Aquilegia

Newsletter of the Colorado Native Plant Society

IN THIS ISSUE

Volume 41 No.1 Winter 2017

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

AQUILEGIA: Newsletter of the Colorado Native Plant Society
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Aquilegia is the newsletter of the Colorado Native Plant Society. Members receive four regular issues per year (Spring, Summer, Fall, Winter) plus a special issue for the Society Annual Conference held in the Fall. At times, issues may be combined. All contributions are subject to editing for brevity, grammar, and consistency, with final approval of substantive changes by the author. Articles from *Aquilegia* may be used by other native plant societies or non-profit groups, if fully cited to the author and attributed to *Aquilegia*. The deadline for the Spring 2017 issue is March 15 and for the Summer issue is June 15. Announcements, news, articles, book reviews, poems, botanical illustrations, photographs, and other contributions should be sent to the editor.

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Front Cover Photo: Rocky Mountain Fringed Gentian and White-lined Sphinx Moth. Photo © Dave Elin. On pages 14-18, Nick Waser & Mary Price discuss changes in the understanding of pollinators and plants.

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Botanicum absurdum by Rob Pudim

Rob Pudim ©2016

From the Editor

Spring is almost here! Originally, this issue was going to feature a summary of the 2016 Colorado Native Plant Society Annual Conference, the 2016 Colorado Rare Plant Symposium, and associated events and the 2016 CoNPS Annual Report. That information is being bumped to the Spring issue because there are so many great articles and book reviews that were waiting for publication.

Two of the articles in this issue are based on talks from the Annual Conference and both of them are quite significant. One is "40 Years of Change in Pollination Biology" by Nick Waser & Mary Price and the other is "Return of the Native: Native Colorado Plants in Horticulture" by Panayoti Kelaidis. We are also fortunate to have articles by Ross McCauley ("Climate Change and Columbines"), Amy Yarger ("The Urban Prairie Project"), and Susan Carter ("The Ute Learning and Ethnobotany Garden").

Photo © Audrey Boag

Waser and Price have spent many years at the Rocky Mountain Biological Laboratory in Gothic, Colorado, researching pollinator/flower interaction. In the past, we learned which flowers were hummingbird flowers, bee flowers, moth flowers, etc. (pollination syndromes), but the article by Nick Waser and Mary Price introduces us to research that demonstrates that the relationships are much more complicated than originally thought. This was nicely illustrated by Audrey Boag's winning photo from the 2016 CoNPS Photo Contest of a hummingbird feeding from the dingy brown "wasp flower", lanceleaf figwort, (*Scrophularia lanceolata.)* The flower of this plant appears to mimic the appearance of a female wasp, attracting male wasps to the flower to pollinate it. Audrey's photo shows that even though the flower is not long, tubular and red, it is still attractive to hummingbirds. According to Nick Waser, *Scrophularia lanceolata* produces large quantities of nectar and hummingbirds are aware of it.

Many members of CoNPS are concerned about the fate of pollinators and have worked to help the situation by becoming bee keepers. Nick and Mary have alerted members that the *Varroa* mite (that carries a virus that infects honeybees) is being spread to bumblebees and other native bees. Flowers can be contaminated with the virus from the droppings of infected honeybees.

Panayoti Kelaidis of the Denver Botanic Gardens is known not only as an outstanding horticulturist but also as a plant explorer who has found beautiful, drought-tolerant plants from other continents and introduced them to Colorado gardens. Many people do not realize that Panayoti is also a native plant expert and one of the earliest members of the Colorado Native Plant Society. He has promoted the cultivation of native plants and served as the second Secretary on the Board of CoNPS. In his article, "Return of the Native," he discusses the history of the use of Colorado native plants in horticulture in our state and a number of the people who played an important role in native plant horticulture and landscaping.

Let's Make a Difference!

In "Conservation Corner," Linda Smith describes what you can do to help protect the public lands. She attended the Wilderness Gathering in Buena Vista and became acquainted with the people and organizations who are working to save public lands, wildlife, and plants. if you are interested in becoming active in groups involved in legislation and litigation to protect habitat and plants, Linda's article provides the contacts for groups that are active in this arena. As reported in the last issue of *Aquilegia*, there are many threats to wildlife and plants including resort development, energy development, and other activities in our region and elsewhere and a number of groups are working to protect areas that are important to sustain biodiversity.

CoNPS has been going through a reorganization and could really use your help. New members are needed on the Board and the Chapter Presidents and Committee Chairs can always use volunteers to help out. If you are interested in helping, please contact Administrative Coordinator, Linda Smith at conpsoffice@aol.com. There is more information about this on the bottom of page 6.

The CSU Extension Native Plant Master Program is celebrating their 20th anniversary. Congratulations to Barbara Fahey, NPM program founder, Irene Shonle, Susan Carter, and the many other staff and volunteers who have made this program such a success. You can help support their program through donations and by taking their classes.

The winter chapter programs are starting to wind down and soon it will be field trip season. Remember that the CoNPS Event Calendar on the CoNPS website has the most current information. (https://conps.org and then click on Event Calendar). If you don't have internet or email, consider visiting a library for access to these because the chapters send out their newsletters of chapter events by email, Linda Smith sends out CoNPS ENews through emails, and all current events are listed on the Event Calendar on the CoNPS website. A librarian can help you use email and the internet or you could ask a relative or friend for assistance.

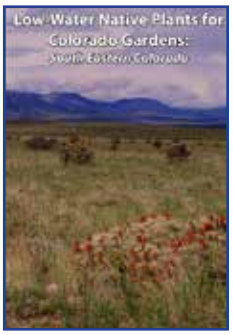
There are many things you can do to raise public awareness about important issues. Through the Education Committee, you can present programs about native plants and pollinators and the importance of native plants for biodiversity, you can garden with native plants to bring biodiversity to your yard, you can help with restoration projects, serve on the conservation committee, help with the plant sale, coordinate a plant sale for your chapter, or write articles or take photos for *Aquilegia*. Whatever your talents, there is something you can do through CoNPS to make a positive difference for native plants and the environment.

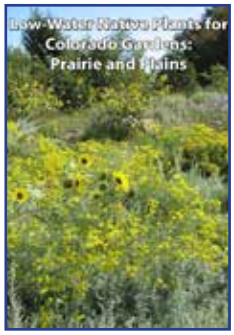
Jan Turner, Editor

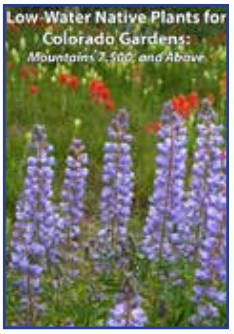
NEWS & ANNOUNCEMENTS

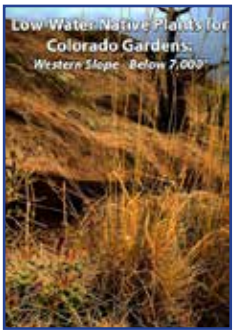
New Native Plant Gardening Guides Now Available on CoNPS Website

The entire series of Colorado native plant gardening guides is now available, covering 5 regions of the state. Many thanks to the CoNPS Gardening Guides Committee chaired by Irene Shonle for producing these beautiful and informative guides. In addition to Shonle, committee members included Nick Daniel, Deryn Davidson, Susan Crick Smith, Jim Tolstrup, and Jan Loechell Turner.









Collect all 5!

Available on CoNPS website https://conps.org

Steve Popovich Heads East for New Job

Steve Popovich (USFS Botanist, Arapaho Roosevelt NF), who grew up in Boulder, accepted the job of Emergency Stabilization and Rehabilitation National Program Leader in the Forest, Rangeland, Riparian and Plant Conservation Division of the Bureau of Land Management in Washington, DC. Steve will provide national policy leadership and program coordination of post-fire recovery programs, emergency stabilization, and burned area rehabilitation. Steve served as chair of CoNPS Field Studies Committee from 2008-2017. Congratulations, Steve!

New Committee Chairs

Field Studies Committee – Due to Steve Popovich's recent resignation as Chair (many thanks Steve, for all the years of hard work), Steve Olson and Lara Duran have offered to become the new co-chairs of the committee.

Restoration Committee - Sara Copp Franz resigned from the committee because of her busy work schedule and Renee Galeano-Popp volunteered to become the new committee chair. Sara has been an outstanding CoNPS volunteer.

Landscaping with Colorado Native Plants Conference 2017

The 2nd annual Landscaping with Colorado Native Plants Conference was held on February 11, 2017, at The Ranch in Loveland. CoNPS teamed up with partners to host the conference: Butterfly Pavilion, CSU Extension, Denver Botanic Gardens, the High Plains Environmental Center and author Susan J. Twiet. There were three tracks including many renowned speakers such as Jim Borland, Kelly Grummons, Scott Skogerboe and Dan Johnson. The conference was sold out a few weeks ahead with a waiting list of 50, which indicates how much interest there is in Colorado native plant landscaping.

Left: Conference Committee members (L to R): Jen Bousselot, Ronda Koski, Amy Yarger, Deryn Davidson, Jim Tolstrup, Irene Shonle, Susan Tweit, Nick Daniel, and Karen Crumbacker; **Right:** Jim Borland

CoNPS Online Spring Native Plant Sale Order Online by April 15th

The CoNPS Online Native Plant Sale is now in progress. Place your order now and pick up your order during the first week of May in one of four locations (your choice): Boulder, Colorado Springs, Denver, or Fort Collins. Specific distribution dates and addresses will be available by April 15th.

Volunteers are needed. To volunteer to help with the plant sale, please contact Jen Bousselot at conpspromote@gmail.com.

CoNPS Native Plant Sale at Denver Botanic Gardens April 15

The Metro-Denver Chapter of CoNPS is partnering with the Rocky Mountain Chapter of the North American Rock Garden Society (NARGS) for a plant sale.

Volunteers Needed!
Friday - April 14: Help with sorting and preparation

Saturday - April 15: Two volunteers needed from 8am to noon, and 2 from noon to 4pm

Contact Jen Bousselot: conpspromote@gmail.com or Lenore Mitchell metrodenverconps@gmail.com

Colorado Rocky Mountain Wildflowers App

Al Schneider's popular Colorado Rocky Mountain Wildflowers app contributes a portion of each sale to CoNPS. See the CoNPS Bookstore for details.

Wildscape Ambassador Training is Back !

Due to the huge popularity of the training sessions last fall, more sessions are now being offered all along the front range, sponsored by Audubon Rockies, CoNPS and the High Plains Environmental Center. Help spread the word about actively restoring natural habitat for birds, butterflies, and other pollinators by implementing water-wise and native gardens in our landscapes and learning the tools of the trade to deliver a presentation to your local garden center/nursery, garden club, community center, HOAs. **Special Notes: Attendees will receive a Wildscape Ambassador Handbook and invitation to our network sharing platform. If you have any questions, please contact David Julie, bldrjardin@live.com.

March 17, 11-1pm - Audubon Society of Greater Denver Nature Center, Littleton. Register at http://www.brownpapertickets.com/event/2766585

March 18, 11-1pm - Rawlings Public Library, Pueblo. Register at http://www.brownpapertickets.com/event/2766550

Intermountain Flora Set (Vol. 1-7) Available

CoNPS has just received a donation from Rudi Schmid of the complete set of I*ntermountain Flora*. unread, in "like new" condition. Schmid's name is written neatly inside some of the volumes. This is a special opportunity for someone to purchase volumes 1-7 (9 books) of this outstanding reference. The newly (2017) published vol. 7 is included.

v.1. Geological and botanical history of the region, its plant geography and a glossary. The vascular cryptogams and the gymnosperms
v.2 pt.A. Subclasses Magnoliidae-Caryophyllidae
v.2 pt.B Subclass Dilleniidae
v.3 pt.A. Subclass Rosidae (except Fabales)
v.3 pt.B. Fabales
v.4. Subclass Asteridae (except Asteraceae)
v.5. Asterales
v.6. The monocotyledons
v. 7 Potpourri: Keys, History, Authors, Artists, Collectors, Beardstongue, Glossary, Indices

The set is being offered at a discounted rate of $460 (you pay shipping) and only one set is available. Our thanks to Rudi Schmid for this generous donation. If you are interested in purchasing this set, contact Linda Smith at conpsoffice@aol.com.

Thank you, Rudi!

Many thanks to Rudi Schmid for his generous donation of the complete set of *Intermountain Flora* (7 volume set = 9 books). Rudi is Professor Emeritus, Integrative Biology, UC Berkeley, and former editor of the RevNot column of *Taxon: The International Journal for Plant Taxonomy.*

Rudi at Antelope Valley Calif, Poppy Reserve, 2003, Photo by Ray Cranfill

From the Board

CoNPS Committee Updates

Conservation Committee
The Conservation Committee met on February 25 for our annual brainstorming meeting. Just prior to that meeting Mo Ewing (Conservation Committee chair), Steve Popovich (Field Studies Committee chair), and Sara Copp (Restoration Committee chair) met to clarify the roles of each committee. The new slimmed-down role of the Conservation Committee will be to concentrate our efforts on advocating for native plants rather than focusing on on-the-ground conservation projects. We plan to work on the state-wide Colorado Rare Plant Initiative, promote native plant advocacy at the chapter level, work jointly with the nationwide Native Plant Conservation Campaign and continue to develop partnerships with other conservation agencies in Colorado to leverage our impact on legislation at the state and federal levels. Minutes of the meeting will appear on the Conservation Committee web page within a couple of weeks. *For information on the Native Plant Conservation Campaign, go to http://plantsocieties.cnps.org/*

Education/Outreach Committee
American Land and Leisure manages campgrounds along the Front Range and has invited CoNPS to lead wildflower and plant appreciation hikes this summer. Opportunities in the north include Dowdy, Mountain Park, Jack's Gulch, and Chambers Lake campgrounds. Near Boulder: Camp Dick and Brainard Lake campgrounds. And near Denver: Echo Lake campground. Dates are flexible. Please contact David Julie (bldrjardin@live.com) if you would like to lead a hike. Thank you!

Media Committee
The 2017 Spring issue of *Aquilegia* will be coming out soon. If you have any submissions for future issues of *Aquilegia*, please contact Jan Turner, editor, at JLTurner@regis.edu.

Restoration Committee
Sara Copp-Franz recently resigned as Chair and Renee Galeano-Popp has volunteered to be the new Chair. Thank you both for your past and future endeavors with this very important committee. The Restoration Committee is devoted to the reclamation and revegetation of disturbed lands as well as the restoration of ecosystem functions at the landscape scale. We are looking for members who will serve on the committee or act as technical advisors to the group. Initial ideas are to:

- Inform chapters of relevant events
- Provide technical advice to land managers
- Prepare regional lists of recommended species by soil types
- Develop workshops
- Promote noxious weed awareness

If you are interested in volunteering or serving as a technical advisor, contact Renee Galeano-Popp mtnpoppies@aol.com

Field Study Committee
The 2017 Bioblitz will take place in San Isabel National Forest near the Leadville. See news item to right. Contact Steve Olson or Lara Duran for details. sdolsonoslods@aol.com, ld.ecowise@gmail.com

Time to become involved in CoNPS and help make us better than ever!

CoNPS is seeking candidates for Members-at-large for the Board of Directors. Each nominee must submit a short biography and reasons for wanting to serve in the position they are hoping to fill by June 15, 2017. All biographies will appear in the Summer issue of *Aquilegia*. Voting will take place electronically around the time of the Annual Conference this fall.

Members-at-large sit on the Board and vote on topics and issues pertinent to the organization. In addition, they may also serve as officers of the board and/or be willing to volunteer for other projects or activities which the board wishes to accomplish.

Members-at-large candidates may also indicate their interest in filling any of the three officer positions which the board will choose later in the fall. The three positions are President, Vice President and Secretary.

The President is responsible for general supervision of the affairs of the Society, running board meetings and serving as the main contact of the Society. S(he), with the help of others, oversees committees and chapter activities.

The Vice President serves in place of the President as needed, assists the President with his/her duties and also supervises elections to the Board.

The Secretary gives notice of Board meetings, prepares agendas, takes minutes and subsequently distributes them to the Board, the website, and to the Regis University Library Archives.

Members of the Board are responsible for making sure that the Society works actively to encourage the appreciation and conservation of the native plants and ecosystems of Colorado. These positions can be demanding but also highly rewarding. CoNPS is as good as the members themselves make it. All are encouraged to volunteer. If interested, contact Amy Yarger at amy@bigempire.com.

CoNPS Scholarship Committee

The Scholarship Committee raises and distributes funds to help alleviate financial barriers and to provide scholarships to support individuals with a desire to further their knowledge of native plants. We encourage anyone with a need to apply (use Scholarship application on website), whether you're a student, recent graduate, developing professional, senior, or working hard to support a family. Please consider gifting a unique opportunity to others (Donate on the websitSe)

For more information contact Cecily Mui, cmui.svcc@gmail.com.

2017 Bioblitz in San Isabel National Forest!

The current plan for a bioblitz on the Pike-San Isabel this year is to feature the wetlands in the watersheds just to the north of the Leadville National Fish Hatchery and south and west of Turquoise Lake. We will be working in coordination with the Lake County inventory being done by Colorado Natural History Program. The dates are July 28-30 (Friday to Sunday). You can sign up now on the CoNPS Event Calendar!

Quigley Introduces Botanical Sciences Bill to Support Biodiversity & Sustainability of America's Ecosystems

The following press release is from U.S. Rep. Mike Quigley's website, https://quigley.house.gov/media-center/press-releases/quigley-introduces-botanical-sciences-bill-support-biodiversity:

Feb 14, 2017 Press Release WASHINGTON – Today, U.S. Representative Mike Quigley (IL-05), Vice Chair of the Sustainable Energy & Environment Coalition, introduced the Botanical Sciences and Native Plant Materials Research, Restoration and Promotion Act to support the botanical science capacity of the federal government.

"Botanical knowledge impacts our lives in more ways than most Americans realize. From combating climate change and enhancing food security to restoring uniquely American native habitats and protecting our endangered species, botany plays a central role in addressing some of our country's biggest challenges," said Rep. Quigley. "One of our nation's greatest assets is its biodiversity, which is why we must support the health of these ecosystems, as well as the dedicated scientists that have made our earth's preservation their life's work. I am pleased that this bill will support their mission to sustain native and locally adapted plants so that America remains a vibrant, inspiring, and sustainable place to call home."

"From the Silver Palmetto to the Beach Sunflower, South Florida is home to a diverse group of native plants, many that are unique to our tropical climate and growing conditions," said Rep. Ileana Ros-Lehtinen (R-FL), who co-introduced the bill. "Introducing this bill with my colleague, Mike, is a positive step in ensuring the preservation, conservation, and restoration of the native species that characterize our communities and nation. We have a responsibility to help maintain a healthy and sound ecosystem that we can all be proud of. I'm glad that this bill will also encourage young people to enter careers in botanical science."

In the United States, botanical experts help to study, effectively manage, and guide the sustainable use of the nation's vast plant resources. However, the country is projected to lose nearly half of its botanical expertise in the next decade as experienced scientists retire and are not replaced, leading to myriad direct and indirect costs both in dollars and in the loss of critical cultural native landscapes. Both the Bureau of Land Management, which employs just over 1 botanist per 4 million acres managed, and the US Geological Survey have already reported a deficiency in botanical capacity. At the same time, advanced degrees in botany have decreased by 41% in the last decade.

The Botanical Sciences and Native Plant Materials Research, Restoration and Promotion Act aims to increase the botanical science capacity of the federal government. It allows federal agencies to act with the expertise required to preserve unique American landscapes and emphasizes the importance of protecting native plants and plant ecosystems.

Additionally, the bill:

- Creates a new program of botanical science research within the Department of the Interior to help increase federal botanic expertise and allows DOI to hire new, additional personnel
- Creates a student loan repayment program for botanical scientists to encourage more students to make the decision to enter the field and to support them once they've graduated
- Declares a federal policy that the Departments of Interior, Agriculture, and Defense preference the use of locally-adapted native plant materials in their land management activities
- Requires states to utilize native plant species where possible and practical
- Establishes a new program to support collaborative grants to prevent rare plant species from becoming endangered and to remediate already endangered populations.

High Plains Environmental Center's Grand Opening and Native Plant Sale in Loveland May 13

On Saturday, May 13, 2017, HPEC will celebrate the grand opening of their new location at 2968 Bluestem Willow Drive in Loveland (located in The Lakes at Centerra). There will be tours and the sale of pesticide-free native plants. The plants were grown at the HPEC nursery and many are from seeds collected in Larimer County. http://suburbitat.org/native-plant-sale/

Directions: 2968 Bluestem Willow Drive Loveland, CO 80538 From I-25 take the Loveland/Highway 34 exit. Head west on 34 to Boyd Lake Road, go north on Boyd Lake to the 2nd roundabout, head east on Long Pine Lake, drive to the end of Long Pine Lake and park at their new building.

Randy Mandel Now with Great Ecology

Randy Mandel – Vice President, Technical Services

Randy Mandel has over 32 years of experience as a restoration ecologist. He has been a key revegetation specialist for multiple restoration, reclamation, and remediation projects, including: 14 national parks and monuments; over 26 wetland, 32 lacustrine, and 29 riverine projects; reservoirs; and various mitigation banking, wetland delineation and remediation, and biofiltration projects. He was the Co-Founder and Vice President of Rocky Mountain Native Plants Company and has authored over two dozen publications, including international journal articles and a stand-alone monograph on the use of wetland plant species for biofiltration. Additionally, Mr. Mandel has overseen the installation of over 5,000 restoration projects, and specializes in site-specific native plant ecology and propagation. He holds a Bachelor of Science in Forest Biology from Colorado State University. He also worked on two Masters-level projects focused on Forest Physiology/Genetics at Colorado State University.

Photo and text courtesy Great Ecology

Happy 20th Anniversary, Native Plant Master Program!

As many of you know, the Native Plant Master Program is a valuable resource in Colorado, connecting residents to research-based information and native plant classes for beginners. They must generate much of their own funding. You can support them with donations and by attending their classes. A webinar is coming up soon and courses will be offered this Spring and Summer.

CSU Extension Native Plant Master Program Metro - to - Mountain Group Classes
Ongoing spring thru summer 2017
For the webinar or classes: https://www.eventbrite.com/d/co--denver/native-plant-master/

CSU Native Plant Master Classes in Grand Junction
Classes at Colorado National Monument, (April/May) Black Canyon of the Gunnison (June), and Grand Mesa (July).
https://tra.extension.colostate.edu/wp-content/uploads/sites/9/2016/02/2017Native-Plant-Master-Volunteer-Application-Adult.pdf
For details contact Susan Carter, *(970)244-1850, susan.carter@colostate.edu*

June 3 first annual CSU Extension Demonstration Day

Larimer County http://larimer.colostate.edu/nati/nati.shtml

Boulder County https://www.eventbrite.com/o/csu-extension-native-plant-master-program-boulder-county-6237139481

Plant Science Degrees Making a Comeback: ASU and Desert Botanical Garden's Collaboration

Many of us, including botany professors and CoNPS members, have been bemoaning the fact that botany degrees and classes have been eliminated from many universities in favor of cellular/molecular oriented classes and research that often receive more grant funding. The lack of classes and degrees has resulted in a lack of qualified botanists to fill positions with government agencies and consulting firms, to research endangered plant species. and their habitats.

At last, there is some good news! Arizona State University is offering a Master's in Plant Science and Conservation in cooperation with the Desert Botanical Garden. Other universities and botanical gardens are working together to offer similar programs.

Researchers at the botanical gardens can serve on graduate committees, provide opportunities for students to work with them on their research to gain "hands on" experience, and lecture on their areas of expertise.

More information at https://asunow.asu.edu/20160930-partnership-plant-biology-and-conservation

Summer Education Program - Research/Internships/Awards RMBL (Rocky Mountain Biological Laboratory)
http://www.rmbl.org/students/undergraduates-beyond/summer-education-programreu/

Jobs

See CoNPS website (http://conps.org) for details.

Boulder County Youth Corps Team Leaders, Asst Team Leaders

Harlequin's Gardens - Boulder - Multiple Positions Open

Seasonal Weed Control Aide for Larimer County

Weed and Pest Technicians (Temporary) for Jefferson County

Seasonal Naturalist Part-Time for the City of Aurora

Seasonal Parks/Urban Forestry Positions for Highlands Ranch Metro District

Parkways Landscape Technician I for Highlands Ranch Metro District

Junior Ranger Teen Crew Leader Seasonal for Boulder County OSMP

Open Space & Trails Resource Specialist for Summit County

Temporary Park Services Technicians for Jefferson County

Watershed Coordinator for Little Thompson Watershed Coalition

Wilderness Workshop 2017 Summer Internship

2017 Natural Areas Assoc. Conference in CO

Taking place October 10-12 at the Hilton Fort Collins in Fort Collins, the theme is "Working Beyond Boundaries: Collaboration as a Key to Natural Areas Management." This year's session topics can be found here: http://www.naturalareasconference.org/session-topics. The types of proposals they are seeking, and instructions on how to submit, are available at: http://www.naturalareasconference.org/abstracts. All presenters must register for the conference. Students are encouraged to submit abstracts for posters and presentations, and compete for prizes in the student presentation competition.

Vickery, Augustine, Prah, and Yarger Present Poster at High Elevation Restoration Conference

John Vickery, David Augustine, Chris Prah, and Amy Yarger presented a poster, "Vegetation Management with Wildlife in Mind," at the 2017 HER-CeRSER Conference (Central Rockies Chapter of the Society for Ecological Restoration), March 7-9, at CSU in Fort Collins. Featured Colorado cases included: Prescribed fire and mountain plover breeding habitat; Wetland vegetation treatments for leopard frog breeding habitat; Prairie restoration and pollinators; Haying practices and ground-nesting birds.

EPA Student Volunteer Program
The US Environmental Protection Agency's (EPA) Denver Regional Office is offering a number of opportunities in 2017 for students to gain valuable professional experience through its student volunteer program. Each position with details may be found at: https://www.epa.gov/careers/volunteer-unpaid-internship-opportunities-currently-open-epa. Student Volunteer Intern Fair: The EPA regional office is hosting two intern fairs at 1595 Wynkoop Street on March 22 from 12:00 pm – 5:30 pm.

(Cont. on bottom of page 35)

Letter to the Editor

Ribes and White Pine Blister Rust: A Second Look by Mikl Brawner

I enjoyed the article by Renee Galeano-Popp in the Fall 2016 *Aquilegia*, but I would like to take exception to her statement that in terms of alternate hosts of gooseberries and currants that "just about any *Ribes* species will do."

Currants and gooseberries have been increasing in popularity among gardeners because their fruits are high in immune-building phytochemicals, because they take up less space than a fruit tree, are easier to pick the fruit, are productive even with late freezes and recent introductions are better flavored and more resistant to diseases.

According to the American Phytopathological Society, symptoms of White Pine Blister Rust (WPBR) on alternate hosts are orange pustules on the undersides of leaves. I personally have never seen that condition on any of the *Ribes* at our nursery, nor have I seen that symptom on *Ribes aureum* or *R. cereum* in the wild. According to Cornell University, both *Ribes aureum*, *Ribes odoratum* and *R. odoratum* 'Crandall' are very resistant to WPBR and in fact both have been used in Canada for breeding resistant varieties of black currant, *Ribes nigrum*.

In general, the European Black Currant, *R.nigrum* is the most susceptible to WPBR, but there are a few resistant varieties: 'Consort', 'Crusader', Titania'.

Based on tests in Oregon and Idaho, these varieties are also considered to be the most resistant to WPBR: Gooseberries: Invicta, Jahns Prairie, Poorman, Captivator, Black Velvet, Pixwell; Currants: Rovada, Rondom, White Imperial, Red Lake, Blanca; Gooseberry-Currant crosses: Jostaberry, Orus 10. *Ribes ussuriensis* is very resistant.

Culturally, White Pine Blister Rust prospers in cool, moist conditions, especially in low-lying areas. So proper watering deeply and infrequently with a mulch to hold moisture while reducing evaporation will help reduce fungal infections of all kinds. Also strengthening the plant with an organic fertilizer and with rock minerals also reduces the chance of fungal diseases. Gooseberries are now only prohibited in 5 eastern states.

One of our favorite resistant *Ribes* is 'Gwen's Buffalo', a selection of our native *Ribes aureum*, the Golden Currant.

Aquilegia in Biodiversity Heritage Library

Aquilegia: Newsletter of the Colorado Native Plant Society, is being added to the online Biological Heritage Library through a federal grant program, Expanding Access to Biodiversity Literature. Patrick Randall, Ernst Mayr Library, Museum of Comparative Zoology, Harvard University is the Community Manager of the grant. The grant is used to add unique content to the BHL. "The Biodiversity Heritage Library improves research methodology by collaboratively making biodiversity literature openly available to the world as part of a global biodiversity community. BHL also serves as the foundational literature component of the Encyclopedia of Life." http://www.biodiversitylibrary.org/

52 Million Year Old Tomatillo Fruit Fossil

An article in the magazine, *Science*, reported that a 52.2 million year old fossil of the inflated 5-lobed calyx of a *Physalis* (ground cherry or tomatillo) fruit was found in Patagonia in an ancient lake bed by Paleobotanist Peter Wilf from Penn State University and his team.

Physalis is in the Solanaceae or nightshade family (that includes tomatillos, tomatoes, potatoes, eggplant, bell peppers, and chili peppers as well as the poisonous sacred datura).

Recent molecular divergence estimates had placed the date of divergence of the Physalinae at 11 million years ago and the crown of the Solanaceae family at 30 million years ago. The discovery of the fossil shows that the family goes much farther back in time and the family originated before South America started breaking apart from supercontinent Gondwana.

Experiments have demonstrated that the lantern fruit can float in water with air pockets around the seeds. This means the genus could have its origins in a rainy, humid riparian environment.

For more information, read the article in *Science* at your local public or university library:

Wilf, Peter, Carvalho, Monica R., Gandolfo, Maria A., and N. Rubén Cúneo. (6 Jan. 2017). Report: Eocene lantern fruits from Gondwanan Patagonia and the early origins of Solanaceae. *Science* vol. 355, pages 71–75.

People and Pollinators Action Network (PPAN)

People and Pollinators Action Network (PPAN) is working across Colorado to promote sustainable agricultural practices, safeguard public health, and improve the environment by fostering a strong movement to build community awareness, change policies and support best practices in pollinator habitat management and the use of chemical pesticides. PPAN engages and mobilizes communities and individuals to find ways to protect pollinators and people at home, in our communities and by educating and engaging our elected officials. PPAN is currently working with Colorado State lawmakers to expand pollinator habitat statewide. The need for state leadership has never been so important considering the current efforts to eliminate environmental protection at the federal level.

Pollinators, both native and introduced species, are essential to ecosystem health overall and to agricultural productivity. Protecting them can be challenging in the face of declining habitat that has safe forage, climate change, and excessive and improper use of chemical pesticides. These issues contribute to lowered immune systems causing pollinators to be more susceptible to pests and pathogens, resulting in record population declines. By creating pollinator habitat on landscapes of all sizes, from rural to urban, we can collectively give pollinators necessary habitat to thrive. Start locally by planting native pollinator-friendly species in your own backyard, avoid the use of pesticides, encourage neighbors to do the same, and speak to local and state leaders about supporting policies that protect and create pollinator habitat. Please join and financially support PPAN's growing movement across the state to create and sustain pollinator habitat. http://peopleandpollinators.org/

Workshops

Sign up for workshops online on the CoNPS Event Calendar, https://conps.org/mfm-event-calendar/#!calendar . Sign in using your member login to receive member rates. CoNPS will provide beverages and snacks. For lunch, attendees can either bring their lunch or purchase lunch at a nearby restaurant.

If workshop is full, please contact conpsoffice@aol.com to be placed on a waiting list.

If you have questions, please contact Ronda Koski, Workshop Coordinator, ronda.koski@colostate.edu

Saturday, March 25, 2017
The Influence of Soil Properties on Where Native Plants Grow
CSU Hort Center, 1707 Centre Ave, Fort Collins
Instructor: Jean Reader and Jim Self
This workshop is full. To be placed on a wait list, please contact Linda Smith at conpsoffice@aol.com for more information.

Saturday, April 1, 2017
Using CO Native Plants on Green Roofs
Douglas County Ext., 410 Fairgrounds Road, Castle Rock
Instructor: Jen Bousselot
Rooftops are often overlooked as available space in our landscapes. Green roofs are an innovative way to bring more green space and biodiversity into our urban areas and can be used to conserve rare or imperiled Colorado native flora. Participants will also understand the relevance of green roofs in Colorado from concept to project completion and maintenance. The day will end with examples of Colorado green roofs that already use native plants and discuss the possibilities for the future.

Instructor: Jen Bousselot is the CoNPS Events Coordinator and teaches classes at Colorado State University in the Department of Horticulture and Landscape Architecture. Jen completed her doctorate research studying green roof species selection, including Colorado native plants, and substrate compositions at Colorado State University in 2010.

Saturday, April 8
Great Plains Ethnobotany and Folklore
Poudre Learning Center, 8313 W F St, Greeley
Instructor: Don Hazlett
Don will begin the session with an introduction on current trends in ethnobotany and ethnobiology research, followed by discussion of specific plant species from eastern Colorado and the Great Plains, and a presentation of the insights to ethnobotany available from the translations of Native American plant names. Attendees are encouraged to participate in the discussions and to share the ethnobotany stories that have been passed down through their families!

Instructor: Donald L. Hazlett, Ph.D., earned his doctorate in tropical forest ecology (Honduras) from the University of Washington, Seattle in 1980. Don lived and worked as a botanist in tropical countries for 10 years and is still actively working on several Honduran floristic projects. For the past 20 years, Don has specialized in ethnobotany and has prepared a series of shortgrass steppe essays that includes folklore and ethnobotanical topics. He maintains a master list of all steppe plants (6 states). On this list are annotations, such as translations of indigenous plant names, Spanish common names, plant uses, ecological notes, and a few humorous (at least to some) anecdotes attributed to Plainsman Pete. Plainsman Pete is a fictional curmudgeon of the Plains with an endless supply of stories. Don often doubts the validity of Pete's stories, but he is assured that they are as true now as they ever were!

Saturday, April 9, 2017
Tropical and Latin American Ethnobotany
Poudre Learning Center, 8313 W F St, Greeley
Instructor: Don Hazlett
Don will show and discuss plants from the ethnobotany materials collection maintained at Denver Botanic Gardens. Attendees will learn intriguing information about the names given to many of our common nuts and grains. Key topics will be herbal plants sold in Hispanic boticas (pharmacies) in CO, NM and TX. Santeria herbal plants, many from Cuba, are also sold: these will be discussed as well. These are the syncretism or merging of plants and rituals from African slaves in the Antilles with Catholic religion and Native American tradition.

Saturday or Sunday, April 29 or 30 (choose only one)
Thistle Identification
Rocky Mountain Arsenal National Wildlife Refuge Contact Station, 6550 Gateway Road, Commerce City
Instructor: Carla DeMasters
This beginner to intermediate level workshop will review plant identification terminology specific to composites, how to identify thistle species in the field using key traits, how to key out thistle species using a dichotomous key and information on the general ecology and prescribed management techniques for noxious weed species. Participants should bring a hand lens and *Colorado Flora: Eastern Slope* (Weber and Wittman). The Larimer County Natural Resources Program will be donating copies of the second edition of "Thistles of Colorado: Identification and Management Guide" to workshop participants. Workshop will include introduced species such as bull thistle, Canada thistle, musk thistle, Scotch thistle and native species such as Flodman's thistle, wavy leaf thistle and yellow spine thistle. Thistle look-alikes such as yellow star thistle, prickly lettuce, prickly poppy, and sow thistle will also be covered.

Instructor: Carla DeMasters has worked as a Plant Ecologist/Botanist in the Western United States for over 13 years. She currently works as a Restoration Ecologist with Westervelt Ecological Services. She has a Master's degree in Geography from CU Boulder, where she studied the biogeography of reproductive modes in *Erigeron strigosus* (prairie fleabane). Carla is interested in habitat conservation and restoration and is finishing a graduate degree in Biology with a focus in ecological restoration from CU Denver this spring.

Chapter Programs & Field Trips

Chapter meetings and other events are listed on the CoNPS Event Calendar at https://conps.org/mfm-event-calendar/#!calendar

Boulder Chapter

Where: Boulder Rural Fire Station, 6230 Lookout Road in Gunbarrel **Time:** 7 p.m. to 8:30 p.m.

If you have questions, please contact Erica Cooper, CoNPS Boulder Chapter President, at boulderconps@gmail.com.

March 14, 2017; 7-8:30 p.m.
City of Boulder Grassland Monitoring
Presenter: Ann Lezberg, Monitoring & Research Analyst, City of Boulder Open Space & Mountain Parks
As part of the City of Boulder Grassland Ecosystem Management Plan (GMAP) implementation, botanists have been monitoring vegetation in our grasslands using long-term transects since 2009. Using data from the eight years of monitoring, Ann will discuss this system-wide approach to monitoring, how the condition of grasslands is tracked using GMAP indicators, and illustrate examples of grassland diversity, stability, and fluctuations observed over the last eight years.

Prior to joining OSMP, Ann conducted ecological monitoring and research examining the aftermath of hurricanes, fire, and logging in the northeastern US, Colorado, and in the Pacific northwest.

Metro-Denver Chapter

These will be held in the Plant Society Building, Denver Botanic Gardens, 1007 York St. from 6:30-8:30 p.m.
The Plant Society Building is a modular unit that is the farthest west from the Conservatory northwest of the main DBG conservatory and greenhouses.
Meetings are from 6:30 to 8:30 pm (dates vary due to meeting room availability, but members voted to change from Wednesdays to Tuesdays when possible).

Bees' Foundational Role in Terrestrial Ecosystems
Tuesday, March 14, 2017; 6:30 pm
Denver Botanic Gardens, Plant Society Building
Presenter: David Julie
The interdependence of flowering plants and their most prolific pollinators, bees, plays a foundational role in many terrestrial ecosystems. In Colorado, about 950 species of bees have been documented. This presentation explores three types of bees and their life cycles. A solitary female leafcutter bee masses a one-time provision of pollen and nectar in a cell she constructs for each egg she lays. A bumble bee queen overwinters alone and incubates and feeds a set of daughter workers in the spring that tend the queen's subsequent offspring, culminating in drones and new queens to repeat the annual colony cycle. A honey bee colony stockpiles honey and pollen to enable the queen and thousands of worker daughters to survive the winter in a perennial colony, which multiplies by rearing a new queen while the original queen and some of her workers swarm. The presentation also introduces some citizen science projects like CU's Bees Needs and the Xerces Society's Bumble Bee Watch.
David Julie avidly grows native prairie plants with his partner, Kate Goes In Center. They observe and research the many species of bees, butterflies, and other insects that visit. They have 67 nesting blocks which contain about 3,000 developing solitary bees and wasps.

April 5 Wednesday; Flower Photography - improving photography with any camera
Panel: Loraine Yeatts, Audrey Boag and Kelly Ambler
Note: Change of room for this meeting only - Gates Room inside DBG's main building (instead of the Plant Society Building)

May 3 Wednesday - Native Plant Gardening by Irene Shonle (rescheduled from January)

More Chapter Events:

Metro Chapter is partnering with NARGS (North American Rock Garden Society) for a plant sale at DBG on April 15, 9am to 5pm . While NARGS promises approximately 10,000 plants from various nursery sources, CoNPS will present a variety of native plants supplied from High Plains Environmental Center and others. Additional volunteers needed: contact Jen Bousselot: conpspromote@gmail.com or Lenore Mitchell: metrodenverconps@gmail.com.

Summer Garden Tour planned for Saturday, June 10, 9 am to 4pm. Each of the 8 gardens on this year's tour will focus on a specific educational aspect of gardening with an emphasis on native plants and pollinator ecology. Marcia Tatroe's garden will focus on soil types and microclimates, while Bob Nold's garden focus is on penstemon varieties. Don Ireland's garden focus is water conservation, Master Gardener, Donna Baker-Brenningstall's focus is her wildflower meadow, Jannette Wesley's focus is on mixed perennial plantings and Lenore Mitchell's focus is the challenge of wind, wildlife and weeds (with labeled weed examples). Two public gardens round out the tour highlighting native plants at Carson Nature Center and also Chatfield Botanic Gardens, where Panayoti Kelaidis will present an informal talk. Free educational brochures will be available at each garden. Volunteers needed: contact Jen Bousselot, conpspromote@gmail.com, or Lenore Mitchell, Metrodenverconps@gmail.com.

We're also in the planning stages for a possible native plant festival event sometime this summer, so stay tuned for dates and details.

Metro-Denver Field Trip Schedule on Page12

Metro-Denver Chapter Field Trips

March 20th, Monday, 10 am to noon
Lair O' the Bear
Lenore Mitchell, Leader

May 5th, Friday, 4:30 pm to 8:30 pm
Hayden / Green Mountain Park
Judy King, Leader
Hike on flat ground following easy lower trail for one hour until 5:30 pm. At 5:30 pm, begin ascent to the tower on the Green Mountain Trail and loop back on the Hayden Trail. Hike is of moderate level 2 in difficulty. Possible flowers include the Easter Daisy, Sand Lily, Golden Banner, Short's Milkvetch, and Mountain Bladderpod. A plant list with updated plant names from Ackerfield will be available. Rattlesnakes are a possibility. Meet at the Hayden Green Mountain Trail Head in the Florida parking lot across from Green Mountain Recreation Center. Bring a flashlight if you plan to join the second hour of the hike.

May 11th, Thursday, 8:30 am to 1 pm
Roxborough State Park
Jannette Wesley & Susan Dunn, Leaders
It will be a casual, easy hike along Willow Creek Trail to find and identify the bountiful wildflowers found in the park. We will have a chance to see some unusual plants, e.g. Indian pipe (*Monotropa hypopithys*), clasping Venus' looking-glass (*Triodanis perfoliata*), hawksbeard (*Psilochenia occidentalis*) and some front range favorites: spreading daisy *(Erigeron divergens*), early spring senecio (*Senecio integerrimus*), white-flowered peavine (*Lathyrus leucanthus)*, and many more. You will need water, hat, sunscreen, good hiking or walking shoes, a snack, and a camera or sketching materials if you like. Snakes are a possibility. Meet at the Roxborough Visitor Center at 8:30 a.m.

A fee of $7 or a state park pass is required to enter the park. If you would like to car pool into the park from the shopping center located at Rampart Range Rd and the Waterton Canyon Rd. please call Jannette at 720-771-8681.

May 24th, Wednesday, 9 am to 11 am
Rocky Mountain Arsenal
Dennis Mead, Leader
Explore prairie plants, native plant garden, native prairie grasses, riparian habitat, short walks on good trails. The plant walk will be guided by a Refuge volunteer who specializes in prairie flora and will be able to help with plant ID. Photography opportunities are possible. We will start with comments on the re-seeding of the Refuge with native prairie grasses (to replace agricultural and other non-natives). We will create a list of plants in the area of Lake Mary and Lake Ladora. Good gravel trails. Walk 0.5-1.5 miles as desired. Bring hat, water, plant ID book.

Meet at 9:00 am at Rocky Mountain Arsenal National Wildlife Refuge Visitors Center, 6550 Gateway Rd., Commerce City, CO 80022. At Quebec and 64th St., turn east onto Prairie Parkway (64th becomes Prairie Parkway). Continue about 1 mile. Turn left onto Gateway Rd. and continue east through the entrance gate of the Refuge and a short distance farther to the Visitors Center.

June 10th, Saturday, 8:30 am – 12:30 pm
North Table Mountain
Tom Schweich, Leader
Traverse the west and southwest slopes of North Table Mountain on the City of Golden North Table Mountain Trail, then climb through the rim onto the top of the mesa, and return by way of the Jefferson County Open Space North Table Mountain Loop, crossing diverse plant communities where plains and foothills species mingle, including lichen-covered lava cliffs, slickrock and talus, grasslands, and shrublands. We won't do any hard-core keying, but some familiarity with local plants will be helpful. There will be a plant list with scientific and common names. A rattlesnake sighting is always possible on North Table Mountain. Western Poison Ivy is found on North Table Mountain. Several of the plants that we may find have stinging hairs.

The route is 2 to 2½ miles and will include a short steep climb with loose rock and a rock scramble requiring 2 to 3 foot steps up. Meet at North Table Mountain Trailhead. Off CO Hwy 93, 2.0 miles north on CO Hwy 93 from the intersection of US Hwy 6, CO Hwy 58 and CO Hwy 93. Watch for signs on the right, make a right turn on to the access road. Please carpool if possible, because the North Table Mountain trailhead parking lot gets very full on weekends. There is additional City of Golden parking at Wyoming Circle and Pine View Road; access from CO Hwy 93 from Ford Street.

June 12th, Monday, 8:30 am – 12:30 pm
North Table Mountain
Tom Schweich, Leader
See above description.

June 17th, Saturday, 9 am - noon
Staunton State Park
Lenore Mitchell, Leader

June 20th, Tuesday, 8 am to 12:30 pm
Hayden / Green Mountain
Judy King, Leader
Hike the Green Mountain Trail to the tower and loop back on the Hayden Trail. Flowers may include Mariposa Lily, White Horsemint, White Larkspur, Cream Tips, Copper Mallow, and Scarlet Gaura. Rattlesnakes are a possibility. Hike is moderate level 2 of difficulty. Meet at the Green Mountain Trail Head, the Florida Parking Lot on Alameda across from Green Mountain Recreation Center.

July 8, Saturday, 9 am – 1 pm
Ransom Edwards Jefferson Co. Open Space
Tom Schweich
Ranson/Edwards Homestead Open Space is unit of Coal Creek Canyon Park in northernmost Jefferson County, just west of Rocky Flats. Vegetation types include mixed prairie and montane forest. We will consolidate cars at the meeting point and make several stops with short forays into the grasslands and ponderosa pine woodland. There will be a plant list with scientific and common names. We won't do any hard-core keying, but some familiarity with local plants will be helpful. A rattlesnake sighting is always possible at Ranson/Edwards. Western Poison Ivy has been found here and we may find plants with stinging hairs.

Distances will generally be short, but we may be hiking off-trail and up and down moderate slopes. There are no facilities of any kind at this park. Be sure to bring supplies, such as water, snacks, sunscreen, etc., to be self-reliant for the morning.
Meeting point: Dirt parking area on Plainview Road just north of Colorado Highway 72, "Coal Creek Canyon Road."
From Boulder, take Colorado Highway 93 south 11.2 miles south, turn right (west) on Colorado Highway 72 "Coal Creek Canyon Road," go west 1.8 miles, turn right on Plainview Road, and look for our group in the dirt parking area on the left.

July 9th, Sunday, 8 am – 5 pm
Mt. Silverheels
Steve Yarborough, Leader

July 12th, Wednesday, 9 am – noon
Staunton State Park
Lenore Mitchell, Leader

July 14th, Friday, 8 am – 5 pm
French Creek
Kelly Ambler, Leader

July 18th, Tuesday, 8 am – 5 pm
Treasures of the Tenmile Range
Jane Hendrix, Leader
The hike begins at Mountain View Experimental Gardens (Hendrix residence) at 10,000 feet and trails through at least 9 ecosystems on a circular route: open meadow, aspen grove, lodgepole pine forest, sunny wetland, shaded riparian, dry hillside, spruce-fir forest, clear-cut regeneration and sunny, disturbed areas. Our focus will be the species of the Upper Montane and Subalpine Zones. English common names plus respective botanical Latin names will be used. All levels, from beginner to expert, will enjoy this outing. Moderate hike of 4 to 6 miles, 600 feet plus 200 feet elevation loss. Mosquitoes around the wetland may be a nuisance. Bring insect repellent. Bring extra clothing and rain gear in case of sudden weather change at high altitude. Bring lunch and water. Wear sturdy hiking boots. Expect to find over 100 species. Optional guide book specific to this area is available for $5.
Meet at Mountain View Experimental Gardens, 133 Lone Hand Way, Breckenridge, CO. From the north, exit I-70 at Exit 203. Go south on CO Hwy. 9 about 8 miles to Coyne Valley Road. Turn right. Drive to stop sign. Turn left. Drive 1/4 mile to Barton Road (CR3). Turn right.

From the south, go to City Market at north end of Breckenridge. Get on Airport Road on north side of grocery store parking lot. Go north on Airport Road to Barton Road (CR3). Turn left. Drive 1/2 mile to Blue Ridge Road. (Slow down or you'll miss this road.) Bear left. Drive up Blue Ridge Road to CR906. Turn right. Drive to last road (Lone Hand Way). Turn right. Drive around curve to "round" house.
Safety Rules: The group must function as a unit. We will travel at the pace that is comfortable for the slowest person. No splitting of the group will be allowed. If one person wants to go back, the whole group must return. This is primarily for safety because the trails in this area do not appear on any map and have many unmarked intersections that can cause confusion for a person unfamiliar with this area.

Hoosier Ridge – West
July 21, 8:30 am – 5 pm
Jane Hendrix, Leader
The hike begins at the parking area in a subalpine forest of spruce and fir. A short descent brings us to a quiet, old road on the south side of the Continental Divide with spectacular views of rugged mountains and many subalpine and alpine species to enjoy and photograph.

Lunch will be on top of the Continental Divide on North Star Mountain,12,300'. This will be the highest point of the hike. From there, we will descend 1/2-mile along a steep, rocky jeep trail to Little Crystal Lake. We will then return on a 1-1/4-mile-long jeep road, paralleling Hoosier Ridge on the north side of the Continental Divide. The leader is "bilingual" - English common names plus respective botanical Latin names will be used. Optional guide book specific to this area is available for $3. All levels, from beginner to expert, will enjoy this outing. The hike is 4 mile long cicular loop with a 900' plus elevation gain. Mosquitoes around wet areas may be a nuisance. Bring insect repellent. Bring extra, warm clothing, a windbreaker, a hat, warm gloves and rain gear in case of a sudden weather change at very high altitude. Wear sturdy hiking boots. Some rock scrambling is required to ascend to the lunch location. Also, loose gravel and rocks on the steep jeep trail after lunch can be slippery. Note: Safety Rules: The group must function as a unit. We will travel at the pace that is comfortable for the slowest person.

Meet at the Hoosier Pass Parking Area (elev. 11,539') at 8:30 am. Take I-70 East to Exit 203 (Breckenridge/Frisco). Go south on Colo. Hwy. 9, through Breckenridge, to Hoosier Pass. Alternatively, take U.S. 285 to Colo. Hwy. 9 at Fairplay. Go north on Hwy. 9 to Hoosier Pass. Park in the large parking area on the west (right) side of the road.
Note: There is no restroom facility at Hoosier Pass. There is a public restroom at City Market at the north end of Breckenridge (from Colo. Hwy. 9, turn right onto North Park Avenue at the roundabout).

Lower McCullough Gulch
July 25th, Tuesday, 8:30 am to 5 pm
Jane Hendrix, Leader
The adventure begins a few miles south of Breckenridge at an elevation of 10,300'. The route is an old mining road that trails through a small meadow replete with flowering species. It then enters a spruce-fir forest, revealing the shade-lovers in the understory. Continuing up a gentle grade, we will stop for lunch in a vast meadow of sunflowers, delphiniums and mariposa lilies. The highest elevation on the hike is 11,050' for an elevation gain of 600 to 750'. We will most likely find at least 100 species. The leader is "bilingual" - English common names plus respective botanical Latin names will be used. All levels, from beginner to expert, will enjoy this outing of 3-4 miles. Optional guide book specific to this area is available for $4. Mosquitoes around wet areas may be a nuisance. Bring insect repellent. Bring warm clothing, a windbreaker, a hat, warm gloves and rain gear in case of a sudden weather change at high altitude.

(Cont. on page 34)

40 Years of Progress in Pollination Biology, and What it Means for Citizen Scientists

by Nick Waser and Mary Price

Introduction

Somewhat to our amazement, the past four decades, which roughly encompass our academic careers, have witnessed a substantial improvement in our scientific understanding of the pollination of flowers by animals. There is progress in science! Here we will sketch some of this progress, and explore what it implies for us as lovers of plants, citizen scientists, and citizen activists.

We begin with a quick review of pollination by animals. This is a ubiquitous ecological interaction in all terrestrial ecosystems. Figure 1 shows a pie diagram of the biodiversity of Earth, representing some 1.5 million species that have been formally described by scientists. About one of every 6 is an angiosperm, or flowering plant—these are the dominant plants on Earth today, and have attained this status over the past 100 million years. By recent estimates, about 90% of these plant species rely on animals in whole or part to move their pollen around.

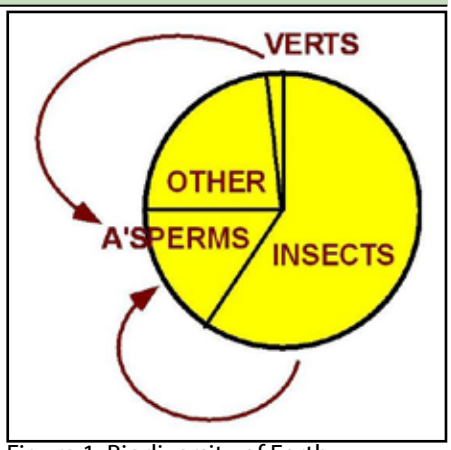


Figure 1: Biodiversity of Earth

An amazing slice of the pie is insects, the dominant animals on Earth—over half of all described species. And most of the pollinators are drawn from this large pool of species, especially from the bees and wasps, the butterflies and moths, the flies, and the beetles—again about one in every 6 species. Add this up and about one third of all species are involved in the pollination interaction. Oh, and the vertebrates (a tiny slice of the biodiversity pie) contribute some pollinators too—birds, bats, and others.

Pollination by animals benefits the plants involved because their pollen grains, and thus their sperm, is moved from flower to flower. It benefits pollinators because they obtain substances, most commonly food in the form of nectar and pollen, in flowers. The interaction also benefits humanity. It is critical for the healthy functioning of natural and many agricultural ecosystems.

Figure 2 shows how it contributes to our diet. The top image is a market with, literally, the fruits of pollination. In the bottom image we see what we would have to eat if the interaction disappeared. Plants that are pollinated by wind would persist, so we would have cereal grains and some other things, but we'd lose much of what makes our meals so tasty, and many of our calories.


Figure 2: Fruits of pollination (top photo) and fruits without pollinators (below). From Whole Foods.

Alas, the mutually-beneficial interaction between plants and pollinators is threatened by human activities—climate change, land use change, invasive species—and again alas, we will need to end this talk by mentioning another threat that is now emerging. There is no more important time than now for scientists to study pollination and for citizens to become informed.

Some History

The scientific study of pollination actually dates to the 1760s—about 250 years ago. From even a much earlier time, surely, humans have been delighted and intrigued by the tremendous diversity of flowers, in their color, shape, scent, and presentation on the plant. Figure 3 shows one example from a subalpine meadow near the Rocky Mountain Biological Laboratory (RMBL) in western Colorado.


Figure 3: Subalpine meadow near Gothic

Scientists studying this interaction began early on to look for ways to classify this remarkable diversity, so that they would not need to consider over 200,000 animal-pollinated species one-by-one!

The proposal that eventually gained wide acceptance is that many flowers can be grouped according to presumed reciprocal specialization with a particular type of pollinator. This idea was first fully presented by the Italian botanist Federico Delpino in a monograph in the 1870s.

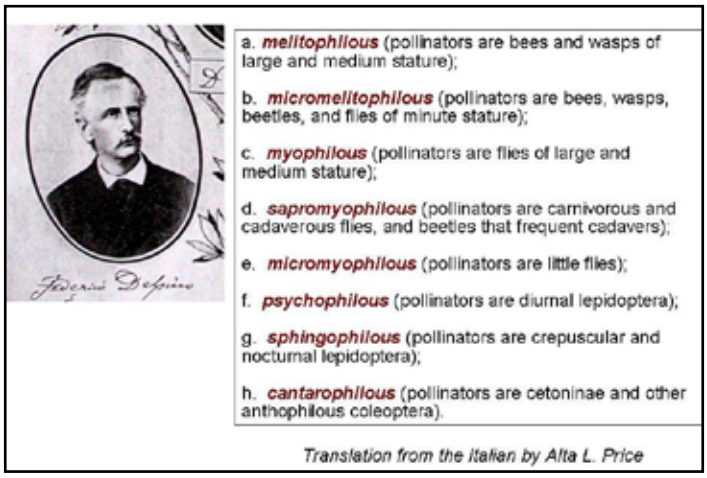


Figure 4: Delpino and flower-pollinator types

Figure 4 shows Delpino and part of his scheme, which may seem quite familiar. The flowers are classified according to what pollinator they "love", for example lovers of large bees (melitophilous flowers), of small bees, and so on. More than a century after Delpino these ideas have been elaborated to include flowers that are co-specialized with birds (such as hummingbirds), bats, and further categories. The modern versions of such schemes are referred to as pollination syndromes and the idea is that distantly-related plant species have converged through evolution in the characteristics of their flowers so as to attract and use one specific pollinator or another, and that the pollinators have reciprocated.

The question is: do the pollination syndromes correctly capture Nature's complexity, or do they miss some important aspects, perhaps even some central aspects, of how pollination interactions are organized?

The Longer You Look the More You See

Let us begin to explore this question by recounting our own early history of work at the RMBL. Figure 5 shows a classic "hummingbird flower", scarlet gilia, *Ipomopsis aggregata*, which Nick began to study in 1972.

Indeed, what was immediately apparent was visitation by hummingbirds, and our later experiments and those of others at the RMBL confirmed that most of the pollination comes from Broad-tailed Hummingbirds (a male is shown in Figure 5) and Rufous Hummingbirds. But the longer one sits in the meadows, the more years and valleys one studies, the more one sees. We began to realize that many insects also visit scarlet gilia!

We won't show you images of all the insects, but they include sphinx moths, butterflies, solitary bees, and hover flies and, as shown in Figure 6, also bumble bees. This is a queen of the bumble bee species *Bombus appositus*, which has a relatively long tongue with which she licks nectar. In some years and valleys these bees are systematic in their foraging at scarlet gilia flowers. It is possible to measure foraging speed and estimate what the bees are gaining from the flowers in terms of energy from nectar, and it turns out that they are realizing a very good caloric reward. They appear to be careful shoppers in the "floral supermarket", not deterred by red color, and visiting scarlet gilia when the profit is good.



Figure 5 (above): Hummingbird and scarlet gilia, Photo by David Inouye; Figure 6 (right) Bumblebee and scarlet gilia.

You might well wonder, however, if this is pollination. The bees and other insects might visit but not pollinate—in effect stealing nectar. However, Margie Mayfield, who is now a Professor at the University of Queensland, Australia, showed 20 years ago as our undergraduate research intern that each bumble bee visit on average deposits three times as much pollen on a virgin scarlet gilia flower as does each hummingbird visit, and leads to four times as many seeds produced! These are not only pollinators, but good ones. The other insects we mentioned also carry scarlet gilia pollen on their bodies, so probably do some pollinating too.

An Unbiased Look at Entire Communities

Although we could try to argue otherwise, it's possible that scarlet gilia is a quirk of Nature, not representative. One way to see whether or not this is so is to look at an entire plant and pollinator community without any a priori filtering of which species to focus on. Ruben Alarcón, who is now a Professor at California State University, did just that in the 1990s at the RMBL, working in Virginia Basin, about 500 meters higher than the 2900 meter elevation of the RMBL.


Figure 7 : Ruben Alarcón and Virginia Basin

What Ruben did was to walk transects through meadows every few days, counting all the flowers to get information on relative abundances of flowers of different species. He also recorded and identified visitors that touched the sex organs of flowers and thus were taken to be pollinators. The result is a striking realization that flowers and pollinators are connected in an intricate web or network of interactions, a pollination network or pollination web. Figure 8 (on the following page) shows one example from Virginia Basin.

The connections in the web are rich and many species are generalized, attracting diverse pollinators if they are plants or visiting diverse flowers if they are pollinators. There are certainly some specialists in these webs—but they tend to associate with generalists, not with other specialists as we had assumed! For example, then, a flower that attracts only a single pollinator is likely to attract one that itself visits lots of other flower species. This is very different from the co-specialization hypothesized by Delpino and subsequent generations of workers. And Ruben's webs are not unique; they resemble pollination webs that have now been characterized around the world.

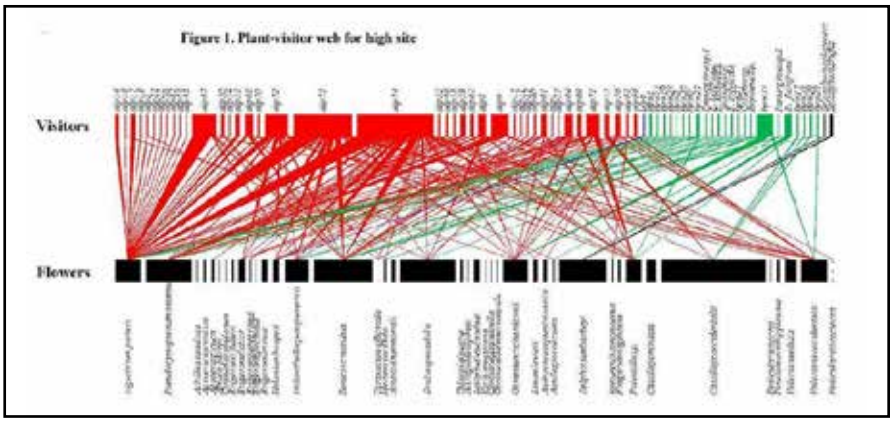


Figure 8 : Plant-Visitor Web for High Site

We can next ask how stable the interactions in such a web are through time and space.

The recent work of Paul CaraDonna at the RMBL sheds light on the first part of this question (and other scientists are beginning to explore variation through space). Paul, who is shown in Figure 9, is now at the Chicago Botanic Garden and Northwestern University. What he did was to walk transects near the RMBL just as Ruben had at higher elevation, but he analyzed the webs on a week-by-week basis through the short summer growing season.


Figure 9 : Paul CaraDonna

Figure 10 shows the result for the summer of 2014. You can see that these webs resemble the Virginia Basin web we showed in Figure 8, but you notice immediately that they change week-to-week. In part this is no surprise—there must be change because of species turnover through the season. As the season progresses from spring snowmelt through to first frost of autumn, different plants are coming into flower and ceasing to flower, different insects are emerging and flying and ceasing to fly.

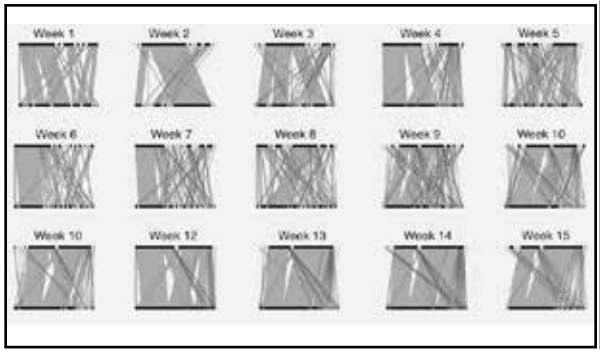


Figure 10: CaraDonna's 2014 research results

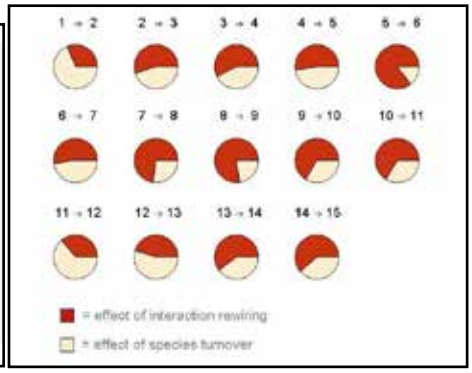


Figure 11

But what is exciting and intriguing is that species turnover is not responsible for all of the turnover of interactions from week to week in Paul's meadows—in fact, it is not even the major cause. On average about two-thirds of interaction turnover can be attributed to rewiring (Figure 11) that is, species that remain in the community across several weeks begin to interact or cease to interact from time to time not because they have appeared or disappeared but because they abandon one another or take up with one another for reasons we must now begin to investigate. Is it all "careful shopping" as with bumble bees and scarlet gilia? Do pollinators "divorce" some flowers if more attractive options appear or become more common? These are new questions to pursue.

Lessons for Citizens

We draw several conclusions from this sketch of 40 years of research.

First, let us recognize pollination by animals as a critical ecological interaction involving most species of flowering plants and many insects and other animals. In other words, not every pollinator is a bee and not every bee is a honey bee (we stress this because the public perception often seems to be that honey bees are "it").
Figure 12 (on the following page) is from the The Xerces Society for Insect Conservation (www.xerces.org), a great place to find out about the astounding diversity of bees—some 25,000 species worldwide described so far! The figure just gives you a glimpse into this diversity (you also might visit http://www.xerces.org/wp-content/uploads/2010/06/CA_CSM_guide.pdf to see what citizen science in California is doing). Also you may wish to obtain the beautiful book for citizens, The *Bees in Your Backyard,* by Joseph S. Wilson and Olivia Messinger Carril, Princeton University Press (disclaimer: the two of us get NO kickback from sales of this book!). Note that the bees shown here, and most bees, are not social creatures as honey bees and bumble bees are; the females work alone to provision offspring, and so are termed "solitary bees".

In fact, as Figure 13 hints, the very diversity of types of pollinators visiting a flower seems to confer superior pollination to the plant. More studies of this sort of effect are ongoing. But for now, as lovers of native plants and gardens we say: plant your gardens for diversity and advocate for wildland diversity and for pockets of semi-natural habitat within urban and agricultural landscapes—all of which fosters pollinator diversity and ecosystem health.

Figure 12 Native Bee Diversity

Second, we've seen that plants and pollinators are connected in a web of interactions, and that some degree of generalization and flexibility are common. In other words, don't think of each plant as having "its pollinator". To be sure, some plants are specialists, but this is not the most common condition.

Finally, remember that schemes for determining pollinators based on how flowers look are only a rough guide. In general, don't take human-constructed hypotheses too seriously or let them come between you and Nature—keep your eyes open and trust what you see! Welcome surprise!


PLOS BIOLOGY

Functional Diversity of Plant–Pollinator Interaction Webs Enhances the Persistence of Plant Communities

Figure 13

Alas, there is a further lesson to bring up, and here we return to the human-caused threats to the plant-pollinator interaction. Honey bees (*Apis mellifera*) are one of the few human domestications of an insect, and the domestication has been extremely successful and important to humanity. But some of us are not treating honey bees all that well. For pollination of some crops, honey bee colonies are transported around North America and even from other countries. This, and the stressful conditions the colonies are sometimes subjected to, has led quite recently to spread of diseases among honey bees worldwide.

Figure 14 shows an image of a parasitic mite, *Verroa destructor*, attached to the thorax of a honey bee worker. These mites are a drain on the health of the bee, and also are one of several vectors for transmission of a host of viral and other diseases.


Figure 14: Mite on honeybee

To make things worse, these diseases are now spilling over from honey bees into native bees such as solitary bees and bumble bees.

As Figure 15 indicates, studies are now beginning to appear that document the spill-over—something that you may think about as a kind of "Ebola virus" situation with insects. Recall that Ebola and other emerging diseases that threaten human pandemics have arisen recently through lateral transfer from other animals (African fruit bats in the case of Ebola).


Journal of Invertebrate Pathology

Short Communication

Widespread occurrence of honey bee pathogens in solitary bees

Figure 15:Widespread occurrence of honey bee pathogens on solitary bees

Let us then finish with some final thoughts for you to take home as citizen advocates. Native bees (and other native pollinators) are excellent pollinators of our native plants, which benefit from their diversity. Due to no fault of their own, honey bees are now infected worldwide with a host of diseases. These are threatening native bees. Therefore: it is not necessary to advocate for honey bees as pollinators in wildlands, and in fact best to work for the opposite—for keeping them as much as possible away from contact with native systems, which are functioning just fine without them!


Mary Price and Nick Waser

Nick Waser and Mary Price are Professors of Biology Emeritus, University of California Riverside, Adjunct Professors, School of Natural Resources and the Environment, University of Arizona, and Principal Investigators, Rocky Mountain Biological Laboratory.

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Return of the Native: Native Colorado Plants in Horticulture

by Panayoti Kelaidis

The history (or perhaps we should say the pre-history) of human-plant interactions in Colorado goes back a very long way. If you think about it, the first people in the state, who likely arrived 12,000 or more years ago, may have been primarily carnivores, but they likely utilized berries and roots and shoots in their diet as well. However, the impact that the extinction of dozens of species of megafauna (very likely in large part due to their hunting) undoubtedly resulted in enormous impacts on Colorado's flora many millennia ago. Colorado's forests evolved over millions of years being thinned by Columbian Mammoth and Mastodons as an example. I am not alone in wondering if the massive die offs in our overgrown mountain forests might not be a belated consequence of the lack of thinning once done by some of the 56 megafauna that disappeared about the time *Homo sapiens* came on the scene?

Mesa Verde

Colorado is blessed with many national parks and monuments. Mesa Verde comprises the most extensive ruins of Pre-Columbian civilization north of Mexico. The rise of such sophisticated architecture and civilization on that rugged plateau was due to the cultivation of corn, squash and other Meso-American crops (the first verifiable "exotics" in our flora), but it is likely the Ancestral Puebloan people also utilized many native plants for food and ornament. Piñon pine nuts were harvested on the years the nuts were abundant.

Flash forward to the first settlers of European ancestry. I suspect that neither the Bents of their namesake fort nor the early trappers in the state and the first waves of miners did much in the way of exotic gardening. Nineteenth Century photographs of Colorado are almost always bleak. Forests across the state were felled for firewood, mine timbers and buildings, and nothing was usually planted in their place. I'm sure that some of the first people who began to grow vegetables to supply mining communities must have also grown ornamentals. The prevalence of "the yellow rose of Texas" (*Rosa* 'Harison's Yellow) in Central City and older neighborhoods of Denver is a relic of this era, along with many lilacs and bouncing bet *(Saponaria officinalis*). Ornamental horticulture (let's not even mention natives!) was a minor pursuit at best during the first years of European settlement in the state.

Robert Speer can be credited for dramatically altering our landscape in every sense of the word. Speer was elected Mayor of Denver in 1904 as a populist. His constituents expected him to wrest power from the elites who had controlled the city, abusing their power to feather their own nests. Speer did create an effective bureaucracy drawn from his constituents that leveled the playing field. Having visited the Columbian Exposition in Chicago a decade or so earlier, Speer had developed a burning vision of a "Green City"—the City Beautiful—the civic expression of the William Morris' Arts and Crafts movement that had set the tone for the period, an aesthetic revolution that implied that the good life depended on creating a physical setting of beauty and excellence to reflect one's inner beauty.

For Speer this meant hiring the first Landscape Architects in the history of the Rocky Mountain Region—European trained Reinhard Scheutze and Dutch trained Saco DeBoer: both designed miles of boulevards and dozens of green parks throughout the dusty, unpromising trampled prairie of Denver. Virtually all of the plants they used were brought in from the Midwest on trains or grown from imported seed by the first attempts at a nursery industry. Aside from the now ubiquitous Kentucky Bluegrass, most of these early plantings were trees originating in the Eastern half of the U.S. (hackberry, green ash, American elm and Eastern red cedar especially) or a small cadre of shrubs including roses and lilacs that trace their origins to Continental Asia.

It's likely that box-elder, cottonwoods, Rocky Mountain juniper and a few conifers were planted occasionally as well, so native plants weren't entirely neglected—but the City Beautiful concept was based on beautiful cities in maritime climates, and Speer could hardly be blamed for wanting to re-create the lusher look of humid climates by using mostly plants from those areas.

These new plantings, and the vegetable plots and gardens that undoubtedly become more important in these times, all required copious irrigation—which was not a problem when people were few and water abundant.

The early pioneers were so absorbed scrambling to extract gold and other precious metals from the earth, surviving by eating mostly tinned and imported vegetables and fruits, until agriculture gained a wobbly foothold in the late 19th century. Almost everything cultivated in that century was non-native. The first generations of Coloradoans did escape the plains to visit the mountains, and loved gathering vast armloads of wildflowers to bring back to Denver. Many mountain wildflowers were very likely dug up back then and brought back to die in grim Denver "yards".

The first nurseryman who made an effort to study, grow and disseminate native Colorado plants was Darwin Andrews, who came from England in the early 1900s and settled in Boulder where he founded Rockmount Nursery, most of which was absorbed and re-landscaped by the National Institute for Standards and Technology. A few acres remain in private hands, however, and these are filled with treasures dating from the time of the nursery sixty years ago including a post oak (*Quercus stellata*), shingle oak (*Quercus imbricaria*), and a grove of native undulate oak (*Quercus* x *pauciloba*). The Rockmount catalog listed a remarkable number of classic perennials, trees and shrubs comparable to Eastern Seaboard nurseries at the time, but Andrews also listed native wildflowers which he sold mail order and even shipped abroad. Reginald Farrer, the leading English horticultural writer of the Edwardian period, mentions plants he obtained from Andrews in *The English Rock Garden*. A copy of that book, signed by Darwin Andrews, was in the University of Colorado libraries when I was a child.

Later in the 20th Century, Kathleen Marriage, another English-born horticulturist, settled in Colorado Springs and founded Upton Gardens, the leading garden center of that city for much of the middle 20th Century. She also engaged in wild plant and seed sales and published several articles in British publications about the wild plants of Colorado. She was likely the source of the Pikes Peak endemic, *Telesonix jamesii*, which has been cultivated in England for nearly a century.


George Kelly

George Kelly, who owned a nursery on South Santa Fe, and his close friend, Harry Swift, who owned Western Evergreens became the most vocal proponents of native plants in the horticultural industry beginning in the decade after World War II through the rest of the 20th Century. Harry lived into his 90's, passing away in 2010. Kelly lectured widely in the area and published many books which featured most of the commoner native woody plants, and some rather obscure ones as well, but Harry's nursery was the first to promote the less common dryland shrubs like Apache plume (F*allugia paradoxa*), cliff rose (*Cowania neomexicana*) and evergreen mountain mahogany (*Cercocarpus ledifolius*). In the 1970s Western Evergreens began to promote many native wildflowers such as *Antennaria*, *Mahonia repens* and even *Penstemon pinifolius* (a New Mexico native, it's true) as groundcovers.

Meanwhile, specialty seed companies throughout the West were arising to promote the use of natives in revegetation of mines and reclamation. Although landscaping with native plants was well established on both East and West coasts, the phenomenon only began gaining traction in the 1970s, largely due to laws passed during the presidency of Jimmy Carter requiring revegetation with natives on reclaimed surface mines and elsewhere. An ambitious venture called Native Plants near Salt Lake City led the charge for nearly a decade, inspiring several native plant ventures I will detail below—beginning with Charles Weddle's Palisade effort.

Native plant gardening began gaining momentum with the invention of "Xeriscape", a concept hatched and ultimately managed by Denver Water in 1982, to promote water conservation. A landscape architect named Ken Ball was the mastermind promoting the zoning of irrigation, employing a zone with little or no irrigation at the extremities of properties that would feature primarily native shrubs and perennials. This movement was very much a consequence of the acute drought Colorado experienced in 1977 when Denver Water first imposed watering bans. I have been told that Denver Water began the water conservation initiative (which is technically self-defeating; they operate by selling as much water as they can, after all) because they could be considered legally liable should a protracted, acute drought lead to entire landscapes succumbing. Xeriscape was at least partly liability insurance for water providers and I believe Ken Ball deserves great credit for essentially creating the profession of "Water conservation officer". There are now thousands of such professionals employed by water providers around the world saving who knows how many billions of gallons of treated water.

Ken Ball

Assisting Gayle Weinstein, Ken helped design the Xeriscape garden at Denver Botanic Gardens (DBG), one of the first of hundreds (possibly thousands) of gardens now bearing that name. Ironically, it was subsequently renamed "Dryland Mesa" at Denver Water's request since it was really an imaginative re-creation of a semi-arid wild habitat bristling with yuccas and cacti—while Denver Water was touting Xeriscape as "not just cactus and yucca"! They were apparently embarrassed to be associated with what has to be one of Denver Botanic Gardens most popular and signature gardens!

But even before this garden was designed in 1985, Denver Botanic Gardens already had a Montane Garden—the very first garden installed at the York Street site in the early 1960s. This garden was built by Saco DeBoer and features all the native trees of the Colorado Rockies. It was a rugged rock garden when first installed, but today the tall pines, firs and spruces tower over the rocks and have created a very woodsy effect.


Jane Silverstein Ries

The Plains Garden was initially designed by Jane Silverstein Ries, one of the most prolific landscape architects of our area. She had designed almost a thousand home landscapes as well as a very schematic plan for this garden, which was much amplified by Gayle Weinstein and ultimately brought to fruition by Rick Brune, who spent several summers carefully platting and planting this garden according to the precise mix of forbs and grasses that occurred in all of the prairie biomes that were herein recreated.

A nearly half acre garden just east of Dryland Mesa was developed as an ethnobotanic garden featuring native plants utilized by Native Americans in the Four Corners area. The initial design was executed by Karen Trout, who now goes by Karen Wright. She left DBG to pursue a graduate degree in Ethnobotany and this garden has been redone since on a grand scale, consecrated by medicine men of four Southwestern tribes (Pueblo, Hopi, Zuni and Navajo). It is now known as Sacred Earth and features many cultivated crops developed in the Southwest as well as wild plants used as medicine or food. It is one of DBG's loveliest, least appreciated and most important gardens.


Rick Brune

After a period of neglect when Denver Botanic Gardens had gone through a budgetary cutback, this garden was resuscitated in the 1990s by Dan Johnson, who was hired as Curator of Native Plants at DBG in 1997. Dan cleaned up the much neglected Plains Garden and Dryland Mesa. It would be hard to overestimate the impact Dan Johnson has had on all aspects of Denver Botanic Gardens horticulture, but I believe we can credit him for literally saving the good work begun by Rick Brune in the Plains Garden. This garden had become infested with bindweed subsequent to Rick's leaving when virtually nothing was done in this garden for nearly a decade. When Dan arrived, there was a sea of white bindweed blossoms greeting him in the grasses the first summer. He began a massive campaign of elimination (including the introduction of a biological control insect specific to *Convolvulus arvensis*). I don't remember seeing a bindweed blossom in this garden for a decade or more now and Dan has incorporated fabulous and rare natives such as soapberry (*Sapindus drummondii*). I especially admire the sweeps of blazing star (*Liatris*) in summer, the bush morning-glory (*Ipomoea leptophylla*) in the sand prairie section, and the frequent appearance of paintbrush (*Castilleja*). Dan naturalized Geyer's larkspur (*Delphinium geyeri*) in the Plains Garden, which makes a spectacular cobalt spectacle in May and June.


Dan Johnson

The Dryland Mesa has become a premier showcase of western native dryland plants, with enormous clumps of some native scarlet hedgehog cacti (*Echinocereus coccineus*) rescued when an old cactus garden in front of the Red Rocks Trading Post was demolished. The Dryland Mesa was the first place Jones' bluestar (*Amsonia jonesii)* was introduced to public horticulture in the 1980s, the very same clumps persisting today. My favorite plants, however, in this garden are New Mexican natives. There are several Texas madrones that have astonished me by thriving for many years through very cold winters: *Arbutus xalapensis* may be the most spectacular small tree one can grow here, with large, glossy evergreen leaves and unbelievably ornamental, peely bark. And it has not received supplemental irrigation in a decade or more.

Dan went on to design three of the four "Western Panoramas" around the Amphitheatre, including the Cottonwood Border, with Great Plains natives, the Ponderosa Border (featuring low elevation foothills and montane natives) and the Bristlecone Border with high altitude wildflowers. These are also composed exclusively of plants native to Colorado (and nearby states).


Panayoti Kelaidis

Seven extensive native plant gardens now exist at Denver Botanic Gardens but, of course, every one of the forty or so outdoor gardens at the York Street site contains at least a few natives. Some, like the Children's Garden and Rock Alpine Garden, have dozens of taxa at any given time, most of them underrepresented in public gardens elsewhere. During my tenure as curator of the Rock Alpine Garden (1980-1997), I served as president of the American Penstemon Society. I planted many dozens of species of *Penstemon* at that time, as well as innumerable species of *Eriogonum* and other native wildflowers, most of which I had personally collected with my ex-wife, Gwen Moore, who operated Rocky Mountain Rare Plants (RMRP), a seed company specializing in Western wildflowers. Seed of over 1000 taxa was offered by that company in its 11 years it was managed by us, most of which we grew in our home gardens and shared with DBG. I suspect RMRP was responsible for offering seed of many dozens of species of *Penstemon* and *Eriogonum* in the trade for the very first time, including *Penstemon acaulis*, *P. arenicola*, *P. mucronatus, P. janishiae*, and many many more.

Chatfield Farms, the 750+ acre site in Jefferson County, is becoming a more important satellite that may one day eclipse York Street gardens in popularity and importance. Ornamental gardens now occupy several acres around the historic schoolhouse and visitor center, a large portion of which consist of a meadow-like garden consisting of grasses and perennials native to the Midwest and Colorado designed by Scott and Lauren Springer Ogden. Their gardens are enormously artistic as well as a unique showcase of dozens of unusual natives. This is where I first saw *Liatris ligustylis*, an extremely showy and little known Colorado blazing star. A large new section of ornamental gardens was added in the last two years, again featuring many natives among the Plant Select and other gems displayed in those gardens. They include a rather large rock garden with dozens of different clones of native Colorado manzanitas.

The third site of Denver Botanic Gardens is the Mount Goliath Research Natural Area, operated in concert with the United States Forest Service. In 1997, extensive rock gardens were constructed around the visitor center in what was once a parking lot by Zdenek Zvolanek, a Czech garden designer who pioneered the technique of "crevice gardening" , which has been adopted worldwide at botanic gardens because it has made the cultivation of challenging alpine plants much easier to achieve in garden settings. I believe this was Zdenek's first public garden. Since then he has built many gardens in England (including Wisley),

Zdenek Zvolanek

Canada (Montreal Botanic Garden), as well as in Sweden, Denmark, Germany and, of course, the Czech Republic as well. Zdenek's crevice garden was planted exclusively with Mt. Goliath natives, mostly rescued from the site of a new Mt. Goliath trail replacing the braided path that had disfigured the bottom end of the trail.

Since the 1990s, Denver Botanic Gardens' propagation unit has grown thousands of native alpines from seed collected on Mt. Goliath to be planted in the original Crevice Garden at the Visitor Center, and the much expanded rock garden surrounding the Center to the west.

There have been many other prominent regional horticulturists who've specialized in native plants and helped promote and provide plants to the public over the last few decades. Charles Weddle (one of America's leading plant hybridizers) developed a wonderful native plant nursery and garden center in Palisade in the late 1970s. I remember my utter shock and delight when I visited there in the early 1980s. Jim Borland was working for Charles, and has gone on to promote natives in many ways. He has grown thousands of native plants in his home nursery, many of which Jim provided for a decade or more to the Genessee Homeowners Association for their native plant sales to advance that large neighborhood's commitment to native horticulture.

Weddle and Borland

Jim has been a frequent promoter of natives on his weekly Talk Show on KEZW (1430 am) where he has been answering garden questions with Keith Funk for nearly two decades. Jim has introduced many ornamental natives to cultivation and showcases them in one of the few exclusively native and unwatered gardens that's often open to garden tours in West Denver. I think it would be hard to gauge the impact Jim has had on regional horticulture, especially in the arena of native plant horticulture. It's been relentless and inspiring for over three decades.

Robert Nold, a homeowner in Lakewood whose day job was telecommunications, became an enthusiastic amateur grower of native plants in the 1980s. Bob credits Larry Schlichenmayer, whose Old Farm Nursery in Golden provided Bob and many others with unusual native plants, some of which have never been offered commercially again. Bob's garden, created in tandem with his late wife, Cindy, contains a wealth of unusual native plants along with dryland plants from Eurasia. It is also one of the few unwatered gardens in Denver.

Bob went on to write gardening monographs (*Penstemons* and *Columbines*), and a landmark book called *High and Dry* outlining his lifelong interest in Western American native plants, especially those of steppe habitats. Bob exemplifies the contributions made to learning about how to cultivate native plants by amateur growers—the ones, after all, who support those of us who work in public horticulture and especially the nurserymen who make a living supplying amateurs with plants!

Bob Nold

Randy Mandel has been another notable spokesman for native horticulture, first during his tenure as director at the Meeker USDA Plant Material Center, then at Rocky Mountain Native Plant Nursery (a fabulous wholesale nursery that succumbed during the economic downturn, sadly) and more recently in his role as consultant with Great Ecology in Denver.

Another long term and extraordinary native plant nursery, Wild Things, is located in Pueblo. Jeff Ottersburg grows thousands of challenging low altitude native plants like *Zinnia grandiflora*, *Melampodium cinereum* and most of Colorado's ball cacti and dozens of other taxa. Many of the plants Jeff grows are avoided by conventional nurseries because they are so sensitive to overwatering. For over thirty years, Jeff has peddled his plants to retail garden centers throughout Colorado and neighboring states, raising the standards of native plant horticulture locally in the process. His nursery operation is exemplary. I have led many tours to visit his place and the many greenhouses are always impeccable, the plants growing in them of the highest production values and almost all of them unique, not grown by any other regional nursery. Jeff is a self-effacing and very modest man who should be better known by the native plant enthusiasts he has served so well for so long.

Randy Mandel

The work of these many nursery partners in addition to staff collections are responsible for providing such a spectrum of the most conspicuous and attractive plants native to Colorado being put on display in the many artistic gardens that have been designed and built over the last half century at Denver Botanic Gardens at York Street, Chatfield Farms and Mt. Goliath.

Jeff Ottersburg

These gardens in turn have helped inspire and supply an expanding industry in native plants in regional wholesale nurseries—especially Little Valley Wholesale Nursery in Brighton and Fort Collins Wholesale Nursery, both of which have brands that are associated with native plants. Most of the many garden centers stock a wide variety of native plants—often in their Xeriscape sections. And the High Plains Environmental Center in Loveland has arisen in the last decade to become a gorgeous showcase of how native plants can be utilized powerfully in urban and suburban gardens. Jim Tolstrup—the executive director of this enterprise—has forged a partnership with CoNPS that promises to propel native plant horticulture to an even higher level.

Yes, indeed the Native has returned to Colorado horticulture!

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Panayoti Kelaidis

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(Thanks to Betty Heid)

Book Review, Intermountain Flora, Vol. 7
(continued from page 33)

There are a number of extremely useful resources in this volume (more about these later) but I must admit that what captured my attention and filled me with delight when I began leafing through the book was the great quantity of historical and biographical information, accompanied by black and white (historical) and color photos of the botanists who worked on the series, botanical artists who contributed to the series - and 43 pages of photos of people who collected plants in the region! It is a gold mine for anyone interested in botanical history; it is highly readable and will hold your attention. I love it!

Chapters 3 through 5 contain the histories, biographies and chronologies. authored by Noel Holmgren. Photos accompany the text in each chapter. These are not dry, academic accounts of their lives but stories about them as people. Because Noel Holmgren knew these people so well, the biographies contain personal anecdotes, helping us understand the personality of each individual, and include photos so these people come alive for us.

Chapter 6, the work of Pat Holmgren, contains a delightful biography of plant collector Arnold "Jerry" Tiehm and a big photo album of plant collectors of the Intermountain West (photos of 353 collectors). You can spend hours browsing through the photo album. It is a real treat and locating photos of all these people must have been a monumental task.

Chapter 3 is devoted to the history of the *Intermountain Flora* project and the roles of Bassett Maguire, Arthur Holmgren, and Arthur Cronquist. A biography and chronology of Bassett Maguire is included in this chapter. Chapter 4 contains a chronology and biographies of the principal authors: Arthur H. Holmgren, Arthur Cronquist, Rupert C. Barneby, Noel H. Holmgren, James L. Reveal, and Patricia Kern Holmgren.

Chapter 4 highlights the artists whose line drawings contributed so much to the quality and usefulness of the set and includes biographies of Jeanne Janish and Bobbi Angell. The importance of botanical illustrations was not underestimated by the *Intermountain Flora* editors and that is one reason the set is so valuable. After reading a description of a plant, one may still be unsure if the unknown plant has been correctly identified, but an accompanying illustration is usually enough to determine whether it is the species in question.

The "business" parts of the book include much useful information: acknowledgements, a list of each volume of the *Flora* and the families contained in each volume with page numbers and an alphabetical list of famlies with the volume and page number of each family (these indices are found behind the front cover), keys to the families contained in the first 6 volumes, and an update by Noel Holmgren to the 1984 treatment of *Penstemon* in Volume 4 of *Intermountain Flora,* complete with botanical illustrations. There is a chapter listing authors, families, and dates of publication with examples of how to cite each volume; it also includes authors of non-taxonomic treatments, families with authorship, and a chronology of the first 6 volumes. The back of the book contains indices pertaining to the complete series, volumes 1 - 7: a comprehensive index that includes species; an index of people whose photographs appear in the series; and an index to nomenclatural innovations, typifications, and chromosome data in the *Flora*. Also included are references with online resources, and a glossary.

Because this is Women's History Month, I would like to add a comment. I was surprised to see how many women are represented in this volume. Because of gender discrimination, women have been underrepresented in many academic fields but my impression is that they have received more recognition and acceptance in botany, especially in the Western US, than in most , if not all, of the other scientific disciplines.

This volume and the entire *Intermountain Flora* series are highly recommended. They are scholarly, well-written, beautifully illustrated, and quite an accomplishment for all those involved. Kudos to Noel Holmgren for the excellent history and biographies and other hard work and to Pat Holmgren for the incredible photo album of plant collectors, and the biography of Tiehm, and the very useful and long-awaited comprehensive index to all the volumes, and the other indices.

Jan Loechell Turner is past co-president of the Colorado Native Plant Society and Editor of Aquilegia. *She is Professor Emerita, Regis University, and the author/photographer of a number of wildflower guides with her husband and past co-president, Charlie Turner.*

An addendum of statistical information about I*ntermountain Flora* can be found on page 34.

Conservation Corner

Conserving Colorado's Native Plants by Conserving Colorado's Habitats

by Linda Smith

So …. conserving habitats ? Where and how can CoNPS fit into this? We don't have a paid staff member or lobbyist roaming the halls of Capitol buildings in Denver or Washington DC, advocating for the native plants or habitats of Colorado. However, what we do have are 1,000+ gung-ho members who have a passion for the great outdoors, the wide open spaces, botanizing at all levels, amateur through professional, hiking, studying and passing along our expertise and interest to grandkids, friends and peers. That's why we're members of CoNPS, "Dedicated to furthering the knowledge and appreciation … of native plants ….of Colorado through education…..," with our multitude of chapter programs, field trips and workshops.

But what about the rest of our Mission — "Dedicated to furthering the knowledge, appreciation and **conservation** of native plants **and habitats** of Colorado through education, **stewardship and advocacy**" ?

In order to protect and conserve all these native plants, their habitats have to be protected. If the habitats disappear, they disappear. This is where our 1,000+ membership comes in handy, especially right about now, when public lands need us the most. One of the best ways we can help keep the habitats and native plants safe is by joining efforts with the various governmental agencies and non-governmental organizations (NGOs) that DO have paid staff and/or lobbyists, and letting our voices be heard, and our signatures have meaning, as individuals, and as members of CoNPS.

Continuing on from Jessica Smith's "Conservation Corner," ("Agencies and Organizations in Colorado Conserving Native Plants,") in the Spring 2016 issue of *Aquilegia,* there are quite a few other organizations in Colorado that aren't specifically about conserving native plants, but that do work extremely hard to conserve and provide stewardship for Colorado habitats. Some of these organizations were represented at the 2016 Colorado Wilderness Gathering in Buena Vista on November 12 and 13, 2016, that Jan and Charlie Turner attended, as well as a few other CoNPS members and I.

It was a "two-day gathering for public land conservation advocates to learn and discuss Colorado wildlands issues, brainstorm advocacy and grassroots strategies, and celebrate past successes while planning for future conservation efforts…".

Some of our big 'take-aways' from the gathering:

Looming challenges during the next few years:

- Increased energy extraction from public lands
- Likely less opportunity to protect through congressional designations but perhaps more opportunities to focus on land management planning
- Climate change may go unaddressed
- Public land grabs
- Weakening of existing land protections
- Repeal or weakening of the Antiquities Act
- Loss of land and water conservation funding
- Attacks on bedrock environmental laws

John Whitney, Regional Director of the Four Corners Region for the Office of Senator Michael Bennett described the most effective ways to communicate your support for the protection of public lands to politicians.

Photo by Jan Turner

During the next few years, public lands will need:

- Grassroots organizing close to home, holding the ground, and mounting a vigorous defense if necessary.
- Communication –an effective message will have 3 to 4 good points. Editorials are a good start. Editorial endorsement of a bill matters to Congress. Talk to your neighbors, convince them that land preservation is a good thing. Have your message ready.
- An educated citizenry involved in local elections – making sure all the candidates are well informed on public lands issues. County commissioners are VERY important. Get to know them. Make sure they know you. Poll results mean a lot to politicians. Reach out beyond the choir; reach out to the kids.
- Collaboration and coordination– figuring out your allies and opposition; Show up at Corey Gardener's public meetings, ask about public lands, find out what he supports (go as an individual, but take 20 people with you who can clap, when you speak)
- Compromise – may have to give up some things in order to get the most important parts. Case in point – ATVs (this group can also become allies in the big picture).
- Persistence and patience – it took 17 years to get the Wilderness Act finalized, 15 years for the Colorado Wilderness Bill. It is important for conservationists and advocates to engage in every step of the planning process.

- **Details to consider:**
  - We learned from John Whitney, Regional Director of the Four Corners Region for the office of Senator Michael Bennet, that, as individuals, even though signing our names to computer-generated letters and/or petitions is very important and

much needed, it's even better to write our own personalized letter, which will have more of an impact, and gets 'to the desk' better than a form letter.

- As an organization, when some comment letters/petitions are being submitted, it's important to have signatures from a broad variety of entities. CoNPS needs to get in the 'loop' so we can be advised when other organizations need us to sign on.
- We are not the only one to put on bioblitzes in Colorado. Several of these organizations have had bioblitzes, and they could use our help and expertise.
- Future areas for preservation need to be identified and inventoried. These organizations, when looking at new areas to preserve, try to save the areas with the highest biodiversity, including populations of rare plants. Areas that are already designated as Wilderness need stewardship and 'feet on the ground' monitoring. These could be possible volunteer opportunities.
- We came away feeling like CoNPS can really help with these processes. We just need to reach out to them, and let them know we may have the volunteers. Although none of the organizations' primary missions specify saving native plants, if they save the land, they save the plants ! Helping them to support their mission will, in the end, support us in our mission.

Public lands need passionate, dedicated advocates and supporters to be their champions. Can CoNPS build a network of advocates to help conserve Colorado's habitats? I think we can fit into this pretty well.

In the near future, we will be inviting representatives of some of these organizations, and also from some the agencies listed in Jessica's article last spring, to write articles for upcoming columns of "Conservation Corner", so we can all become more familiar with their missions, what their plans are for the future, and how they see a role for our members in the future of native plants within their organizations. Here is a bit of information about some of these organizations, and how we, as individuals and members, can help them preserve the native plant habitats of Colorado right now:

The Wilderness Society works "…to protect wilderness and inspire Americans to care for our wild places." The society is nationwide, with headquarters in Washington, D.C., and two regional offices in Colorado (Denver and Durango), among many other regional offices across the country. One way to get involved is their "Make your voices heard: sign up for wild alert" at https://e-activist.com/page/2063/data/1 . On the same site, you can sign up to get BLM Action Center Updates.

Great Old Broads for Wilderness is based in Durango, Colorado, with eleven chapters in Colorado, 36 chapters across the country. This is a national grassroots organization, consisting of women and men, of all ages, "that engages and inspires activism to preserve and protect wilderness and wild lands." They have a very good webpage for Advocacy Resources, including suggestions for letter writing: http://www.greatoldbroads.org/advocacy-resources/

Wilderness Workshop is "The conservation watchdog of the White River National Forest and adjacent federal public lands." "Take Action" page at: http://www.wildernessworkshop.org/action/

Conservation Colorado (formerly Colorado Environmental Coalition) has offered to help guide our members through the comment letter-writing process. We'll find out more information and get back to you. Take Action Page: http://conservationco.org/take-action-for-colorado/#/

Wild Connections."works to identify, protect and restore lands of central Colorado to ensure the survival of native species and ecological richness." One of their main concerns is the fragmentation of wild lands. They have a very informative newsletter online right now: http://www.wildconnections.org/images/LANDSCAPES_2016-DecWeb.pdf

Colorado Mountain Club's Stewardship Team is heavily involved in hosting volunteer events for the monitoring, restoration, removal of invasive species, fuel management and fire restoration on public lands. They also have a terrific Public Lands Management webpage that CoNPS may strive to duplicate to a degree: https://www.cmc.org/Conservation/PublicLands.aspx

To see the powerpoint and notes from the 2017 Colorado Wilderness Gathering, please see: https://drive.google.com/open?id=0B5_EWtiHz17NN0h1VzNfME5rUlU

In the very near future we will be updating our "Conservation" web page with links to all the above organizations and others, and will provide resources and information about current issues to help our members advocate for Colorado's native plants and their habitats.

If you'd like to join the CoNPS Conservation Committee, please contact Mo Ewing at bayardewing@gmail.com

Linda Smith is a Member of the CoNPS Conservation Committee and is the CoNPS Administrative Coordinator. She is the author and illustrator of Identification Key for Woody Plants of the Pikes Peak Region *published by CSU Extension, El Paso County, where Linda worked for many years. Linda was a Native Plant Master trainer, at Garden of the Gods in 2008.*

Photo at Right: Linda Smith at Colorado Wilderness Gathering, Photo by Jan Loechell Turner

How Do I Find Out About Upcoming Gas and Oil Lease Sales?That information is available at http://rockymountainwild.org/upcoming_lease

Climate Change and Columbines: Using Herbarium Specimens to Track Changes in Flowering time of *Aquilegia coerulea* in Colorado

Ross McCauley

Changes in phenology (the yearly patterns of biological phenomena) are one of the most sensitive indicators of climate change. In plants these phenological changes involve important processes such as budburst, leaf senescence, and flowering. Here in northern temperate regions climate change leads to changes in phenology in two specific ways, 1) the warming of winters and 2) the earlier onset of warmer temperatures in the spring. As the timing of these processes changes, it may affect how the plant interacts with its environment. Cues of earlier warm spring temperatures may lead to earlier budburst of either vegetative or floral buds which could leave a plant vulnerable to frost damage or it may affect the timing of interactions between the plant and other organisms, particularly the interactions with pollinators and seed dispersers. Pollinators, too, respond to changes in climate; however they may not respond at the same rate as the plants they pollinate, leading to a change in the historical phenological relationship.

Columbine Photo courtesy Ross McCauley

Due to the importance of flowering time to plant reproduction, it is one of the most widely studied phenological patterns and changes have been documented worldwide. To detect these changes in flowering time, it is generally necessary to have a large body of observations extending back in time. For instance observation of cherry blossoms in Washington D.C. have shown that peak flowering occurs five days earlier today than when the park service began keeping records in 1911. Here in Colorado a unique dataset recording flowering times for a multitude of species at the Rocky Mountain Biological Laboratory has shown differing responses of different species over the last 40 years.

But what if we have no direct observations of flowering time? What can we use? Herbarium records are turning out to be a huge source of important plant phenological data. In the US the first studies to evaluate the ability of herbarium records to accurately document phenology were performed at the Arnold Arboretum in Boston, Massachusetts and showed that herbarium records were able to accurately depict changes. Numerous other studies have since followed. For most herbarium-based studies of phenological change direct observation of large numbers of herbarium specimens is required, however this can be difficult as it requires viewing of species from likely a number of institutions. One of the recent and exciting innovations in the use and access of herbarium data is the databasing and digitizing of specimens. Through this process it is now possible to access a large amount of plant data without ever visiting the herbarium collection. This newly digitized data has not yet been widely used for determination of phenology although it has great potential for expanding our ability to study these patterns.

Figure 1: Columbine specimen from University of Colorado Herbarium (COLO)

As a botanical educator I am interested in having students address real-world botanical problems through investigation. Toward this goal I gave my sophomore level Introductory Botany course this past spring the following problem: "Can we use digitized herbarium data to draw inferences regarding changes in flowering time in the Rocky Mountains?" I wasn't sure we would have sufficient data to draw conclusions as the digitization of specimens for our region is not complete but I thought it worth trying. Phenological data can be gleaned from on-line data sources in one of two ways. For collections which have completed imaging of their individual sheets you can examine the specimen itself (Figure 1). This would allow for fine scale evaluation of phenological state – Is the plant in full flower? Is the

plant in bud? Has the plant produced fruits? The second method is that many herbaria are now including phenology as a field in the database. This method is not as nuanced as it generally only lists the general state of the specimen: sterile, flowering, fruiting.

Following a short tutorial on data access, organization, and analysis I let the class go. After a couple weeks of work examining digital databases including SEINet, iDigBio, and the University of Colorado, we got together to discuss the findings. The students chose a number of different taxa, principally from higher elevations, to examine such as *Arnica*, *Gaillardia*, *Hymenoxys*, and *Phacelia*. All showed some changes in phenological response although the magnitude of the change varied greatly. One group comprised of two students, Colby Reynolds from Farmington, NM and Elliot Towne from Golden, CO examined the problem with one of the most charismatic of our local plants – the Colorado Columbine (*Aquilegia coerulea*). Their dataset differed in that it covered a variety of elevations and habitats. Following their class assignment we worked on expanding and refining this comprehensive dataset to investigate the phenological patterns.

From the digital data we only used specimens that 1) indicated flowering phenology either by examining a digital image or by relying upon a phenology determination in the database and 2) provided a specific day of collection. In total this resulted in 498 specimens extending back to 1893. As we needed to rely upon the rough phenology determinations for many of the specimens we determined average flowering time as opposed to time of first flower or peak flowering, two measures which are commonly employed in floral phenological studies. We knew that this reliance on average flowering time would be less sensitive to earlier spring warming but given the currently few available imaged specimens it we felt the greater number of data points was more valuable.

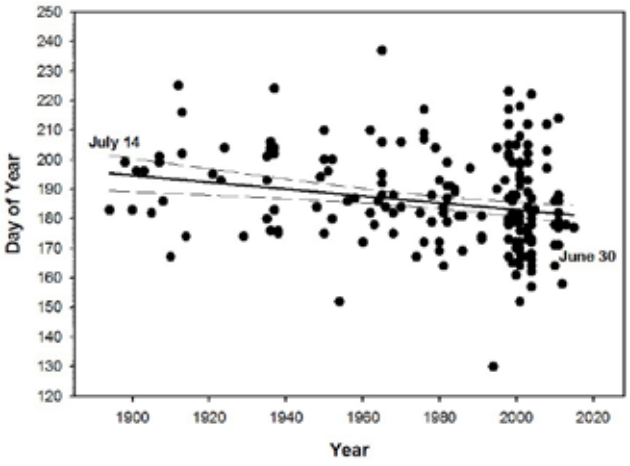


Figure 2

Initial examination of the full dataset showed a shift of 4-5 days earlier in average flowering over the 122 year period. As herbarium specimens contain a lot of other associated data we began evaluating if this was consistent in different environments. What became clear was a pronounced difference in plant response at different elevations. When partitioned between elevations lower and higher than 3000 m (9842 ft) we found the lower elevation populations have a mean flowering time 15 days earlier today than in the 1890s (Figure 2). Upper elevation areas in contrast are only showing a three day shift in their mean flowering time (Figure 3). These results show that climate changes will not affect species equally but be the result of an interaction between species and environment. Whether or not these phenological changes are leading to changes in the relationship between the plants and their pollinators is hard to say without further work examining this in the field. But what is clear is that there has been a change in the flowering time of many of our Colorado Columbine populations. Further work may find that specific environments and not just elevation plays an important role in the sensitivity of individual plant species to climate changes.

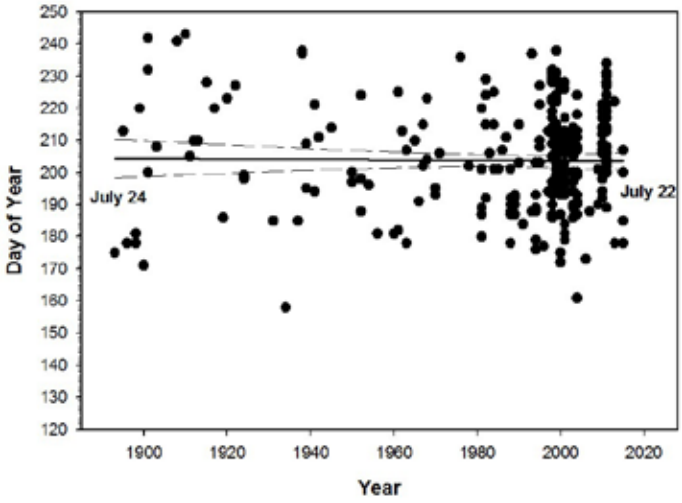


Figure 3

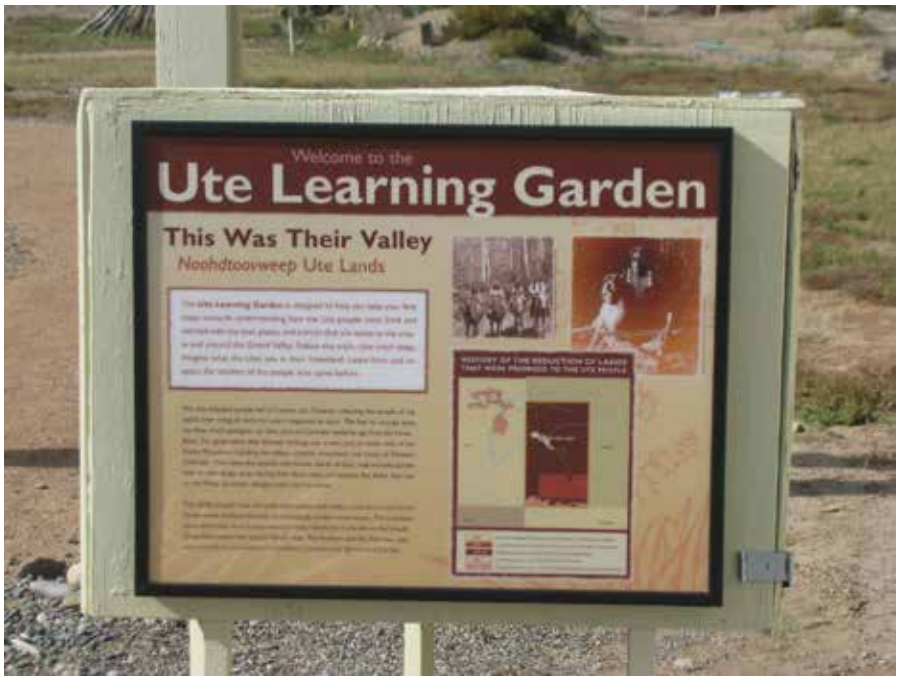
And as for the question I posed to my class "Can we use digitized herbarium data to draw inferences regarding changes in flowering time in the Rocky Mountains?" I think the answer is yes and as many herbaria around the state are actively involved in the databasing and imaging of their collections the increase in available data will make these kinds of analysis more accessible and reliable.

Ross McCauley is Associate Professor of Biology at Fort Lewis College, Durango, Colorado, and Curator of the Fort Lewis College Herbarium (FLD).

The Ute Learning and Ethnobotany Garden

by Susan Carter

The Ute Learning Garden was built through a collaboration of CSU Extension, Bureau of Land Management (BLM), Mesa County, the US Forest Service, and the Ute Indian Tribe in 2005. This garden, located at 2775 Highway 50, Grand Junction, CO, is used to help us teach cultural diversity, promote water conservation, provide a place for the Ute children to come back to, and supply a place to teach to all ages the life zones of the Grand Valley and the native plants and their uses. The garden covers 2.5 acres and is organized by plant life zones. The decomposed granite paths provide ADA access to the gardens. Many of the plants are labelled and there is signage discussing different habitats and the Ute people. Upon taking a docent tour, children are taught how to properly enter and exit our tipi, how plants were used by the Ute people, how to grind blue corn from our Three Sisters Garden and, sometimes, how to make cordage from yucca foliage.



Ethnobotany is the relationship between plants and people. At the garden, children learn what was used by the tribe as food, plant parts that can be used for dye, to make string, baskets or other textiles, or in ceremonies. All the plants have at least one use and some have many uses. Coming to the garden in the Grand Valley is coming home to their native land for the Uintah Utes. They are very involved in our garden and visit several times a year. In 2016, Susan Honea, our Horticulture Program Coordinator, and I had the opportunity to go with members of the tribe and the BLM staff to a higher elevation to properly collect lodgepole pine poles to use in constructing our new tipi. We really enjoyed our day collecting the poles. Did you know that lodgepole pine is used for lodges because it is the best to build temporary lodging? Its name refers to its use. We also have wiki-ups, a ramada, a scaled version of a sweat lodge, and a cooking hearth; the most recent addition to the garden is animal silhouette artwork in the appropriate life zones.

Rabbit art in our desert life zone

Every year, we hold docent training for volunteers to help lead and teach in the garden. This past year, almost 500 people attended docent tours of the garden. The majority of these visitors are elementary school students. The history and the plant life zones fit well into their class curriculum. We have a grant that assists with busing reimbursements for school groups as well as a grant to maintain and improve the gardens. Many teachers discuss their goals with us prior to their visit so the docents can tailor the tour to the

needs of the class. We can use the garden as a teaching tool for native plants because all the plants are native. This year is the twentieth anniversary of the CSU Extension's Colorado Native Plant Master program that was started by Barbara Fahey, former Director of CSU Extension, Jefferson County. Barbara works out of the Jefferson County Extension office and has a very active program there. Ours on the Western slope is a little quieter but we do offer classes at three wonderful sites and beginner Botany classes. Contact Susan Carter if you are interested in any programs. Stop by and take a self-guided tours Give us a couple weeks' notice if you want a docent guided tour.

Docents getting ready for a school visit

School group activities in the garden

Susan Carter is the Horticulture Agent for Colorado State University Extension, Tri River Area which consists of Mesa, Delta, Montrose and Ouray Counties. (970)244-1850, susan.carter@colostate.edu

Website: http://tra.extension.colostate.edu/program-areas/gardening-hort/

Photos courtesy Susan Carter

Urban Prairie Project (cont. from page 29)

work for two pilot sites: Metzger Farm and Plaster Reservoir. Both of these open space parks are disturbed grasslands with access to riparian areas. The scope of work outlined what restoration tasks were appropriate for staff, for trained volunteers and for untrained volunteers and also created a plan for evaluation of these efforts.

With open space department staff stretched thin, it made sense to tap into local enthusiasm for open spaces in order to train volunteer stewards of these parcels. Beginning in March 2016, the partners launched a Restoration Master Volunteer program. These committed and passionate individuals are required to complete 25 hours of intensive training which includes subjects from weed identification and management to how to share scientific information with the public. So far, the partners have trained 21 Restoration Master Volunteers, who have contributed their skills to everything from weed mapping to revegetation projects to pollinator monitoring. These volunteers have so far astounded us with their skills and expertise, as well as their enthusiasm for the hard physical labor of restoration.. The Urban Prairies Project partners have also worked closely with other nonprofits, such as the Broomfield Open Space Foundation, and local schools to involve more local residents in restoration work. A relationship with Legacy High School resulted in two youth service learning projects, including planting native shrubs and collecting invertebrate diversity data. These students are now pursuing the National Wildlife Federations Eco-Schools designation and tying in the habitat restoration.

Amy Yarger is Director of Horticulture at the Butterfly Pavilion and a member of the CoNPS Board.

Urban Prairies Training in Westminster Photo by Amy Yarger

The Urban Prairies Project:
Habitat Conservation and Community Wellness
by Amy Yarger

One of my favorite memories is of a spring day when I was walking to Big Dry Open Space, a Westminster Open Space property adjacent to Butterfly Pavilion. Because of its location, the trail gets heavy use from families, schoolkids and local residents. At the trailhead, I saw what I thought was an explosion of paper litter in the distance and hurried over to clean up. What a happy surprise to find that I was actually looking at a patch of crown-leaf primrose (*Oenothera coronipifolia*). Nature is full of surprises, and one of the goals of having urban and suburban open spaces is to make these transformative experiences accessible to everyone, while providing healthy habitat for native plants and wildlife.

Youth service project in Broomfield.
Photo by Kristi Schaad

Healthy open spaces can address many of the challenges of growth by providing accessible opportunities for people to exercise, to pursue lifelong learning and to appreciate natural beauty. The link between accessible, attractive open spaces and human health is reinforced by a traditional association between the beauty of nature and healing. In 2013, the American Public Health Association officially recommended that land use decisions should prioritize the preservation and restoration of natural areas and green spaces for people of all ages, income levels and abilities. Many researchers have sought a quantitative demonstration of this connection between nature and wellness. Urban and suburban open spaces also contribute millions of dollars in ecological services, including flood management, pollution abatement and access to crop pollination.

But not all open spaces are created equal. Suburban open spaces often struggle with a high degree of ecological disturbance, due to fragmentation, pollution from industry and residential use, and the establishment of invasive species. In comparison to wild lands, human-influenced landscapes generally have a far lower number of plant and animal species, along with less structural complexity. By restoring local open spaces to a greater degree of 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. In order to accomplish a baseline of ecological health for urban and suburban areas, cities and counties can work with nonprofits and local businesses and residents to create "habitat pockets" throughout the community. These "pockets" over time can grow to become linked corridors for wildlife and plants. One successful example of this model is Seattle's Pollinator Pathway, which revolutionized the idea of human and natural landscapes by educating the public to reconsider the priorities for public and private landscaping.

For that reason, habitat restoration becomes a key function of urban and suburban open space departments. Effective habitat restoration aims for ecological integrity, resilience and self-sustainability. These qualities may vary according to the location and conditions of each site, but often, restoration managers will compare a site under restoration to an established reference site. Restoration managers use current best practices to remove exotic species, reintroduce native species and manage erosion and other anthropogenic damage. These activities have greatest impact in restoring a rich vegetative structure, which according to current models, will lead to greater animal diversity and recovered ecological processes.

The growing communities of Westminster and Broomfield, Colorado currently have over 5000 acres of open space parks and trails. Since residents in Broomfield and Westminster report that they value the wildlife and native plants found on open spaces, effective habitat restoration plays a vital role in maintaining these sites for the community to enjoy. While restoration is currently a priority in these communities' open space management plans, limited personnel and resources consistently challenge the effective management of these lands. In order to increase impactful restoration activities on open space parks and to cultivate a stewardship ethic among local residents, Butterfly Pavilion, the City of Westminster and the City and County of Broomfield created the Urban Prairies Project.

The Urban Prairies Project began in 2016 with two pilot open spaces, Plaster Reservoir and Metzger Farm, which served as the basis for a successful model of habitat restoration and public engagement in the region. First, the partners worked together to develop a comprehensive scope of restoration
(Continued on the bottom of page 28)

Garden Natives
by Jim Borland

Creeping Oregon Grape
Mahonia repens

The late American horticulturist Bernard McMahon was fortunate in having an entire genus named after him. Common to all *Mahonia*s in having evergreen pinnately compound leaves with bristle-toothed edges, Creeping Oregon Grape differs only in the soft tips of these teeth which makes this one of the few truly versatile evergreen groundcovers able to withstand the rigors of high, cold and dry western summers and winters.

Native to sandy, chalky or granitic soils of western coniferous forests, both full sun and shady environs prove favorable to this 5 to 10 inch tall groundcover which is fully covered with 1 1/2 to 4 inch long compound leaflets. These dull, dark green leaflets, when exposed to winter sun usually turn color variations of red, maroon, yellow or purple. 'Winter burn', that malady so common to many evergreens used in the high, cold West, is relatively unknown with Creeping Oregon Grape.

Blooming may occur as early as March in favorable climes and as late as June in colder areas. The dense, many flowered bright yellow inflorescence is complete with a strong sweet fragrance. Flowering is soon followed by a cluster of green turning blue-purple berries which usually remain until spring. Resembling grapes in cluster and with their black-blue covering bloom, these berries are edible, though quite tart, and have been used to make jellies and jams.

Spreading is natural through underground stolons which, given time, will slowly creep and form a large colony of continuous groundcover. Most well-drained soils have proven suitable, including shallow, rocky and loam soils and those which test weakly in salinity. Soils testing as high as 7.6 in the landscape produce excellent plants as do nursery soils either weakly acid or basic.

Propagation is through seeds (54,000 to 71,000 per pound) which exhibit a double dormancy which can be broken by at least two methods. Stratification (cool & moist) at 45°F for 30 days followed by warm (68° F) temperatures for 60 days, then followed by stratification at 45°F for 196 days will usually do the trick. Alternatively, a 24-hour wash with running water followed by stratification has also been reported to work as well. Root cuttings can also be used to increase stocks, but this tedious method holds little advantage over seed propagation. The nursery plants which are usually sold as flatted material can also be dug and sold bare root.

No major pest problems are noted and no pruning is ever necessary.

Although this *Mahonia* is common from British Columbia to southern California, east to Arizona, Colorado, New Mexico and Texas, it is known and used widely only in the central Rocky Mountain States, where it is used extensively. Its adaptability to sun and shade, dry conditions as well as irrigated bluegrass lawns should extend its usefulness even wider. Only slightly more than 15 inches of annual precipitation will ensure a healthy stand. *Hortus III* assigns it cold hardiness to zone 4 but zone 3 is a more accurate accounting.

Jim Borland is a well-known horticulturist and co-hosts the radio show, "Ask the Garden Pros with Jim and Keith", AM 1430 KEZW from 7-9 a.m. on Saturdays. Jim is a former President of CoNPS.

SE Chapter Field Trips (cont. from page 34)

6/17/17 Elk Park Knoll on Pikes Peak

Meet at 8 am at the Toll Gate. We'll carpool up to almost 12,000 ft. to see the unique alpine tundra in this unusual habitat, including dwarf alpine columbines, endemic alpine bluebells, endemic alpine parsley, and dozens of other high altitude blooms. Our hike will be less than one mile, but can be strenuous due to the altitude and weather. Come prepared for cold winds, hot sun and maybe rain on a rocky trail. Bring jacket, raingear, sunblock, water and snacks/lunch. We will try to be back down by 2 pm.

The toll will be $7 per person; please bring cash.

6/25/17 Cottonwood Pass Alpine Flowers

Meet at the summit of Cottonwood Pass (Chaffee County 306) at 9 am. Paving is scheduled for the other side, so the pass will likely be closed beyond the summit. We'll do a short hike thru the tundra to see alpines not found on Pikes Peak, including lavender wallflower and *Smellowskia*. The elevation is just under 12,000 ft; be prepared for short climbs and descents, cold winds, hot sun and maybe rain. Bring sturdy footwear, jacket, sunblock, raingear, water and snacks. We will try to finish by 1.

7/15/17 Buffalo Canyon - Woodlilies

Starsmore is at the mouth of N. Cheyenne Canyon; from S. Nevada (Hwy 115) take either Cheyenne Rd. or Cheyenne Blvd. west. Meet at Starsmore Discovery Center (east lot) at 8 am to carpool up the canyon to the trailhead. We'll follow the creek below St. Mary's falls to look for rare woodlilies and many other lower elevation (7000 ft.) riparian flowers. Please come prepared for warm weather, but bring raingear, water and snacks/lunch. We'll hike 4-5 mi. and be back before 2 pm.

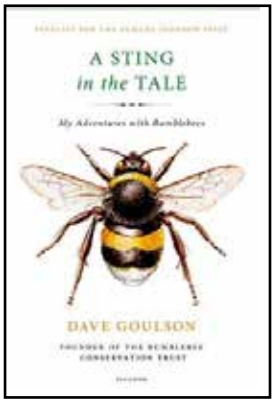
8/5/17 Independence Pass

Meet at 8:30 am at the public parking lot in the village of Twin Lakes. We'll carpool up to well over 12,000 ft. on Independence Pass to investigate the high altitude tundra at the summit, along relatively level ground and ponds. The walk can be easy, but be prepared for cold winds and possible storms at this very high altitude. Bring warm jacket, sunblock, raingear, water and snacks/lunch. There is also a more strenuous hike we can do if anyone chooses, dropping down off-trail from the summit through alpine meadows and thick willowbrush to the lower switchback. We should be back to Twin Lakes by 3 pm.

Book Reviews

A Sting in the Tale
Review by David Julie

A Sting in the Tale: My Adventures with Bumblebees by Dave Goulson. Picador, 2013.



A Sting in the Tale would frustrate Dragnet's Sergeant Joe Friday. Author Dave Goulson recounts more than "just the facts" about bumble bees in his engaging and highly informative book. He confesses to much formative pet-keeping and nature-collecting during his youth. He conveys the reader through revealing field studies in England, Scotland, New Zealand, and Tasmania. He introduces colorful doctoral students who collaborate with him on revealing experiments. Throughout, Goulson accessibly explains fascinating aspects of the biology and conservation of bumble bees.

Dr. Goulson, a scientist and professor who has taught at universities in England and Scotland, continues a century-long British tradition of affection for bumble bees and leadership in research about them. In his first book, the scientific treatise *Bumblebees: Behaviour, Ecology, and Conservation*, Goulson documents the current worldwide body of research. With *A Sting in the Tale*, he appeals to non-scientists to understand and appreciate his favorite animal.

Goulson devotes chapters to especially notable bumble bee characteristics. In "The Bumblebee Year" chapter, plant enthusiasts will see parallels between bumble bee colonies and annual plants. Analogous to a seed, a mated queen overwinters alone in loose soil or leaf litter. In the spring, she emerges, finds a nest site, lays a first batch of eggs, and provides pollen and nectar to the larvae, all of which develop into female workers. The workers take over foraging and nest duties, while the queen lays more eggs. When the worker population becomes sufficiently large, the colony produces new queens and males. After a new queen mates with a male, usually from another colony, and builds up fat reserves, she finds a place to overwinter alone, repeating the cycle. The old queen, workers, and males all die. In contrast, analogous to perennial plants, honey bee colonies use their sizable honey stores to sustain their queen and thousands of workers throughout the winter.

In "The Hot-Blooded Bumblebee" chapter, Goulson summarizes the research of American Bernd Heinrich, author of *Bumble Bee Economics,* into endothermy. A bumble bee's thorax temperature must be at least 86 degrees Fahrenheit for the bumble bee to fly. Bumble bees raise their internal temperature by shivering their flight muscles.

In the "Ketchup and Turkish Immigrants" chapter, we learn that bumble bees can "buzz pollinate", vibrating as they grasp a flower, unleashing a shower of pollen. This ability makes bumble bees exceptionally effective pollinators of nightshades, like tomatoes. Greenhouse growers now employ commercially-reared bumble bee colonies. But shipping colonies spreads disease and introduces species outside of their native ranges. Many researchers believe that commercially-reared colonies transported to the U.S. in the 1990's spread exotic diseases to wild populations, causing dramatic declines in once common U.S. species like the Western Bumble Bee (*Bombus occidentalis*).

In 2006, Dr. Goulson founded the Bumblebee Conservation Trust in Great Britain to promote preservation and restoration of suitable habitat as well as celebration of this amazing animal. The Xerces Society supports similar goals in the U.S. for all invertebrates.

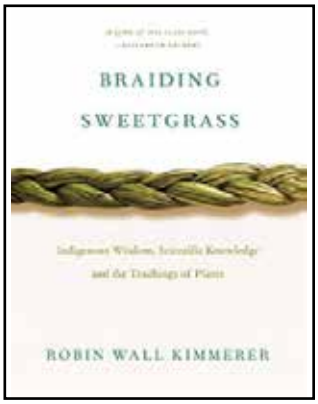
While British fauna and flora predominate Goulson's account, the biology and substance apply to North America. *A Sting in the Tale* offers a stirring chance to listen to one of the world's leading authorities candidly describe his life's work and essentials of what we know about this wonderful creature. I heartily recommend it.

David Julie is Chair of the Education & Outreach Committee.

Braiding Sweetgrass
Review by Suez Jacobson

Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants by Robin Wall Kimmerer. Minneapolis, MN: Milkweed Editions, 2013.

If you have time for only one book during the long winter nights of 2017, choose *Braiding Sweetgrass*. As you read, and your spirit and body open to the sun of the lengthening days, Kimmerer's powerful prose will shine the light of the beauty of our natural world into your mind and heart through her seamless weaving of indigenous wisdom and western science. Kimmerer, who describes herself first as a mother, then as a plant ecologist, writer, and Distinguished Teaching Professor and Director, Center for Native Peoples and the Environment at SUNY Syracuse, takes you into the world of ancient wisdom, a world infused with the magical power of the natural world, its reciprocities and generosities. From keen observation and quiet contemplation, Kimmerer shares with you her deeply rooted traditional knowledge mixed with her science education. On every page, you will find something to touch your soul, to make you think, or to give you hope in a time when our connection to our biotic community is ever more threatened by technological and commercial invasion.



Here's an example, chosen at random:

"I wonder if much of what ails our society stems from the fact that we have allowed ourselves to be cut off from that love of, and from the land. It is medicine for the broken land and empty hearts" (p. 126).

And here's another – an example of Kimmerer's blending of heart and mind, magic and science, describing how algae works with fungus in a partnership:

"The algal partner is a collection of single cells, gleaming like emeralds and bearing the gift of photosynthesis, the precious alchemy of turning light and air to sugar. The algal is an autotroph, or one that makes its own food and will be the cook of the family" (p.270).

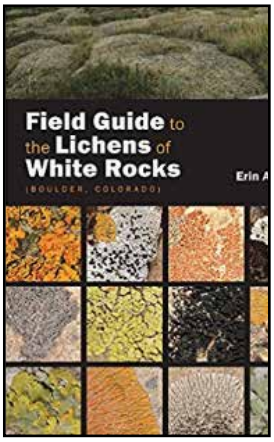
Braiding Sweetgrass is packed to overflowing with the power of the natural world to produce gratitude, joy, respect, giving inspiration to act to protect all your relatives in the natural world. You will want to remember something from every page, so the added benefit is that you will find yourself reading *Braiding Sweetgrass* again in the dark nights of 2018.

Suez Jacobson is a professor of economics at Regis College and a member of the board for Great Old Broads for Wilderness. She is also the executive producer of a film, Wild Hope, working with HaveyPro Cinema. You can watch the film's trailer at wildhopefilm.com. Contributions for the production of the film are appreciated.

Field Guide to the Lichens of White Rocks (Boulder, Colorado)

Review by Bob Powell

Field Buide to the Lichens of White Rocks (Boulder, Colorado) by Erin A. Tripp. Boulder, CO: University Press of CO, 2016.



Dr. Tripp has written a valuable field guide to lichens on sandstone outcrops in the High Plains at the edge of the northern Front Range. White Rocks is a ~100 acre protected natural area at the eastern edge of Boulder that contains large outcroppings of white Upper Cretaceous Fox Hills Sandstone with intermediate deposits of Laramie Formation shales, sandstones and soils. That habitat and similar sandstone ones occur from Boulder north to the Wyoming border; so the lichens that she describes occur in a much larger area than just White Rocks. Although "…the primary purpose … is to facilitate future research …", it is also a very good photo reference for general naturalists. Many of my comments below suggest ways that the book could have been more usable for those interested, but non-specialist, readers.

In 13 pages of introductory text she describes the research area and gives an overview of lichens, their biology, structure, reproduction and substrates. She discusses the general overall concepts and avoids the numerous detailed complexities and rare exceptions. A minimum number of specialized terms are used and those are well defined in the Glossary near the end of the book. Discussions of features often have a reference to the relevant White Rocks lichen that display the feature. Her text shows both a broad and detailed knowledge of current lichenology.

In "Lichen Biology: The Basics" she describes the fungal thallus, the vegetative portion of lichen. The corticies, layers, attachments to substrates and internal matter (medulla) are significantly different in the four main types of lichen. Included in the chapter is a brief discussion of photobionts, green alga or cyanobacteria, that have a symbiotic relationship with the main fungus. The photobionts are usually just below the upper cortex. In the Glossary definition of "Photobiont", she notes the very recent discovery that most lichen have more than one type of photobiont, as was assumed for many years.

In the next chapter, "Lichen Reproduction" there is a short review of an extremely complex subject. She describes many types of asexual and sexual (most often apothecia) reproduction with many specific examples of lichen in White Rocks. Many species of lichen are differentiated by the shape, size and number of very small spores in the spore sack, asci. This often makes species designation difficult for amateurs like myself. Even asexual reproduction structures are complex. In her chapter on "Growth Forms" she describes crustose, foliose, fruticose and squamulose types; the former two are much more common in Colorado. Her introductory text is very well written, technically correct and logically presented. However, if one is not already familiar with lichen structures, it would be hard to visualize the diverse features that she describes. A few line drawings would have helped immensely.

An additional chapter labeled "Further Reading" would have been very helpful to non-specialists. It could contain, among other references, the following with brief reviews: (1) For descriptions and linedrawings of lichen structures and 804 photos, "Lichens of North America" by Brodo, et al. (2) For intermediate-level discussions of lichen structures and physiology, with many illustrative photos, "Lichens" by W. Purvis. (3) For the same on the internet, "Australian Lichens" by the Australian National Herbarium at anbg.gov.au/lichen [the introductory text covers lichens in general, not just Australian ones]. (4) For an up-to date check list with many current synonyms, "North American Checklist" by Theodore Esslinger that is documented in Opuscula Philolichenum (New York Botanical Gardens) and is available at ndsu.edu/pubweb/~esslinge/chcklst/chcklst7 [several letters are left out of the address]. (5) For an internet site with 7000 photos of 1275 species, located at sharnoffphotos.com. That site lists many synonyms and has 3-6 photos of many species that show variations in shape and color. And (6) for the most thorough field guide for Colorado, "A Color Guidebook to Common Rocky Mountain Lichens", 1999, by Larry L. St. Clair. I frequently use the latter two internet sites; their addresses are bookmarked on my computer.

The second, and longer, part of the book has photos and discussions for all 57 species that occur at White Rocks. She discovered, named and documented two of those species.

Worldwide, there are many named lichen species– 19,387 accepted species' names as of January 2017.

The book has a very convenient arrangement with a color photo on the left page and a discussion of the species on the opposite page. The descriptions and comments in the texts are very informative and helpful. The discussions are easy to read and are free of highly technical features. Again, technical words necessary for descriptions are defined in the Glossary. She gives easy-to-recognize features and when necessary, lists special features that separate the species from similar species that are at White Rocks or nearby. She also includes information on type of form, color, propagation method, ecology, substrate and distribution. Unlike the monumental book by Brodo, et al., references to the original research are given for each species. Another difference between this book and many others is that each photo is tied to a voucher specimen in a herbarium, an excellent innovation for a field manual. I was surprised that some species that are common in the Great Plains are not present at White Rocks. For example, Tiny Button Lichen, *Amandinea punctata*, was absent; but it has been recorded in every North American state but Nevada (as of 2001).

My next comments are personal preferences concerning order of arrangement, synonyms and color. The species and photos in the book are arranged alphabetically by genera, not by family and then genera as is usual in flora of angiosperms. When arranged by genera, species that differ by family and appearance may be on adjacent pages, for example, *Xanthoparmelia lavicola* and *Xanthoria elegans*. But species that look similar, are in the same family and have the same distinguishing chemical can be widely separated. For example, *Caloplaca trachyphylla* and *Xanthoria elegans* look similar, are both in the same family, Teloschistaceae, and have the same strong orange pigment anthraquinone parietin.

Many genera, like *Aspicilia* and *Caloplaca*, have been separated into several newer genera in recent versions of the "North American Checklist". However, Dr. Tripp and many other lichenologists do not yet accept all of the new species names. It would still be helpful to have synonyms included in the text for each species where there have been changes. She does mention some synonyms like *Caloplaca trachyphylla*, *Xanthomendoza trachyphylla* and a few others like *Montanelia*, formerly *Melanelia*. But there are others not mentioned, for example, *Caloplaca decipiens*, *Calogaya decipiens* and the very common orange *Xanthoria elegans*, *Rusavskia elegans.*

A few lichen species have significantly different color variations, even when dry. For example, *Staurothele areolata* is brown at White Rocks, but olive green in northern New Mexico. Apparently White Rocks has a small enough area to not have color significant variations within a species. Some lichens appear white even though their thalli are colored because pruina (white dead fungal cells) cover their upper surface. An example in the book is *Acarospora strigata*. The large photo shows a dark gray specimen with very few pruina; the insert photo shows a white specimen covered with pruina. The book also illustrates an important change in color when some species become wet. A few species with thin upper cortices are brown when dry, but turn green when wet. The large photo for *Endocarpon pallidulum* shows the brown specimen while it is damp. Smaller inserted photos show the green color when it is wet and the grayer color when it is very dry. An excellent illustration! The text omits that *Placidium squamulosum* also turns from brown to green when it becomes wet.

There is one significant item that was beyond Dr. Tripp's control: insufficient funding. The Regents and administration at C.U. feel that it is much more important to support semi-professional farm teams rather than fund small research projects by the faculty. After she had completed the manuscript it took a long time to obtain funding for its publication. Finally with support by CoNPS and many individuals, publication became possible. A few line drawings of lichen structures by a botanical artist would have helped the introductory text. Many of her photos would show better if they had been printed by the plate process with dpi of 300+ rather than the cheaper and lower quality web process with less color control and dpi of only 200.

Dr. Tripp wrote a valuable and very informative booklet on lichens in one habitat. It is probably futile to hope that someone with her skill will have the time and funding to prepare such a thorough book for our area, southwestern Colorado, with habitats that range from cold alpine to dry hot semidesert. It is even more futile to hope for a modern and complete book on all of Colorado.

Bob Powell is on the Board of Directors of the Colorado Native Plant Society.

Intermountain Flora,Volume 7

Review by Jan Loechell Turner

N.H. Holmgren and P.K. Holmgren. 2017. Volume 7: Potpourri: Keys, history, authors, artists, collectors, beardtongues, glossary, indices. In: A. Cronquist, A.H. Holmgran, N.H. Holmgren, J.L. Reveal, and P.K. Holmgren. *Intermountain Flora. Vascular plants of the Intermountain West,* U.S.A. Bronx: New York Botanical Garden.

The arrival of the final volume of I*ntermountain Flora* was greeted with excitement at my house. Anyone who is acquainted with the preceding 6 volumes of the series knows what a treasure it is and it is now complete with the publication of Volume 7, *Potpourri: Keys, History, Authors, Artists, Collectors, Beardtongues, Glossary, Indices.*

The Holmgrens have created something very special. Even if you do not own the preceding volumes (but you should!), you will want to purchase this volume not just for reference, but to curl up in a chair and enjoy the interesting reading.

This volume is called the Potpouri volume because it contains a bit of this and a bit of that.

(Cont. on page 22)

Colorado Native Plant Society Membership Form

Name_____

Address _____

City _____State _____Zip _____

Phone _____E-mail _____

Chapter (if known)_____
CHAPTERS: Boulder, Metro-Denver, Northern (Ft. Collins-Greeley), Plateau (Grand Junction & West Slope), Southeast (Colorado Springs-Pueblo), Southwest (Durango) or Unaffiliated

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

Address _____

City _____State _____Zip_____

Most members receive the *Aquilegia* newsletter electronically.

☐ Check the box if you would like to receive the printed copy of *Aquilegia*.
Please make check payable to: Colorado Native Plant Society

DUES include newsletter *Aquilegia* published quarterly.
Membership dues cover a 12-month period

☐ New ☐ Renewal

☐ Student $17 ☐ Senior (65+) $17 ☐ Individual $25

☐ Family $35 ☐ Plant Lover $50 ☐ Supporting $100

☐ Patron $250 ☐ Benefactor $500 ☐ Life Member $800

CONTRIBUTIONS to CoNPS are tax deductible

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

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

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

☐ **Check box to receive information on volunteer opportunities**

Chapter Programs (cont. from p. 13)

Northern Chapter Programs

Where: Gardens at Spring Creek, 2145 Centre Ave, Fort Collins **Time:** 7 p.m. to 8:30 p.m. If you have questions, please contact Renee Galeano-Popp at mtnpoppies@aol.com.

Thursday, April 6, 2017, 7pm
Displaced Plant Communities
Casey Cisneros, Larimer County Open Space
Casey will talk about vegetation restoration efforts on Larimer County Open Lands

Thursday, May 4, 2017, 7pm
The Role of Monitoring Vegetation in the City of Fort Collins Natural Areas
Crystal Strouse, City of Fort Collins Natural Areas
Crystal will talk about how the City of Fort Collins Natural Areas Department uses monitoring to determine the management of the lands they own.

Southeast Chapter Field Trips

To register for these trips, reply to Doris Drisgill at mtnflora@gmail.com

April 22, 2017 Tunnel Drive in Canon City
Meet at 9 am at Veterans Park, Hwy 50 & S. 3rd St., near the restrooms on the east end. We'll carpool the short distance to Tunnel Drive trailhead, and do an easy, almost level walk along the scenic Arkansas River to look for Claret Cup cactus and other hot and dry, rocky spring flowers. There's always a chance to see bighorn sheep here. Bring water and snacks; we'll try to be finished by noon. ***(Continued on page 30)***

***Intermountain Flora* Book Review Addendum**
(Continued from page 22)

In his book reviews in *Taxon,* Rudi Schmid, former RevNot editor, took pleasure in statistical information so, the following information is for Rudi and anyone else with his love of numbers:

The eight earlier volumes include descriptions of 146 families (plus three cultivated families..., 898 genera, 3847 species, and 1571 varieties. An additional 426 cultivated species 551 extralimital taxa are treated in keys and/or discussions. The five largest families are Asteraceae (volume 5), Poaceae (volume 6), Fabaceae (volume 3b), Brassicaceae (volume 2b) , and Scrophulariaceae (volume 4). The five largest genera are *Astragalus* (volume 3b), *Eriogonum* (volume 2a), *Penstemon* (vol. 4), *Carex* (volume 6), and *Erigeron* (volume 5).

The four authors (Barneby, Cronquist, Noel and Patricia Holmgren) based at The New York Botanical Garden prepared manuscript for 82% of the 3867 pages in the volumes with taxonomic treatments. " (quotations from the Introduction of volume 7, p. 7).

Volume 7 is dedicated to over 350 collectors of plants of the Intermountain West.

The work of 27 artists was used in *Intermountain Flora* with a line drawing of each species and variety. Jeanne Janish and Bobbi Angell were each responsible for more than 1200 line drawings each for a total of 68% of the illustrations. Ninety-seven percent of the illustrations were produced by 7 artists: Jeanne Janish, Bobbi Angell, Robin Jess, Anthony Salazar, John Rumely, Laura Vogel, and William Moye. (p. 104).

The *Intermountain Flora* project took 40 years to complete.

Calendar

MARCH

March 16, 12pm-1pm, Native Plants for Every Landscape Situation WEBINAR, CO Native Plant Masters® Program
Mar 17, Fri, 11am; Wildscape Ambassador Training, Audubon Society of Greater Denver Nature Center, Littleton
Mar 18, Sat, 11am; Wildscape Ambassador Training, Rawlings Public Library, Pueblo
Mar 20, Mon, 10am; Lair O'Bear Field Trip (MD)
Mar 25, Sat, 9am; CoNPS Workshop: The Influence of Soil Properties on Where Native Plants Grow; CSU Hort Center, Ft Collins - FULL

APRIL

Apr 1, Sat, 9am; CoNPS Workshop: Using CO Native Plants on Green Roofs; Douglas County Fairgrounds, Castle Rock
Apr 5, Wed, 6:30pm; Plant Photography, Improving Photos with any Camera (MD)
Apr 6, Thurs, 7pm; Displaced Plant Communities: Challenges and Strategies of Prairie Restoration in Northern CO (N)
Apr 8, Sat, 9am; CoNPS Workshop: Great Plains Ethnobotany and Folklore; Poudre Learning Center, Greeley
Apr 9, Sun, 9am; CoNPS Workshop: Tropical and Latin American Ethnobotany, Poudre Learning Center, Greeley
Apr 11, Tues, 7pm; Updates from Longmont – After the Flood (B)
Apr 11, Tues, 8:30-4:30pm; Front Range Open Space Symposium in Boulder
Apr 15, Sat, 9am-5pm; Plant Sale with NARGS at DBG (MD)
Apr 22, Sat, 9am; Tunnel Drive in Canon City Field Trip (SE)
Apr 29, Sat, 9am; CoNPS Workshop: Thistle Identification, Rocky Mtn Arsenal NWR, Commerce City
April 30, Sun, 9am; CoNPS Workshop: Thistle Identification, Rocky Mtn Arsenal NWR, Commerce City

MAY

May 3, Wed, 6:30pm; Native Plant Gardening (MD)
May 4, Thurs, 7pm; Role of Monitoring Vegetation - Fort Collins Natural Areas (N)
May 5, Fri, 4:30pm; Hayden/Green Mtn Park Field Trip (MD)
May 10-12, Wed-Fri; Partners in the Outdoors Conference, Breckenridge
May 11, Thurs, 8:30am; Roxborough State Park Field Trip (MD)
May 13; High Plains Environmental Center, Loveland, Grand Opening
May 13-14; AZ Native Plant Society Annual Botanists Meeting
May 24, Wed, 9am; Rocky Mountain Arsenal Field Trip (MD)

JUNE

June 2-5; American Penstemon Society 2017 Annual Meeting, Vernal Utah
June 3-4; CoNPS West Slope Festival
June 3 First Annual CSU Extension Demo Day, Grand Junction
June 10-17 – Colorado Native Plants Week
June 10, Sat, 8:30am; North Table Mtn Field Trip (MD)
June 10, 8am-4pm; Summer Garden Tour (MD)
June 12, Mon, 8:30am; North Table Mtn Field Trip (MD)
July 15, Sat, 8am; Buffalo Canyon Woodlilies Field Trip (SE)
June 17, Sat, 9am; Staunton State Park Field Trip (MD)
June 17, Sat, 8am; Elk Park Knoll on Pikes Peak Field Trip (SE)
June 20, Tues, 8am; Hayden/Green Mtn Field Trip (MD)
June 25, Sun, 9am; Cottonwood Pass Alpine Flowers Field Trip (SE)

JULY

July 1, Sat, 8am-12-noon; Boulder Area Native Plant Garden Tour
July 8, Sat, 9am; Ransom Edwards Jeffco Open Space Field Trip (MD)
July 9, Sun, 8am; Mt. Silverheels Field Trip (MD)
July 12, Wed, 9am; Staunton State Park Field Trip (MD)
July 14, Fri, 8am; French Creek Field Trip (MD)
July 18, Tues, 8am; Treasures of Tenmile Range Field Trip (MD)
July 21, Fri, 8:30am; Hoosier Ridge-West Field Trip (MD)
July 21-23; Eriogonum Society 2017 Annual Meeting, Siskiyou Mtns area
July 25, Tues, 8:30am; Lower McCullough Gulch Field Trip (MD)

AUGUST

Aug 5, Sat, 8:30am; Independence Pass Field Trip (SE)

SEPTEMBER

OCTOBER

Oct. 11-12 Natural Areas Assoc. Conference, Fort Collins, CO

NOTE: *Events of other organizations (Not CoNPS) are in italics.*

KEY

B	Boulder Chapter
MD	Metro-Denver Chapter
N	Northern Chapter (Fort Collins-Greeley-Loveland)
P	Plateau Chapter (Grand Junction and more)
SE	Southeast Chapter (Colo. Springs, Pueblo, more)
SW	Southwest Chapter (Durango and m

EPA (Continued from page 8)

Students are not required to attend the fair to apply.

Application Requirements: To apply for any of these positions supply the following by March 31, 2017: transcripts, resume and a cover letter (indicating the position or positions you are interested in, your available start date and approximate hours/weeks you could work) to R8EPAintern@epa.gov with the subject line: Student Volunteer Internship Program.

Colorado Native Plant Society

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

Tasselrue
Photo by Bob Powell