoring his grandfather and his life's work. On the site is posting the online journal, *Acta Botanica Weberi*, a creation of some members of the Weber family, where Bill's recent publications will appear. The first issue of the journal contains the paper "Global Plant Distribution and Continental Drift: Two Mosses," by Dr. Weber and his daughter, Linna Weber Müller-Wille. With characteristic Weber humor, the website states:

"At the age of 99, Dr. Weber cannot wait on the peer review process to see his latest writings published if they are not to become posthumous works. Instead, he and we feel that publication in this form to be the most appropriate at his age. The resulting dissemination of these works among his botanical colleagues, known and unknown, and the uses, references and discussions thus arising will be enough of a peer review and contribute to the continuing endeavors to research scientific questions."

With his 100th birthday in November, we can still expect to hear more from Dr. William A. Weber, botanist, bryologist, lichenologist, and "the naturalist."

"Weber ..." continued on page 32 ▶

Botany Basics

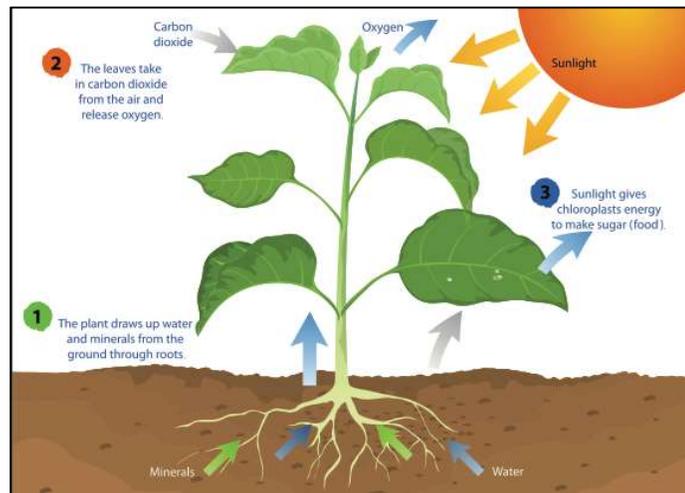
Plants. What Good are They? By Lenore Mitchell

Sure, you love plants. That's nice. But what good are they? Some houseplants help remove toxins from inside our homes. That's nice, too. Lawns provide a place for dogs and kids to play. Nice, right? Then again, lawns use lots of water, need mowing, and are often inundated with pesticides and selective herbicides. Not so nice. But lawns are green, and green is good, right?

The average home is surrounded by some grass, a tree or two, some juniper shrubs and, in summer, clumps of petunias or zinnias. That's gotta be nice. When we visit state parks or local open space trails, forests and flowers add to the scenery. When we visit farmers' markets or grocery stores, we find wide arrays of edible plants. No wonder we like plants!

But what good are plants? They decorate our interiors and our yards. They provide shade. They feed us. But that is only the start. Plants are the *only* living organisms that harness the sun's energy and provide oxygen through photosynthesis. Without plants, we wouldn't be here, nor would any other animals. Nothing could survive on earth without plants!

Plants take in carbon dioxide and give off oxygen, an importance that cannot be overstated. Air holds approximately 21% oxygen, which is sufficient to support life here on earth.



Photosynthesis is the process by which plants take in carbon dioxide, water, and light and then create sugars and oxygen. This image appears in a helpful article about photosynthesis on the Smithsonian Science Education Center's website at <https://ssec.si.edu/stemvisions-blog/what-photosynthesis>.

Inhale a deep breath and imagine the oxygen coursing through your body. We exhale a mixture that includes carbon dioxide. So plants take in what we exhale and give off what we require. Doesn't that make you appreciate plants more? In the web of life plants are the main link. When you eat meat, the cow or chicken you're consuming was sustained by plants in the form of grasses and grains.

While the earth is said to be 4.6 billion years old, the oldest vascular land plants (those forming roots) are Ferns and Fern Allies (like horsetails, the *Equisetums*) which began approximately 350 MYA (million years ago). Gymnosperms (naked seed plants such as conifers) began approximately 300 MYA and Angiosperms (covered seeds which include flowering plants and 80% of all current plants) began approximately 150 MYA, but became more prominent around 70 to 100 MYA.

So, after taking a moment to be thankful for plants, consider some ways to identify them.

Steps to Identifying Angiosperms

Pay attention to all these steps before attempting to key the plant. These steps will help to identify the family, and that makes keying much simpler. Specifically, take note of:

- Location (plains, foothills, montane, etc.; also note specific trail)
- Ecology (sun/shade, moist/dry, sand/clay soil, other plants)
- Bloom time (spring, fall, and so on), date & time of visit
- Plant type (herbaceous vs woody; tree or shrub)
- Size & height of entire plant
- Number of these plants at the site (or at least note many vs few)
- Consider plant parts
 - ◆ Leaves
 - stem placement (alternate, opposite, or whorled)
 - differentiate between leaf and leaflet size & shape (simple, palmate, lanceolate, etc.)
 - venation (parallel, netted, palmate)
 - hairs (none vs numerous; soft, bristly, etc.; top vs bottom)
 - differentiation of color on top & bottom of leaf
 - edges (smooth vs toothed)
 - petiole (present vs absent)

“Botany ...” continued on page 33 ►

Ten Native Plants for a Stunning Ethnobotanic Garden

By Kevin Healey

Ethnobotany—being a serious scientific study of plants and their traditional uses among humankind—is a field for serious people. Doctorates in biochemistry, anthropology, linguistics, and botany (among others) all have a home under the umbrella of ethnobotany. Ethnobotanists take the biochemical approach look to the past to discover and isolate specific secondary metabolites to treat diseases and ailments of the future (see Dr. Cassandra Quave’s research at Emory University). In fact, a great many modern medicines have their roots in the esoteric knowledge of the First Peoples of North America.

As you know, CoNPS has annual spring and fall plant sales. While all are attractive low-water alternatives to those available at typical nurseries, we don’t often discuss these plants in terms of their history of use among humankind. So, together, we are going to take a lighthearted and low-brow dip into the pool of ethnobotany.

All plants have a story, and the following 10 species would be an excellent start for a low-maintenance,

backyard ethnobotanic demonstration garden. It is exhilarating to learn and share stories about the histories of plants that sometimes stretch back hundreds, if not thousands, of years.

Of course, this article should not be confused with medical or definitive gustatory advice so be warned. Each person may have their own allergies and sensitivities.



Artemisia frigida (fringed sagebrush). © Mo Ewing

Fringed sagebrush (*Artemisia frigida*)

If we were to call this pleasant-smelling arid-land perennial an evergreen, we’d be dirty liars; however, if we were to call it eversilverish, we’d be witnessing the miracle of birth: a new word. Welcome to the world, eversilverish! As you admire your eversilverish sagebrush in your native garden, you will be delighted by its fresh scent and low-maintenance qualities. Perhaps you would also be interested to know that Native Americans traditionally used this plant as an analgesic, anti-convulsive, anti-hemorrhagic, cold remedy, cough medicine, dermatological aid, febrifuge, gastrointestinal aid, gynecological aid, hemostat, incense, mountain fever remedy, spice, stimulant, tonic, and toilet paper for millennia?

Purple prairie clover (*Dalea purpurea*)

That purple prairie clover you purchased from the CoNPS sale has its own history of traditional uses by humankind. This ornamental not only had a secret life in kicking butt and taking names, it was also used in healing wounds and making tea. Its sweet roots were chewed as candy, and it was medicinally used for heart troubles and diarrhea. We cannot simply stare a plant down and expect it to tell us its secrets. We must continue our research.

James’ buckwheat (*Eriogonum jamesii*)

Forget James! This is your buckwheat now and, boy, does it have a super-specific cure for what ails you: troubling dreams involving tobacco worms. We’ve all been there. Well, I’m glad you are reading this because *E. jamesii* is probably the only Navajo remedy you will find for your horrible recurring t-worm nightmares. This mat-forming plant with cream-colored blooms has also been used to ease labor pains, as a contraceptive, to treat depression, stomach aches, sore tongues, sore eyes, and it was also used to kill those red ants you accidentally swallowed.

Red dome blanketflower (*Gaillardia pinnatifida*)

Red dome blanketflower is a spring-blooming perennial that is sure to attract early pollinators to your garden. However, it is not only a “looker.” The Havasupai used the parched seeds of this plant for food. The Hopi used it in cases of painful urination. The Keres used to apply this plant to a mother’s breast to wean infants, and the Navajo used *G. pinnatifida* for gout, bewitchment, heartburn, nausea, and stuffy nose. There is always more to the story than a pretty face. ►



Liatris punctata
(gayfeather).
© Mo Ewing

◀ Gayfeather (*Liatris punctata*)

Speaking of the hopelessly attractive, gayfeather also has secrets hidden below the surface. The roots of *Liatris punctata* were used as a food by the Blackfoot, Kiowa, Lakota, and Tewa. As a medicine, it was used by Native Americans for stomach aches, swellings, bladder trouble, itching, gonorrhea, and swollen testes. It will also attract butterflies, bees, and hummingbirds to your garden.

Scarlet penstemon (*Penstemon barbatus*)

Scarlet penstemon will not only attract hummingbirds to your garden with its beautiful red and totally tubular flowers, it was also used as a panacea by the Navajo to treat various horrific injuries, namely, gunshot wounds, arrow wounds, burns, broken bones, and internal injuries. Assuming you are not actively reading this article with a war-arrow sticking out of your arm, scarlet penstemon was also used for more relatable ailments like coughs, menstrual pain, trouble urinating, and stomach aches.

Threadleaf groundsel (*Senecio flaccidus*)

With sunshine-yellow flowers, threadleaf groundsel will not disappoint you with its aesthetic charms. However, its reputation and history as a medicine often carries with it the word powerful. Internal uses for this plant are not recommended, as the Kawaiisu stated the plant was such an effective laxative that it could essentially cause death-by-diarrhea (yikes). Externally, threadleaf groundsel was used to treat wounds and sores among the Costanoan First Peoples. The Hopi used it to clear up acne and soothe sore muscles, and the Navajo used the plant to clear up boils.

Sand dropseed (*Sporobolus cryptandrus*)

An elegant and drought-tolerant grass, sand dropseed was used extensively as a food among Native Americans. The Apache and Navajo produced a flour from the seeds in order to make cakes, bread, and porridge. The Hopi also used the flour for bread and pudding. It may take some patience and creativity in the trial-and-error department to thresh and winnow the seeds, but this ornamental native grass has the potential to challenge any intrepid chefs hiding among us.

Indian ricegrass (*Achnatherum hymenoides*)

Indian ricegrass, whose seeds hover over our arid lands on delicate panicles, is bound to make a ponytailed entrepreneur a gazillion dollars one day. It is an ancient grain (check), it is gluten free (check), and it is a Colorado native that requires nearly zero supplemental watering (double check). It seems that flour preparation is simple compared to sand dropseed as the seeds only need a brief fire-parching before they are ground into flour or simply cooked as you would rice. All we need is a few empty acres and some artfully designed bags and we are in business.

Prairie zinnia (*Zinnia grandiflora*)

Prairie zinnias will bring striking yellows and oranges to your ethnobotanic teaching garden. It will also bring with it a history of use amongst Native Americans as a dye, throat aid, kidney aid, stomachache aid, heartburn aid, and an emetic.



Zinnia grandiflora (prairie zinnia). © Mo Ewing

That's right, the Navajo used this plant internally to cause vomiting. You should keep this use in mind if you feel compelled to experiment with this plant internally and experience a miserable self-inflicted case of emesis.

CoNPS sells all of these plants and more at its annual sales. With any luck, this article has inspired you to start your own ethnobotanic demonstration garden. If you are curious about the historical uses of other plants for sale during the CoNPS annual plant sales, visit <http://naeb.brit.org>. This free website is an omnibus database compiled by a hero of mine, Dr. Daniel Moerman, and his former students at the University of Michigan. It lists most uses of plants by Native peoples recorded in scientific literature from the 19th century until 2010.

Well, I guess this is the end of the dip. It was a pleasure chatting with you. Have a great day and happy plantings!

Kevin Healey (who occasionally writes in the third person) is a husband, father, forager, blogger, and recent graduate from Colorado State University—Pueblo (BS in biology) and is a proud CoNPS member. For a deeper dive into the ethnobotany of unusual plants, join Kevin's botanical bacchanalia on the web at www.pullupyourplants.com. For questions, comments, or other resource recommendations, feel free to email him at pullupyourplants@gmail.com. ✨

Western or Alderleaf Serviceberry, *Amelanchier alnifolia*

By Jim Borland

The name serviceberry, as one story goes, recognizes the association of this shrub's blooming period with that time in spring when soil is sufficiently thawed to bury and hold services for those who failed the final muster during the previous winter. The same story holds that the north sides of roofs served a temporary burial function until serviceberry bloom time arrived. Yet another story relates the serviceberry's bloom to the time when shad fish made their up-river spawning passage, thus, it is called shadbush by some.

In any event, we can all thank R.H. Dana, author of *Two Years Before the Mast*, for giving us the character "Old Curious," based on Thomas Nuttall, an English-American naturalist, botanist, and ornithologist. It was Nuttall who first described the serviceberry.

There are approximately 25 species of *Amelanchiers* throughout North America, Europe and Asia, but most are found on our own continent. Western, or alderleaf, serviceberry is the most common western species, inhabiting a wide variety of vegetation types from 4,500 to 9,000 feet elevation in the Rockies from Alaska and the Yukon to Hudson Bay and south to California, Arizona, New Mexico, and Nebraska. Throughout this range we find individual, multi-stemmed plants up to 15 feet tall or colonies of low shrubs attaining only half this height on a variety of sandy to clay loam soils.

A plant of the foothills where only 16 to 18 inches of annual precipitation is received, western serviceberry is not a plant for the sodic and saline soils usually associated with some drier western regions. Neither does it perform well in acidic (<6 pH) or organic (>20% by weight) soils. Its young stems are a favorite among our four-legged furry friends as are the sweet, juicy purplish to black-purple fruits in fall. While the fruit makes delicious jams and jellies, we humans are hard pressed to grab our fair share before the birds consume it.

Unlike currently popular cultivated serviceberry species, this one is compact in shape, especially

when grown in full sun. This compact nature in addition to columnar shapes and improved fruiting types has resulted in at least 26 cultivars available in the market. Shady locations are tolerated well, but habit suffers and branching becomes much more open. Blooming in most parts will be in May with a profusion of fragrant white to pinkish blossoms.

Propagating western serviceberry

Propagation for the species is typically accomplished sexually via its flat, oval, brown, and slippery smooth seed (82,000/lb.) which are first moist-chilled 120 to 180 days at 34 to 41°F. Some shade should be provided for a seedling's slow growth for the first growing season, followed by full sun. Asexual propagation for the species is usually reserved for the named cultivars which may be increased via sucker division, grafting, budding, or cuttings. Semi-hardwood cuttings that are wounded and treated first with 0.8% IBA (indole-3-butyric acid) root and grow fairly well if they are left in the rooting medium until after the first flush of growth the following spring. Root cuttings have also been used by taking 2.5 to 5 inch sections and treating accordingly.

Little, if any, pruning is required for most *Amelanchiers* and pests of all types are seldom encountered.

Whether called serviceberry, shadbush, juneberry, Saskatoon or sugar plum, it is cold hardy

throughout the US. Best uses in the landscape include specimen plants, hedges, garden corners, semi-shady locations and gardens devoted to feeding our furry and feathery friends. Expect at least a bright yellow fall color with some plants showing a great deal of red and orange as well.

Jim has been fooling around with native plants for more than 40 years in private, commercial and public venues. His home garden contains 1,000s 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. ✨



***Amelanchier alnifolia* (western serviceberry). © Mary Menz. Photo taken at Colorado National Monument 2018.**

Restoration Roundup

Restoration Masters Volunteer Program and the Urban Prairies Project

By Allison Hamm

Anyone interested in getting more involved with on-the-ground prairie and grassland habitat restoration work might consider Butterfly Pavilion's Restoration Masters Volunteer Program. The RMV program trains an elite corps of long-term, committed, expert volunteers who assist staff with habitat restoration efforts for pollinators and other wildlife. The program was designed in connection with the Urban Prairies Project, created in 2016 by Butterfly Pavilion, along with partners the City of Westminster and the City and County of Broomfield in the Colorado Front Range, to increase impactful restoration activities in open spaces and to cultivate a stewardship ethic among local residents.

In the Winter 2017 issue of *Aquilegia* (Vol. 41, No. 1), Butterfly Pavilion horticulture director Amy Yarger wrote about the Urban Prairies Project that encapsulates the important role this project is providing in the restoration of urban and suburban habitats in the Front Range of Colorado. Urban and suburban open spaces are often faced with a high degree of ecological disturbance. This is due to fragmentation and past and adjacent land uses (urban, residential, and agricultural) that are not compatible with native plant ecosystems, giving rise to the establishment of invasive species.

As a result, human-influenced landscapes generally have a far lower diversity in plant and animal species. Amy Yarger explains that, "By restoring local open spaces to a greater degree of native biodiversity, land managers and volunteers can include 'planned complexity' in urban and suburban landscapes. With over half of the human population now living in cities and towns, a habitat network of open spaces, parks and private gardens can add significant resources, especially for beneficial wildlife such as pollinators."

Habitat restoration has become a key component of the work of urban and suburban open space departments, aiming for ecological integrity, resilience, and self-sustainability. The capacity of these departments to achieve effective habitat restoration is consistently constrained, however, by limited personnel and resources. To address the reality of thinly stretched open space department staff, the UPP partners developed the Restoration Master Volunteers

program to develop a corps of trained volunteers to help steward these open space habitat restoration sites.

RMV volunteers complete 25 hours of training which includes subjects from identifying plants and managing habitats to sharing scientific information with the public. The core RMV training, offered at Butterfly Pavilion three times each year (for a \$25 fee), provides 16 hours of this training. The remaining training requirements may be fulfilled by attending lectures, workshops, and field trips offered by partners or other aligned organizations in the local area. Restoration Master Volunteers commit to at least one year of restoration volunteering of about two hours per month. They contribute their skills to activities such as noxious weed mapping, supporting large volunteer groups for specific revegetation projects, and monitoring pollinators.

While the core training schedule is completed for 2018, trainings for 2019 are already scheduled. For more information about the Restoration Master Volunteer program, contact Amy Yarger at ayarger@butterflies.org.

Allison Hamm has a master's degree in environmental studies. She led the certification process for the City of Hesston to become the first Community Wildlife Habitat in Kansas and is currently working with the Butterfly Pavilion Urban Prairies Project. ✨



Results from the Urban Prairies Project.
© Butterfly Pavilion

Research and Reports

More Than Just a Dandelion: Niche Differentiation and Reproduction of Native *Taraxacum* Species in the Mosquito Range of Colorado

By Austin Lynn

*CoNPS annually funds approximately \$3,500 in grants to support field and laboratory research on the biology and plant communities of Colorado. The grants are made possible by the John W. Marr and Myrna P. Steinkamp funds. Austin Lynn was awarded \$900 in 2017. In this issue, we are pleased to feature his report, resulting from his investigation of evolutionary relationships among native and exotic *Taraxacum* in the Colorado Rocky Mountains. Reporting on their findings is a requirement of all grant recipients. MM*

The introduced European dandelion (*Taraxacum officinale*) is commonly found along roadsides and lawns of North America, but there are three species of native dandelions that dwell high in alpine habitats of the Colorado Rockies. In studying these closely related wildflowers, my goal is to gain insight into the ecological and genetic factors that mediate their coexistence. As an ecologist, I am especially interested in the process of niche differentiation. For this research I used the frameworks of geographic parthenogenesis and cost of reproduction to formulate hypotheses about why these different dandelion species spatially segregate across their alpine habitat.

Geographic parthenogenesis is a theoretical framework that explains a broad trend of closely related sexual and asexual plant species inhabiting different habitats (Tilquin and Kokko 2016). Often asexual species occupy sites at higher latitude and/or altitude than their sexually reproducing congeners. While most studies of geographic parthenogenesis relate to sexuality and asexuality *per se*, the underlying mechanisms giving rise to differing ranges may involve correlated trait changes that alter susceptibility to stress.

Here, I consider two such mechanisms that may contribute to niche differentiation and coexistence between sexuals and asexuals at a local scale: polyploidy—sexuals typically have higher chromosome numbers than sexuals (Verduijn *et al.* 2004b); and cost of reproduction—sexual dandelions are hermaphroditic and invest heavily in male and female reproduction while asexual species are only dependent on female function.

Polyploidy associated with asexuality leads to larger cell size, which could lead to niche partitioning across habitats by making polyploid plants more susceptible to freezing and drought (ploidy hypothesis) (Oertli 1986; Tanaka *et al.* 2014). Subsequent selection against the cost of male function could also evolve in hermaphroditic polyploids as a mechanism of coping with stress, with higher ploidy level being negatively correlated with male investment (reproductive allocation hypothesis; (Ashman 2006; Meirmans *et al.* 2006). ►

Figure 1: *Taraxacum ceratophorum*, a native Rocky Mountain dandelion. Note how the involucre bracts are appressed and point upwards, as opposed to the exotic dandelion with reflexed bracts on the outer row. © Austin Lynn



Figure 2: *Taraxacum eriophorum*, a native dandelion. Commonly known as woolly dandelion, note the tuft of pubescence on the scape beneath the involucre. Also notice the reddish (sometimes brown or black) tips of the bracts. © Austin Lynn



Figure 3: *Taraxacum scopulorum*, another native dandelion of diminutive stature. This species is limited to high alpine scree slopes. © Austin Lynn



◀ The genus *Taraxacum*, with recurrent evolution of apomixis (clonal and asexual production of seeds), is well suited to addressing these hypotheses. In the central Rocky Mountains, diploid sexual *Taraxacum ceratophorum* (Figure 1) is more drought tolerant than its triploid apomict congener *T. officinale*, consistent with the ploidy hypothesis (Brock and Galen 2005). With CoNPS grant funding, I extended this initial comparison by exploring habitat preferences, ploidy levels, and pollen viability characteristics of this species pair along with two more native dandelions, *T. eriophorum* and *T. scopulorum* (Figures 2 and 3).

Determining Sexuality, Ploidy Level, and Male Function

On Pennsylvania Mountain in the Mosquito Range (Figure 4), I collected seeds from populations of the four Colorado dandelion species to determine ploidy level by propagating the seedlings and staining chromosomes in young roots. In dandelions, sexual species have either two or four copies of their chromosomes, while apomicts have an odd number of chromosome copies. To determine if species are apomictic or sexual I sliced immature buds in half laterally, removing the stigmas and anthers. When subjected to this treatment, sexual species fail to set seed while apomicts successfully reproduce, as pollen is unnecessary (Richards 1970).

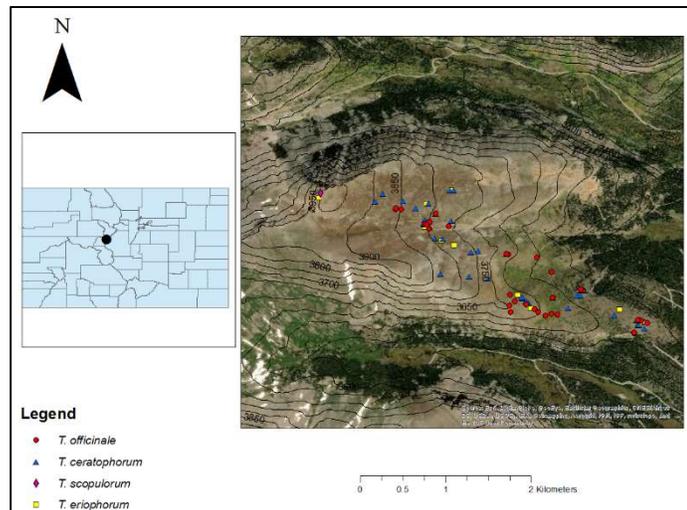


Figure 4: A map of Pennsylvania Mountain showing locations of different *Taraxacum* species. The inset shows the location of Pennsylvania Mountain within Park County and Colorado.

Bud dissection showed that *T. eriophorum* is an apomictic (asexual) species. This inference is also supported by the number of chromosomes it possesses—40, meaning it has five copies of each chromosome (the haploid, gametophytic chromosome number for dandelions is eight). Thus, *T. eriophorum* is a pentaploid species. In contrast, the dwarf dandelion *T. scopulorum* has sixteen chromosomes

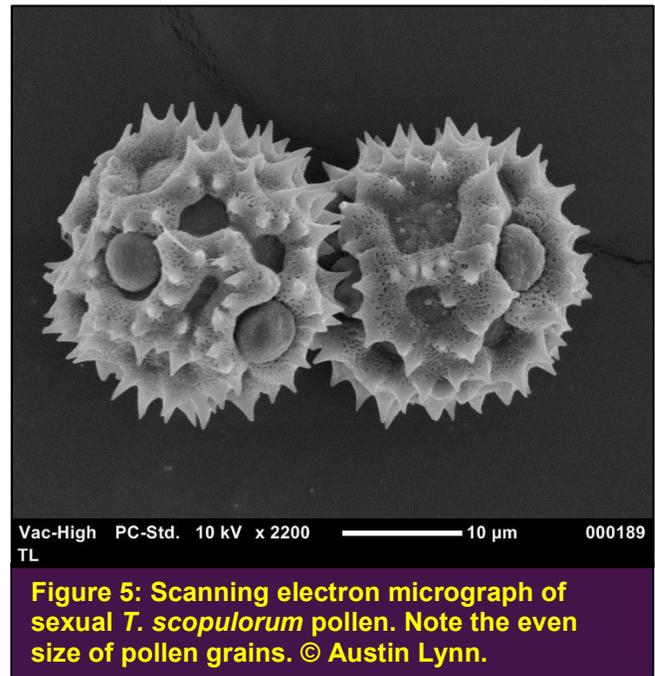


Figure 5: Scanning electron micrograph of sexual *T. scopulorum* pollen. Note the even size of pollen grains. © Austin Lynn.

indicating a diploid sexual species. Elsewhere, sexual system may vary in this species—there are herbarium collections of *T. scopulorum* from the Canadian Rocky Mountains that are listed as apomictic.

I also measured variation in pollen size within species as another line of evidence for sexual or apomictic status. All measurements of *T. scopulorum* pollen showed even-sized grains, indicative of sexually reproducing plants with functional pollen (Figure 5) (Tschermak-Woess 1949). Higher variance in pollen size and shape also supports the apomictic status of *T. eriophorum*. Apomictic dandelions produce deformed or “monstrous” pollen (Figure 6) with greater variance in size compared to pollen of sexually reproducing dandelions. ▶

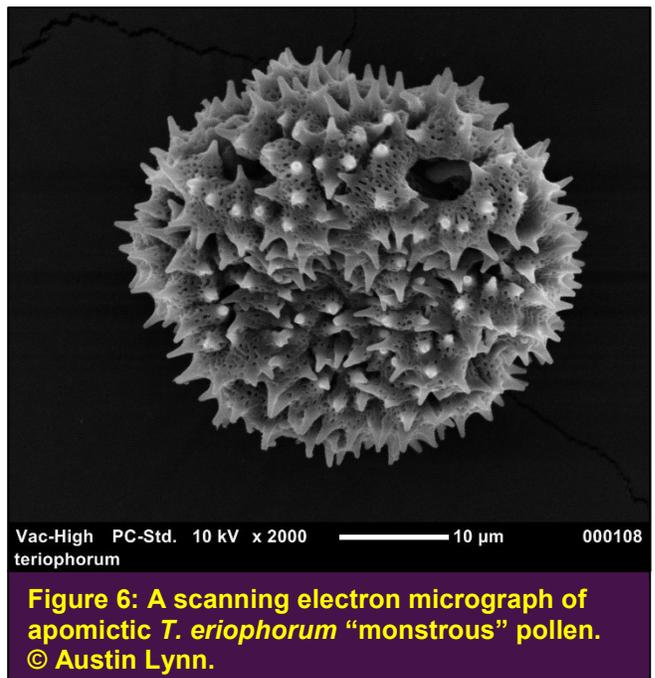


Figure 6: A scanning electron micrograph of apomictic *T. eriophorum* “monstrous” pollen. © Austin Lynn.

◀ To assess the degree of investment in male function, I compared pollen viability rates in the different dandelion species by staining pollen with lactophenol to test for the presence of viable sperm. In accordance with its status as a sexual outcrossing species, *T. ceratophorum* had pollen viability nearing 99%. The triploid *T. officinale* had 75% average pollen viability, while pentaploid *T. eriophorum* had 35% average viability.

Habitat Preferences and Niche Differentiation

To elucidate habitat preferences, I took GPS points to map patches of each species by surveying Pennsylvania Mountain several times during the growing season of 2015. Since the dandelion achene is equipped with an umbrella-like pappus enabling long distance dispersal, I predicted the spatial distribution of different dandelion species to be delimited by suitability of different habitats.

In comparing the two most common native Colorado dandelions, the map shows sexual *T. ceratophorum* is widespread above treeline, and even occurs in high elevation sites characterized by drought-tolerant cushion plants (e.g., *Trifolium nanum*). While apomictic *T. eriophorum* is not found in these dry sites, both dandelion species can be found in the more mesic conditions of swale and krummholz habitats, growing near *Salix* spp. Conversely, the dwarf sexual species *T. scopulorum* is restricted to high elevation scree slopes, co-occurring with species such as *Claytonia megarhiza*.

Discussion

Habitat preferences of the Rocky Mountain *Taraxacum* species overlap broadly at the landscape scale, with some differentiation within altitudinal zones aligning with the ploidy hypothesis. Specifically, the apparent limitation of diploid sexual *T. scopulorum* to alpine scree slopes and fell fields and *T. ceratophorum* to drier open habitat (see also Brock and Galen, 2005) agrees with the association between diploidy and environmental stress (drought and frost) tolerance (Oertli 1986; Tanaka *et al.* 2014). Studies on range differences between European dandelions also show a prevalence of sexual species on dry, south facing slopes (Verduijn *et al.* 2004a).

All else being equal, apomixis should be accompanied by reduced pollen viability, as pollen has negligible function in apomictic individuals and is costly to produce (reviewed in Ashman 2006). Among apomictic species, those inhabiting more stressful environments and exhibiting higher ploidy levels should experience stronger selection against pollen production due to the mismatch of large cell size with cold or dry conditions (reproductive allocation hypothesis). Triploid *T. officinale* and pentaploid *T.*

eriophorum reflect this trend, with reduced pollen viability compared to sexual species and the latter (a pentaploid) having roughly half the pollen fertility rate of the former (a triploid).

Conclusions

Overall, these preliminary results suggest that dandelions, a large genus with multiple pairs of asexual and sexual congeners, are a model system for future research into mechanisms of geographic parthenogenesis. Co-occurring dandelion species in the Rockies differ in multiple traits including male fertility, cell size and ploidy. Correlations among these traits and habitat preference provide partial support for both the ploidy hypothesis and reproductive allocation hypothesis, and suggest that ecological and genetic mechanisms underlying geographic parthenogenesis are complex. In the future, I plan to use information collected in this study to delve into recurring patterns of evolution of apomixis for the genus *Taraxacum* in North America.

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“Taraxacum ...” continued on page 33 ▶

News and Announcements

Chapter Reports

Boulder Chapter News

Erica Cooper has announced that she will be stepping down as Boulder Chapter President. She will keep her position as Restoration Committee Chair and will continue to be a member of the Strategic Plan and Mission Grant Committees.

Erica will stay on the Boulder Committee until a new Chapter President is identified and up to speed. As she said, the “chapter is overdue for some new energy!” Please let Erica know if you can help identify a likely candidate for the position.

Southeast Chapter News

Rich Rhoades has decided to step down as chapter president. Maggie Gaddis has already accepted the position and will be leading the chapter soon. She can be reached at ecocitycoloradosprings@gmail.com. We look forward to hearing from Maggie about her plans.



Southwest Chapter News

Lichens Featured in Southwest Chapter’s Final Field Trip of the Season

The Southwest Chapter thanks Bob Powell for leading a group into the fascinating world of lichens on its last field trip of the season, September 8.

“Lichens are such strange creatures,” said chapter president John Bregar. “They’re a mixture of fungus, yeast, and algae of various sorts forming a symbiotic community.”

John said the group saw 20-25 species of lichen on the field trip, including various species of crustose lichens, foliose lichens, fruticose lichens, and squamulose lichens. He said this field trip was a great follow-up to Bob’s lecture on lichens in 2016.



Don Grotts, Bob Powell, and Bob Hutson examining lichens on rock near Coal Bank Pass.
© John Bregar.



The bright orange pin-cushion sunburst lichen (*Polycauliona polycarpa*) growing on a dead tree.
© John Bregar.

2018 Event Calendar

Chapter Meetings

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

Boulder Chapter Meetings: 2nd Tuesday of the month (usually), Boulder Rural Fire Station, Gunbarrel, 7–8:30 pm

Nov 13: Lynn Riedel, “Preserving rare plant habitat in the path of progress: Ute ladies’ tresses orchid, working landscapes, rare fish and more.” A look at the twists and turns of Ute ladies’ tresses habitat conservation in Boulder and Dinosaur National Monument. The presentation by Lynn Riedel, plant ecologist with City of Boulder Open Space and Mountain Parks, will include a virtual tour of Boulder area rare plants.

Metro-Denver Chapter Meetings: 2nd Tuesday of the month (usually), Denver Botanic Gardens, Plant Society Building; 6:30–8:30 pm

Nov 13: Tom Schweich, “Early Colorado Botanists and Colorado Flora.” Learn about early Colorado botanists, most of whom were physicians, many of whom became avid explorers and some who had Colorado peaks named after them. Selected Jeffco flora will also be presented.

Dec 11: Holiday Party. Speaker: TBD; potential lecture on botanical Latin, and the latest Angiosperm Phylogeny Group information

Northern Chapter Meetings: 1st Tuesday of the month (usually), Gardens on Spring Creek, Fort Collins, 6:30 social; 7-8:30 pm, presentations

Nov 6: John Sanderson, “From rare plants to landscapes and cities: The Nature Conservancy’s work to conserve the lands and waters on which all life depends.” John leads a staff of scientists who work on a range of conservation challenges, including determining the water needs of endangered fish in the Yampa River, measuring the effects of fires in Colorado’s Front Range forests, planning for sustainable grazing on the Great Plains, and adapting conservation strategies to a changing climate.

Dec 4: Luke Tembrock, “Genetic characterization and comparison of three disjunct *Populus tremuloides* stands across a latitudinal gradient.” *Populus tremuloides* has the largest species range of any deciduous tree in North America and is ecologically and economically important. Since the melting of Cordilleran and Laurentide ice sheets, the range of *P. tremuloides* has expanded northward. With the northward expansion, many areas in western North America that would have been suitable during the early Holocene are no longer suitable for *P. tremuloides*. However, microrefugia still harbor small aspen stands in otherwise ecologically anomalous disjunct sites across the west.

Based on theoretical and empirical studies it is thought that the individuals at these sites could harbor locally adapted genes. Microsatellite markers and a range wide dataset for *P. tremuloides* were employed to compare three different microrefugial sites, two of which occur in US National Parks, across a latitudinal gradient. All microrefugial stands were found to possess a single genotype and among all three genotypes each contained rare alleles suggesting selective or demographic processes are an important factor in disjunct relictual genotypes for aspen. These findings suggest that further study of these and similar sites is needed, as well as *in situ* and *ex situ* conservation.

Plateau Chapter Meetings

Events TBD

Southeast Chapter Meetings: Cheyenne Mountain Library, 1785 S. 8th St., Colorado Springs, 1:30 pm

Events TBD

Southwest Chapter Meetings: Lyceum Rm., Center for Southwest Studies, Ft. Lewis campus, 6:30-8:00pm

Events TBD

Position Openings

Event & Marketing Coordinator

Congratulations to Jennifer Bousset on becoming a full-time professor at CSU. As she will be leaving her part-time position with CoNPS, CoNPS is looking for a new marketing and events coordinator. Anyone interested in this approximately 40 hours per month position should contact David Julie at bldrjardin@live.com. Pay is \$19 per hour.

Responsibilities include, but are not limited to, organizing plant sales, garden tours, the annual conference, fund-raising activities, and collaborative events with other organizations.

East Slope Workshop Coordinator

CoNPS seeking east slope workshop coordinator to start immediately on Spring programs. The permanent position is five hours per week at \$18 per hour. Interested applicants should contact Denise Wilson at (303) 642-0510 or by email at deniseclairewilson@gmail.com

The successful candidate must be full of creative ideas, able to motivate and recruit speakers and volunteers and enjoy running a successful program developing workshop ideas related to native plants. CoNPS currently sponsors 8-12 workshops per year on the East Slope from Colorado Springs to Fort Collins.

Cross Pollination Events

Landscaping with Colorado Native Plants Conference

This fourth annual conference is presented by a coalition of partners, including the Butterfly Pavilion, Colorado State University Extension, Colorado Native Plant Master Program®, Colorado Native Plant Society, Denver Botanic Gardens, Front Range Wild Ones, High Plains Environmental Center and Susan J. Tweit, author.

Keynote speaker: Andrea DeLong-Amaya, Director of Horticulture, Lady Bird Johnson Wildflower Center

Saturday, February 16, 2019, 9 AM to 5 PM

Auraria Campus

Denver, CO

For more information, visit

<https://landscapingwithcoloradonativeplants.wordpress.com>

The Landscaping with Colorado Native Plants Conference promotes the inclusion of native plants in landscaping to benefit pollinators and songbirds, save water, and restore the beauty and health of nature in the places we live, work and play.

Check out the other interesting events on this page.

Other Events

November 7-10

2018 California Invasive Plants Council Symposium

Monterey Hyatt Regency, Monterey, CA

<https://www.cnps.org/event/2018-california-invasive-plants-council-symposium>

November 9

Colorado Pollinator Summit 2018 Building Living Landscapes

Denver Botanic Gardens, Denver, CO

<https://www.botanicgardens.org/programs/2018-pollinator-summit>

November 12, 10am

Webinar: Sierra Forum: Nature as a Prescription

https://zoom.us/webinar/register/WN_SmyRQq6wT5uXBtSb79KMIw

November 13, 2018

Gambel Oak Webinar Symposium

<https://mailchi.mp/colostate.edu/gambel-oak-webinar-symposium-nov-13-18?e=09796e04da>

November 14, 2018

Grow Native! Professional Member Conference Missouri Prairie Foundation

<http://grownative.org/events/wednesday-nov-14-2018-grow-native-professional-member-conference/>

December 5-6

Colorado Weed Management Association Annual Conference

Grand Junction, CO

<https://cwma.org/event/cwma-annual-conference/>

December 20

Prairie Biotic Research Small Grants Deadline

<https://prairiebioticresearch.org/PBRPage.aspx?pg=13>

January 3-February 1, 2019

Colorado Water Conference

Westin Hotel, Westminster, CO

<https://www.cowatercongress.org/annual-convention.html>

February 5-7, 2019

Riparian Restoration Conference

Desert Botanical Garden

Phoenix, AZ

<https://riversedgewest.org/events/2019-riparian-restoration-conference>

February 9-17, 2019

Colorado Home and Garden Show

Colorado Convention Center, Denver, CO

<https://www.coloradogardenfoundation.org/colorado-garden-home-show>

February 16, 2019

Landscaping with Colorado Native Plants Conference

Auraria Campus, Denver, CO

<https://landscapingwithcoloradonativeplants.wordpress.com/>

February 21-23, 2018

Colorado Environmental Film Festival

American Mountaineering Center, Golden, CO

<http://www.ceff.net/festival-info/>

February 23-24, 2019

Gordon Research Seminar Plant-Herbivore Interactions Using Interdisciplinary Approaches

<https://www.grc.org/plant-herbivore-interaction-grs-conference/2019/>

March 12-14, 2019

HAR-CeRSER 2019 Conference

CSU, Fort Collins, CO

<https://sites.warnercnr.colostate.edu/restoration-conference/>

March 17-23, 2019

Sustainable Trails Conference

Grand Junction, CO

<http://www.trailbuilders.org/training/sustainable-trails-conference-grand-junction>

Border Crossing: Native Plants in New Mexico

By Kelly Ambler

Are you aware that there are native plant societies in every state? All of them have activities and events that are open to members and nonmembers. Here's an account of the New Mexico Native Plant Society's annual conference that took place the weekend before the CoNPS conference. MM

I had the pleasure of attending the annual conference of the Native Plant Society of New Mexico, held in Silver City in September. Silver City is in the foothills, on the transition between the Chihuahuan desert plains to the Mogollon Mountains of the Gila National Forest. Thus, it is surrounded by a rich variety of ecosystems.

The theme of their 2018 conference was "Plants, People and Culture," and the event took place over three days. It included two presentation sessions, three half-day field trips or workshops, and a banquet. I was particularly honored to be the Colorado representative at the banquet. Jack Carter was the keynote speaker. He spoke about his and his wife Martha's involvement in local conservation issues after moving to Silver City upon their retirement.

Attendees heard presentations on specific plants (penstemons, osha, tamarisk, and saltbushes), on ecosystems and how to protect them, citizen scientist and community driven projects, pollinators, and on local cultural uses of plants. Most of the talks concerned plants and ecosystems from the Mogollon Mountains and the Gila River.

The conference's 26 field trips and 8 workshops covered a wide range of topics and locations. Workshops included edible native plants, herbarium education, herbal remedies using native plants, grasses and sedges, and even yoga. Field trips included plant identification in different ecosystems around the region, learning about the birds and the bees, exploring local history and ethnology, and landscaping with native plants.

I participated in three different field trips: The Gila's Bees; Birds and Botany on the Gila River; and

Chihuahuan Summer: Mahoney Park in the Florida Mountains. A personal highlight of the conference was the trip to the Florida (pronounced Flo-ree-da) Mountains. I spent much of my childhood in this region but without the botanical knowledge I have gained recently. It was a real treat to be able to learn more about the botany of these iconic "sky-island" mountains. In addition, the summer monsoon rains had stimulated a late summer burst of flowers.

The trip was led by the very knowledgeable Gene Jercinovic, who is conducting a botanical survey of the Floridas. As we drove towards Mahoney Park, we left

the creosote-dominated flats and gradually climbed the alluvial skirts of the mountains. Plant diversity increased as we gained elevation. Our first stop was near the beginning of the alluvial outflow. What a surprise! More than two dozen flowering species greeted us. We eventually continued on foot up a dry wash, finding new plants all along the way. A special treat was a small spring running into the sand. The damp soil attracted scores of butterflies, as well as wasps and bees. After a brief rest at the top of a small ridge, six of us dropped into Mahoney Park, braving the growing heat. It was well worth it, as we added more than another dozen plants to our list for the day. And this is where we saw the showy yellow bells, or trumpet bush (*Tecoma stans*). What a hidden treasure! Another

personal favorite was angel's trumpets (*Acleisanthes chenopodioides*) with lovely fuchsia-colored blossoms on sprawling vines that provided such vibrant color against the desert background. A couple of surprises included the rock hibiscus (*Hibiscus denudatus*) and a desert fern (*Astrolepis cochisensis*). These are just a few examples of the many plants flowering in September. I had no idea there were so many interesting plants in what had once been my own backyard.

This conference left me ready for the CoNPS conference the following weekend and the opportunity to compare the flora of two distinct regions during the same time of year. ✨



Yellow bells, *Tecoma stans*.
© Kelly Ambler



Angel's trumpets, *Acleisanthes chenopodioides*. © Kelly Ambler

Member Profile: Norma Grigs

Botanical Connections: Norma Grigs, one of William A. Weber's Early Herbarium Assistants

by Lenore Mitchell

Norma Simonds Grigs credits William A. Weber with her life-long love of botany. Although she's now ninety, age did not stop her from taking CSU Extension's Native Plant Master field course at Cherokee Ranch this summer, acing the final test.

In 1928, when William Weber was a ten-year-old living in the eastern US, Norma Simonds was born out west.

Nearly twenty years later, William Weber, who earned his PhD in 1945, was teaching at CU Boulder when Norma entered college there. Although she intended to major in geology, after one class with Dr. Weber, Norma switched to a botany major with a geology minor.

It wasn't long before Norma became Dr. Weber's herbarium assistant. The job involved taking pressed flowers from field trips, carefully laying them on paper, and then putting them into a flower press. After a few weeks, she'd dip the dried specimens in glue and place them on permanent paper, finally securing stems with strips of glued paper. When she'd have to leave friends and go to work, they'd joke "Oh, Norma has to go stripping now!"

She says Dr. Weber was so nice to work for, was never cross or critical, and had a fun sense of humor, too. One of the first courses she took from him was taxonomy. The day after the final, he called and said "I'm so sorry to tell you, Norma, but you flunked the class." Then he laughed and said, "No, you got the highest grade!" She remembers his constant enthusiasm. Once during a group collecting

trip, he suddenly slammed on the brakes, shouting "There it is! There it is!" He sprinted halfway up a hill almost before the others realized the car had stopped. The specific plant is forgotten, but the memory of his excitement remains.

Norma also recalls exploring an interesting South Park bog, among many other trips. One time, they gathered sand lilies from Chautauqua Park in Boulder to sell to

pharmaceutical companies. There were so many lilies back then, those harvested didn't even make a dent in the population.

Years later, she took early retirement and joined Dr. Weber on a field trip to the High Creek Fen in South Park, where he searched for a small sedge that had only been described once before from a population in Siberia. He found it, of course.

Norma's early childhood was spent in construction camps, as her father was a civil engineer and oversaw dam building all over the west. When her father worked on the Hoover Dam, the family visited the Valley of Fire and Death Valley. Her grandfather was chairman of the geology department at University of Texas and she was intrigued by his marvelous fossil collection. Everything from birds, rocks, trees, and flowers ignited her curiosity. Riding horses and square dancing were other youthful pursuits.

Later on, she married and shared her love of nature with two sons and two daughters by helping them make collections of rocks, leaves, butterflies, and flowers, followed by library visits for information. ►



Norma holds a flat of milkweed plants grown from seed that she and her daughter Jeannine collected. They raised the seedlings in a greenhouse at Hidden Mesa. Norma and daughter distributed both seeds they packaged and seedlings to people attending the presentations they gave to senior centers, garden clubs, schools, and the Douglas County Fair and the Parker Honey Festival. © Jeanine Colley

◀ She led Camp Fire girls and Cub Scout boys to encourage children's love of nature. After living in Boulder and Denver, she spent twenty-two years in Harris Park, a mountain community south of Bailey, Colorado. She's still in contact with a women's hiking group there. A recent move to live with her daughter, Jeannine Colley, in Parker hasn't slowed her down much, as the two of them created a pollinator conservation program which they present at schools, garden clubs, and Parker's Honey Festival. Norma and her daughter remain in occasional contact with Dr. Weber.

As for advice on living a full life, this white-haired lady with sparkling eyes makes conscious decisions to engage in something mental, physical, and social daily. She might multiply the number of dishes she washes by seventeen or calculate how many steps she takes daily, and she maintains social contacts, too. As for NPM courses, she hopes to take another course next year. It's safe to say that Norma Simonds Grigs is a great example of how to age well.

*Lenore Mitchell, the current Metro-Denver chapter president, is a long-time member of CoNPS and an avid amateur who has taught the Native Plant Master® courses for over a decade. Macro photography, hiking, and gardening with natives also keeps her busy. **



◀ "Weber ..." continued from page 18

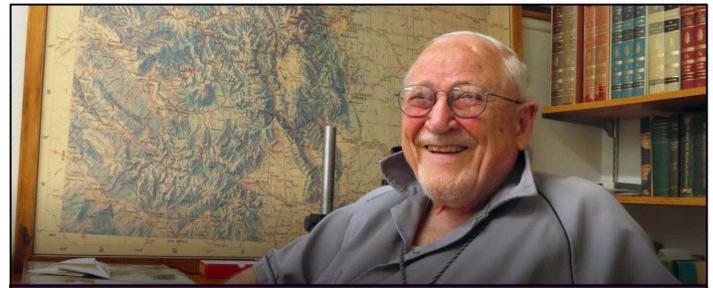
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This recent photo of Dr. Weber was taken during a filmed interview at CU Boulder Library. © AC Violet, CU Boulder Libraries.

Toby Spribille. (website) <http://tobyspribille.weebly.com/> (Accessed: 9/28/2018)

Weber, William A. 2013. Impressions of the Linnaeus Apostles' Achievements. *iLINNAEUS | iMagazine | iStories* (April); <https://www.ikfoundation.org/ilinnaeus/istories/williamweber.php> | ISSN 2397-7302 (Accessed: 9/28/2018)

William A. Weber – Official Website. Williamaweber.com (Accessed: 9/28/2018)

William Alfred Weber. Wikipedia. https://en.wikipedia.org/wiki/William_Alfred_Weber (Accessed: 9/28/2018)

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Yong, Ed. 2016. How a Guy from a Montana Trailer Park Overturned 150 Years of Biology. *The Atlantic*. <https://www.theatlantic.com/science/archive/2016/07/how-a-guy-from-a-montana-trailer-park-upturned-150-years-of-biology/491702/> (Accessed: 9/28/2018)

Learn more about Dr. Weber:

Strain, Daniel. "Faculty in Focus: At 99, botanist's love of lichens still going strong," *CU Boulder Today*. 17 Sept. 2018. <https://www.colorado.edu/today/2018/09/17/faculty-focus-99-botanists-love-lichens-still-going-strong>

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*Jan Loechell Turner is former co-president of CoNPS, former editor of Aquilegia, and Professor Emerita, library science, Regis University. Jan and her husband, Charlie Turner, are the authors/photographers of several wildflower guides including Wildflowers of Mesa Verde. **

◀ “Botany ...” continued from page 19

- ◆ Stem (if square, consider Lamiaceae - mint)
 - flowers over all
 - color & size
 - arrangement: single, raceme, umbel, etc
 - perfect (with both stamen & pistil)
 - imperfect (staminate or pistillate, but having only one, not both)
 - regular (actinomorphic - round shape vs zygomorphic - irregular shape)
- Observe one representative flower from outside-in
 - ◆ Sepals (number & separate vs united)
 - ◆ Petals (number & separate vs fused)
 - ◆ Stamens (number if present)
 - ◆ Pistil (number if present - usually in the middle)
 - ◆ Ovary placement (possibly challenging to see)
 - superior - above sepals
 - inferior - below sepals
 - ◆ Tepals (same color petals & sepals)
 - ◆ Note: some flowers have no petals

Photographing plants: try to take a close-up of the bloom and then take a picture of entire plant. Hold the camera very steady and take more than one photograph. It's easier to take too many than to have to return to the site to take more.

Sketching in the field is a great way to remember a plant and include details. You needn't be an artist to make a simple sketch. This also forces you to really look at details.

Last, and most important, is to take time to not only look at the plants, but also to enjoy them. While you're enjoying them, watch the various pollinators who visit, too.

If you have a lawn, consider using less or even no pesticides and herbicides, and plant natives. The pollinators will thank you, and maybe your good example will influence neighbors to plant natives too. Harlequin Gardens and High Plains Environmental Center are two of the many nurseries that sell wonderful native plants. No matter where you live, patronize the locally owned nurseries for a better selection of locally grown natives for your elevation and growing conditions.

Lenore Mitchell is an avid amateur who has taught Native Plant Master® courses through CSU Extension's Jeffco office for more than twelve years and has presented courses for Osher Lifelong Learning Institute (OLLI) at Denver University and other programs. She says teaching is a great way to keep learning. She's also the current Metro-Denver chapter president. ✨

◀ “Taraxacum ...” continued from page 26

Verduijn, M. H., P. J. Van Dijk, and J. M. M. Van Damme. 2004b. The role of tetraploids in the sexual-asexual cycle in dandelions (*Taraxacum*). *Heredity (Edinb)*. 93:390–398.

Austin Lynn is a PhD candidate at the University of Missouri working with Dr. Candace Galen on questions dealing with pollination biology, breeding system, and niche differentiation. He has worked on Pennsylvania Mountain in the Mosquito Range for the past five summers, and aspires to continue researching alpine ecology in the future. Austin is also passionate about outreach, and has worked with the Mountain Area Land Trust to lead guided wildflower hikes and teach alpine botany to local enthusiasts. Contact Austin at alynn91@icloud.com or amlqb4@mail.missouri.edu.

The author gives special thanks to Dr. David Bogler and the Missouri Botanical Garden for training on the scanning electron microscope. ✨

Utah's Pando: the World's Oldest and Largest Living Organism Threatened

Pando is Latin for “I spread.” Recent media reports say the spread of Pando (a grove of *Populus tremuloides* in Utah) has diminished. The cloned forest encompasses 107 acres and formerly comprised of more than 80,000 trees. Recent reports say it is much reduced due to a number of factors.

Check out the following resources for more recent information:

<https://www.atlasobscura.com/places/pando-the-trembling-giant>

<https://cosmosmagazine.com/biology/the-largest-organism-on-earth-is-dying>

<https://www.nytimes.com/2018/10/17/science/pando-aspens-utah.html>



Aspen Grove. © Mary Menz

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Please make check payable to:
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DUES include *Aquilegia* newsletter, published quarterly.

Most members receive the *Aquilegia* newsletter electronically.

Send completed form and full remittance to:
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Check the box if you would like to receive the printed, black-and-white copy of *Aquilegia*.

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



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2018 Photography Contest



Third place winners of the annual photo contest include (clockwise from upper left) Kelly Ambler (Native Plant: *Calypso bulbosa*, fairy slipper), Laurie Paulik (Landscape: Dallas Divide *Populus tremuloides*, aspen), Carol McGowan (Artistic: *Mentzelia decapetala*, blazingstar), and Jan Gorski (Wildlife: sphinx moth with *Delphinium barbeyi*, subalpine larkspur). All photos are copyrighted by the photographers mentioned and used with permission.



Colorado Native Plant Society

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Check out the CoNPS job openings on Page 28!



Above are two of the four second place winning photos in the CoNPS 2018 Photo Contest. See inside front cover for more about the annual contest and award-winning photographers.