

Newsletter of the Colorado Native Plant Society

Aquilegia

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Marr Fund Research: Population Structure of Colorado Piñon Pine, *P. edulis*

SEINet: Using Herbarium Specimens to Enhance Biocollaborative Efforts

Native Pollinators, Native Plants

Nantucket Notes: Glaciers and Plants

Ethics of Collecting: CoNPS Revised Policy

The Native No Water Garden

Lichen Profiles

Volume 37 Number 6 Winter 2013

Aquilegia: Newsletter of the Colorado Native Plant Society

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

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Question: What do Aldo Leopold, Alice Eastwood, John Marr, and Charles Darwin have in common?

Answer: Their birthdays are all listed on the 2014 CoNPS Wall Calendar! Not only does the calendar contain gorgeous photos of plants taken by CoNPS photo contest participants and winners, the birthdays of 26 noteworthy botanists/ecologists are included in the calendar. Get yours now! At \$8 these calendars are an incredible bargain!



Win a free CoNPS calendar!
See page 27!

Lichen Profile

Photo & Text by Sally L. White

FROSTED ROCK TRIPE

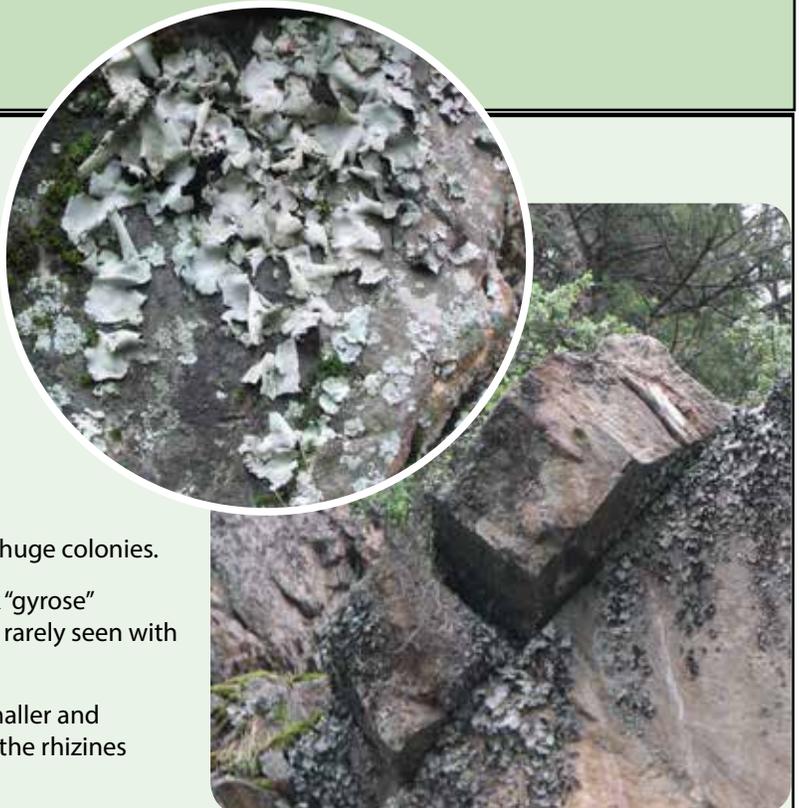
Umbilicaria americana

This species and its relatives are known as “rock tripe” and said to be edible, though perhaps only in dire situations. For example, the related species *Umbilicaria mammulata* fed George Washington and his starving troops during the harsh winter of 1777 at Valley Forge. A distinctive and abundant lichen on moist, vertical cliff faces in the Front Range, it lacks apothecia and has a sooty black underside covered with rhizines, creating a velvety appearance. Leathery (when wet) thalli are “umbilicate” (attached only at one central point) and can be 15 cm across. Largest and most notable of our umbilicate species, this often grows in huge colonies.

Fun fact: Some species of *Umbilicaria* have intriguing black “gyrose” apothecia with concentric fissures. This species, however, is rarely seen with apothecia.

Don't be fooled: *Umbilicaria vellea* is similar, but usually smaller and generally found at higher elevations or latitudes. Details of the rhizines distinguish the two.

Sally L. White celebrates lichens at coloradolichens.org



Cover Photo © Jeffry B. Mitton

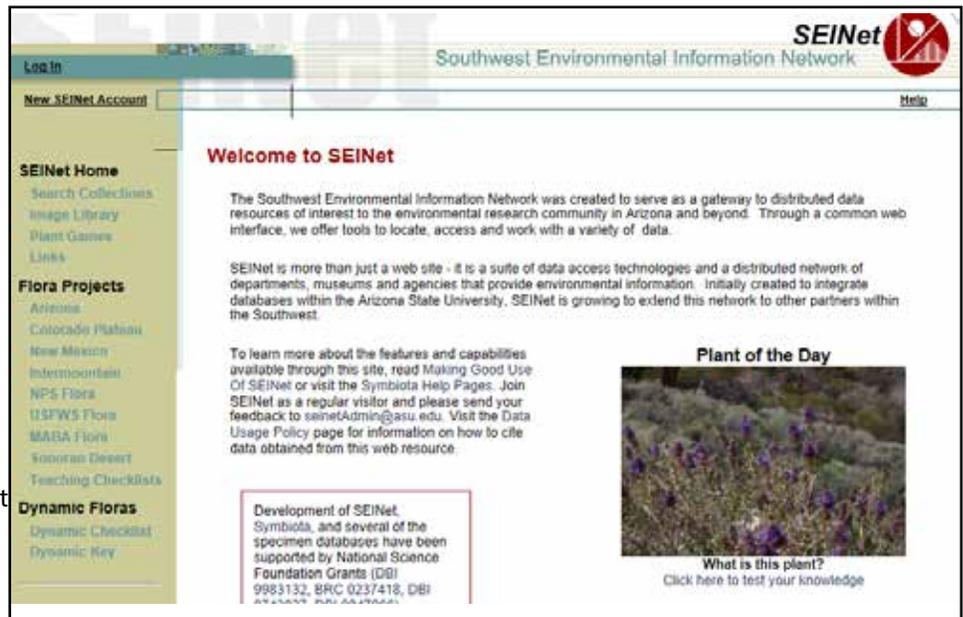
SEINet: Using Herbarium Specimens to Enhance Biocollaborative Efforts

by Ed Gilbert

Introduction

Technology advancements over the last decade have significantly improved the access and availability of scientific information for educational and general use. The Southwest Environmental Information Network (SEINet) is a great example of how scientific resources can provide reliable and easy-to-use methods for anyone to explore local biodiversity. SEINet is a public website built upon a foundation of research data that have been integrated into a single resource. This resource originated as an NSF-funded project out of Arizona State University, but has since grown into a collaborative project that now incorporates numerous partners across the nation. On the most basic level, SEINet provides public access to common names, images, distribution maps,

taxonomic information, local inventory checklists, interactive identification keys, and far more. Furthermore, the website also serves as an online data management system that allows the research community to manage scientific data within an integrated environment. This direct relationship with the research community ensures that the resource maintains a high level of data integrity. However, contribution and management of data is not limited solely to the professional. Methods are being developed that allow students and amateur biologists to add data, find and resolve errors, and help in improving the resource so that it best serves the entire community.



Importance of Physical Specimens

When asked about my graduate student research, I would tell people that I spent most of my time within the campus herbarium. However, few folks had any idea that “herbarium” was a valid word, let alone that represented an extremely valuable yet underappreciated resource. It is a little known secret that there are thousands of plant collections located worldwide. Most botanical gardens and universities—big and small—curate a botanical specimen repository, or a herbarium, containing specimens that have been collected both regionally and globally over periods of decades and even centuries. These specimens are pressed, dried, mounted on sheets of archival quality paper, and then stored in cabinets within a controlled environment. It is not unusual for some of these specimens to be over 100 years old and still have color in the flowers and leaves. In essence, a herbarium is analogous to a museum or research library of carefully preserved plants that support scientific research and furthers our understanding of the plant world.

Taxonomists, ecologists, geneticists, and field biologists are a few of the many professionals that find herbaria an invaluable resource for supporting their research. The morphology and genetic information available from the physical specimens provide key information for understanding plant relationships, geographic distributions, species discovery, economic usefulness, and even molecular change over time and space. Of equal value, herbarium specimens contain information describing by whom and when the collection was made, along with specific details about the locality, habitat, associated species, and description of the plant. Until recently, this wealth of scientific data was literally locked away in dark cabinets. However, over the last couple decades, great efforts have been made to image these specimens, digitize the information recorded on the specimen label, and organize them within a network of databases. These efforts, in conjunction with developments in web technology, have not only unlocked this data but provided an opportunity to develop an extremely versatile resource that is particularly well-suited for the education and exploration of regional and local biodiversity. Herbarium data serve as the core data foundation for SEINet.

Useful Tools for General Public

Imagine that you are on a local wilderness hike and you find a plant you have not seen before. How do you go across identifying this unknown? Field guides can be helpful but they typically cover only a fraction of the species found within any particular area, so there is a good possibility that the species you found will not appear in the guide. You can use a more complete

academic resource, such as a statewide flora, that will cover all the known species observed within the region, but these technical resources often require extensive knowledge to successfully navigate identification keys that even experts may struggle with. Digital resources such as SEINet offer new opportunities with enhanced flexibilities. Since the data foundation consists of expert-reviewed specimens that represent all of the known species found within the greater region, the website represents a fairly complete and high quality resource. Yet it is also constructed in a way that even amateur botanists armed with limited morphological knowledge can easily filter out unlikely species and narrow the possible identifications to a small handful of possible species.

Within SEINet, click on “Dynamic Key” within the left menu to open an interactive Google map. This common Google map interface allows one to pan, zoom, and click on the location where the unknown plant was observed. Upon submission of the coordinates, the system will dynamically build a species list based on the expertly identified specimens collected within the immediate area. This will usually reduce the number of species found within the greater region down to a third. Once a species list is created, one is presented with a list of morphological traits that provide the user with the ability to further reduce the plant list based on descriptive characteristics of the plant. If you know the habit (tree, shrub, herb, etc.), leaf type (simple, compound), leaf arrangement (alternate, opposite), and/or flower color, one can often reduce the list to a small handful of possibilities. From here, one only needs to click on the plant names to display field images, descriptions, and distribution maps, which will aid in determining

the correct identification.



CACTACEAE OF ARIZONA
Mohave County

Echinomastus johnsonii (Parry ex Engelm.) E. M. Baxter

Meadview South 7.5' USGS topographic quadrangle: 11S 07 68 240mE 39 76 690mN [NAD 27]; N35° 54.0 ' W114° 01.6'; 1190m (3900ft) elevation; above and to the west of Grapevine Wash, north of Kingman, rolling hills of basalt and limestone rock and gravel, *Coleogyne ramosissima* scrub with *Cylindropuntia acanthocarpa* var. *coloradensis*, *C. whipplei*, *Opuntia basilaris*, *O. phaeacantha*, *Yucca brevifolia* and *Y. schidigera*.

Stems 1-2 in number, spines pale yellow and pink at the base or pink throughout.

Marc A. Baker 16152 3 May 2006
with Rafael Routson

Digitized Inventories

SEINet is also a repository of a large number of inventory checklists originally compiled by floristic research projects. These floras can be easily explored by scientific names, synonyms, and even common names. Interactive identification keys are automatically available for any checklist. Floras typically represent higher quality species lists; they are systematically compiled over an extended period with each observation documented through the collection of one to several voucher specimens deposited within publicly accessible herbaria. Within SEINet, voucher information, which increasingly includes images of the physical specimen, can be displayed for many of the checklists by selecting the “notes & vouchers” checkbox. If there is any doubt that a species occurs within the given area, the voucher supplies reproducible proof

of the observation. More importantly, herbarium vouchers are routinely reviewed and verified by taxonomic experts. This is important as no one person can be an expert in all plant groups and mistakes are bound to happen. When a misidentified voucher is found, an annotation label is applied with the new identification, which then gets entered into the herbarium database. SEINet has established protocols with most participating herbaria that ensure that the new identification filters up through the system and notifies the checklist authors of such errors. This maintains a direct relationship between the taxonomic specialist working within herbaria and general researchers out in the field.

Community Participation

Building a species checklist is an excellent way to explore and learn about the plants within a particular area. Everyone has the ability to manage checklists within SEINet, whether they are research grade or simply a list of the plants found within one’s backyard. By default, personal checklists are private and viewable only through one’s user account until the user decides to publicly release the data. Search tools, interactive keys, and plant games are automatically available for all checklists. Anyone can turn a simple checklist into a research grade flora by documenting species observations with the collection of a herbarium voucher. After being sponsored by a local herbarium, collectors can use SEINet to enter their own collection data that will be used to print herbarium labels. Although conducting a documented flora can be a lot of work, it can also provide an enjoyable and rich learning experience. Floras make excellent long-standing group or class projects that can be coordinated directly through SEINet. For details on creating personal checklists or participating in more extensive flora projects, visit the tutorial pages available through the Help link in the upper right of all SEINet pages.

Conclusion

SEINet is a developing resource that is rapidly expanding into a national network of biodiversity websites. New websites are being established that work from the same data resource but are tailored to present information specific to a particular region. For example, the Intermountain (<http://intermountainbiota.org>) and Great Plains (<http://ngpberbaria.org>) data portals are sister websites that are powered by the shared SEINet data repository. In this same manner, efforts are in the works to establish a Rocky Mountain portal specifically designed for the Colorado and Wyoming communities. Building and managing the data within these extended non-profit resources can be an overwhelming task for any one institution. However, data management tools provided within SEINet offer an opportunity for this to be done collaboratively as a group effort and jointly we can ensure that the resource reaches its full potential to best serve the community as a whole. Find SEINet at <http://swbiodiversity.org/portal/index.php>.

Originally trained as a botanist, Edward Gilbert now works for Arizona State University as a Biodiversity Informatics Specialist.

Images provided by Ed Gilbert

SEINet
Southwest Environmental Information Network

***Cirsium arizonicum* (A. Gray) Petrak**
Go to [Encyclopedia of Life](#)
Family: Asteraceae
Arizona thistle. more...

Flora of North America | General Description

David J. Keil in *Flora of North America* (vol. 19, 20 and 21)

Perennials, 30-150 cm; taprooted caudices or runner roots. **Stems** 1-several, erect or ascending, glabrous to thinly arachnoid-tomentose with fine non-septate trichomes and/or villous with septate trichomes, sometimes ± glabrate; branches 0-many, ascending. **Leaves:** blades oblong-elliptic, 3-40 × 1-13 cm, unlobed and spinulose to shallowly lobed or divided nearly to midvein, lobes few-many, ovate to linear-acuminate, often again lobed or divided, main spines 2-30 mm, abaxial faces green, glabrous to densely gray tomentose, sometimes midveins villous with septate trichomes, adaxial green, glabrous to gray-tomentose, sometimes glabrate; basal sometimes present at flowering, unlobed to deeply spiny-lobed, winged-petiolate or sessile; principal cauline sessile, well distributed, gradually diminished distally, bases sometimes decurrent as spiny wings to 2.5 cm or clasping; distalmost sometimes ± bractlike. **Heads** 1-100+, erect, in corymbiform or paniculiform arrays. **Peduncles** 0-15 cm. **Involucres** cylindric or ovoid to campanulate.

Max Licher

Max Licher

Max Licher

Li Mjonga

Max Licher

Open Interactive Map

Please Participate in the Advocacy Survey Now!

Please complete the survey on page 6 and send it to: CoNPS Office, P.O. Box 200, Fort Collins, CO 80522 or take this survey online at the CoNPS website through SurveyMonkey <https://www.surveymonkey.com/s/9TRPYXK>

Dear Colorado Native Plant Society Member:

The CoNPS Board of Directors would like your input on our current consideration of the CoNPS role advocating for the protection of Colorado's native plant habitat as specified in the CoNPS Mission Statement: "The Colorado Native Plant Society is dedicated to furthering the knowledge, appreciation and conservation of native plants and habitats of Colorado through education, stewardship and advocacy."

Our motivation as a board in taking up this issue at the present time stems from these concerns:

1. The pressure on Colorado's public lands has never been greater, and is expected to grow over the next several decades. This puts our habitats for native plants and the other biota that depend on them at ever increasing risk. (See the article by Mo Ewing, "Conservation Corner: Oil, Gas, Native Plants and US," from the

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Fall issue of *Aquilegia*, Vol. 37, No. 5, pages 14-15.)

2. There is an urgent need for an honest and objective evaluator of the impact of these development projects on the health and, in some instances, on the survival of Colorado's native plant communities.

CoNPS defines Advocacy as: "Influencing public policy through existing procedures." This involves collaborative, civic engagement with our public land managers working within existing processes (i.e., this will not involve chaining ourselves to any bulldozers!).

Please take a few minutes to answer the questions on page 6. CoNPS wants and needs your input as we consider this important issue. Thank you.

The Board of Directors for The Colorado Native Plant Society

Advocacy Survey

1. “The CoNPS should become more of an advocate for the protection of native plant habitat on Colorado’s public lands.”

I strongly agree. I agree, but with some reservations I’m neutral on this issue
 I somewhat disagree I strongly disagree

2. Would you contribute to a one time “advocacy fund” to help the CoNPS hire a full-time advocate for native plant habitat on public lands?

Definitely Probably I’m neutral on this issue Probably not Definitely not

3. Are you concerned that CoNPS advocacy for native plant habitat would impact other parts of our mission, such as education (field trips and workshops)?

Yes, I’m greatly concerned I’m somewhat concerned I’m neutral on this issue I’m not concerned

4. Are you concerned that CoNPS advocacy for native plant habitat would negatively affect the neutrality of our organization and impact relationships with current partners?

Yes, I’m greatly concerned I’m somewhat concerned I’m neutral on this issue I’m not concerned

5. How would CoNPS advocacy for the protection of native plant habitat on Colorado’s public lands affect your relationship with the CoNPS?

- I would be significantly more involved and supportive.
- I would be somewhat more involved and supportive
- It wouldn’t change my level of support or involvement
- I would be less involved and supportive
- I would likely drop my membership in the CoNPS

6. If asked by a CoNPS advocacy coordinator or Chapter president, would you be willing to do the following to assist with plant conservation?

- Visit a public land location within 50 miles of your home to assess and report on native plant populations
- Review a federal management plan to assess the impacts on native plants
- Attend a public meeting to voice concerns for native plant conservation

I would definitely be willing I would probably be willing I would possibly be willing
 Not very likely Definitely not willing

7. If you were convinced the CoNPS was highly effective in helping protect Colorado’s native plant habitats (from damage due to potential oil / gas development or the extraction of other resources), would you be willing to pay more for your CoNPS membership?

Yes, up to a maximum of \$_____ more per year No, I’d rather not support these efforts.

8. The areas of native plant conservation you’re most concerned about are (please check 2 highest concerns):

- Oil and gas development
- Forest management/fuels treatment
- Noxious/invasive weeds
- Recreational impacts
- Residential development
- Other: _____

Comments: _____

Please complete this survey and send it to: CoNPS Office, P.O. Box 200, Fort Collins, CO 80522 or take this survey online at the CoNPS website (<http://conps.org>) through SurveyMonkey <https://www.surveymonkey.com/s/9TRPXK>

Marr Fund Research:

Population structure of the Colorado Piñon Pine, *Pinus edulis*

by Kristy Duran

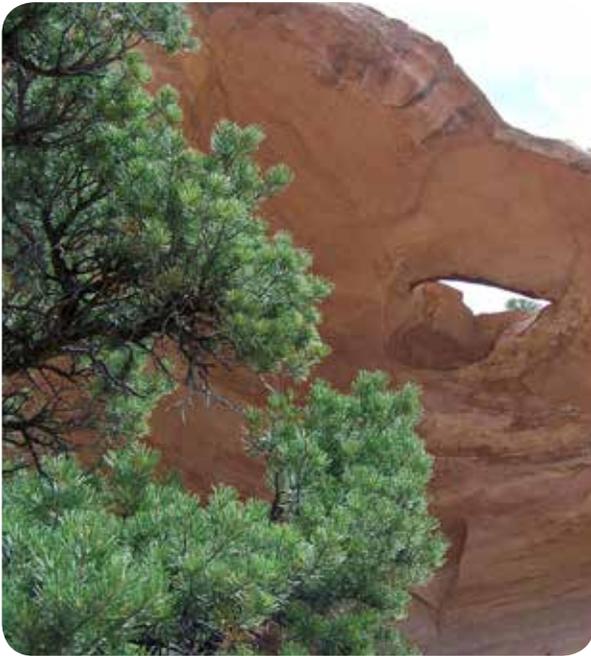


Photo © Kristy Duran

Piñon-juniper woodlands are a dominant community in the southwestern United States. *Pinus edulis*, commonly known as the Colorado Piñon, is a member of the piñon pines (*Pinus* subsection *Cembroides*) and is native to the southern Rocky Mountains. It is the first pine encountered when moving from the arid deserts into the Rocky Mountains and occupies elevations between approximately 1300 and 3300 meters (4,265 - 10,827 feet). Its seeds are edible, hence the name *edulis*, and are widely collected. Not only has this pine historically been used for food, but for fuel and building materials as well. *Pinus edulis* is of both ecological and economic importance.

Today, *P. edulis* is distributed throughout Colorado, New Mexico, Utah, Arizona, and western Texas. However, during the Last Glacial Maximum (LGM), distributions of both plants and animals were restricted to more suitable areas called glacial refugia. The distribution of *P. edulis* during the LGM was much smaller than it is today. Packrat middens, which contain preserved plant material collected by packrats, have provided data for historical plant biogeography in the western United States. They provide evidence that *P. edulis* was restricted to two glacial refugia during the late Pleistocene. One refugium spanned western Texas and southern New Mexico and the other was located in north-central Arizona (Betancourt et al., 1990). Packrat middens containing *P. edulis* in western Texas and southern New Mexico were dated at 40,000 yr BP, 28,000 yr BP, and 16,000 yr BP (Betancourt et al., 1990). Packrat middens in north-central Arizona were dated at 17,000 yr BP suggesting *P. edulis* expanded out of western Texas and southern New Mexico, reaching Arizona prior to 17,000 yr BP. When its distribution

contracted during the LGM, *P. edulis* persisted in this second refugium. Based on packrat midden data, it is hypothesized that as the climate began to warm *P. edulis* migrated out of these two refugia. *Pinus edulis* reached the Rocky Mountain foothills within the last 9000 years, and some sites were colonized only within the last 1000 years (Betancourt et al., 1991). Figure 1 shows the current distribution of *P. edulis* and locations of glacial refugia. If present-day populations of *P. edulis* are descended from two

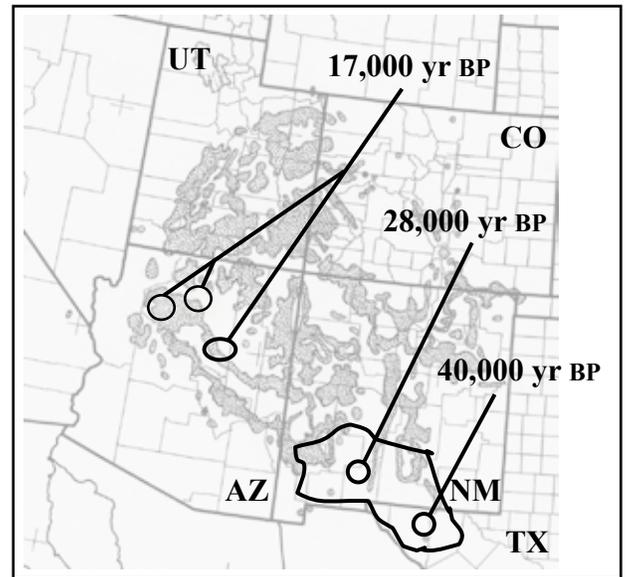


Figure 1: The modern, native distribution of Colorado Piñon, *Pinus edulis* (in grey), and refugial populations inferred from materials by carbon dated packrat middens. Adapted from Duran and Mitton (2012).

genetically differentiated glacial refugia, remnants of refugial genetic signatures should be retained in modern populations. The population structure would be shaped by patterns of migration out of glacial refugia, confounded by modern gene flow. The influence of confounding gene flow can be minimized by utilizing mitochondrial markers, which are moved solely by seed. In this study, three regions of mitochondrial DNA (mtDNA) and nine regions of chloroplast DNA (cpDNA) were used to test the hypothesis of migration out of the two glacial refugia as inferred from packrat midden data.

Pinus edulis needle samples from 26 populations were collected across its range. Because *P. edulis* occurs with and readily hybridizes with *P. californiarum* var. *fallax*, needle samples were collected from two populations of *P. californiarum* var. *fallax* and three hybrid populations of *P. edulis* X *P. californiarum* var. *fallax*. A maximum likelihood phylogram was constructed and is shown in Figure 2.

Four haplotypes were found in the mtDNA of *P. edulis* and are represented by different shaded bars. The circles on the map in Figure 2 represent pie diagrams that illustrate the frequencies of those same haplotypes found in that population sample.

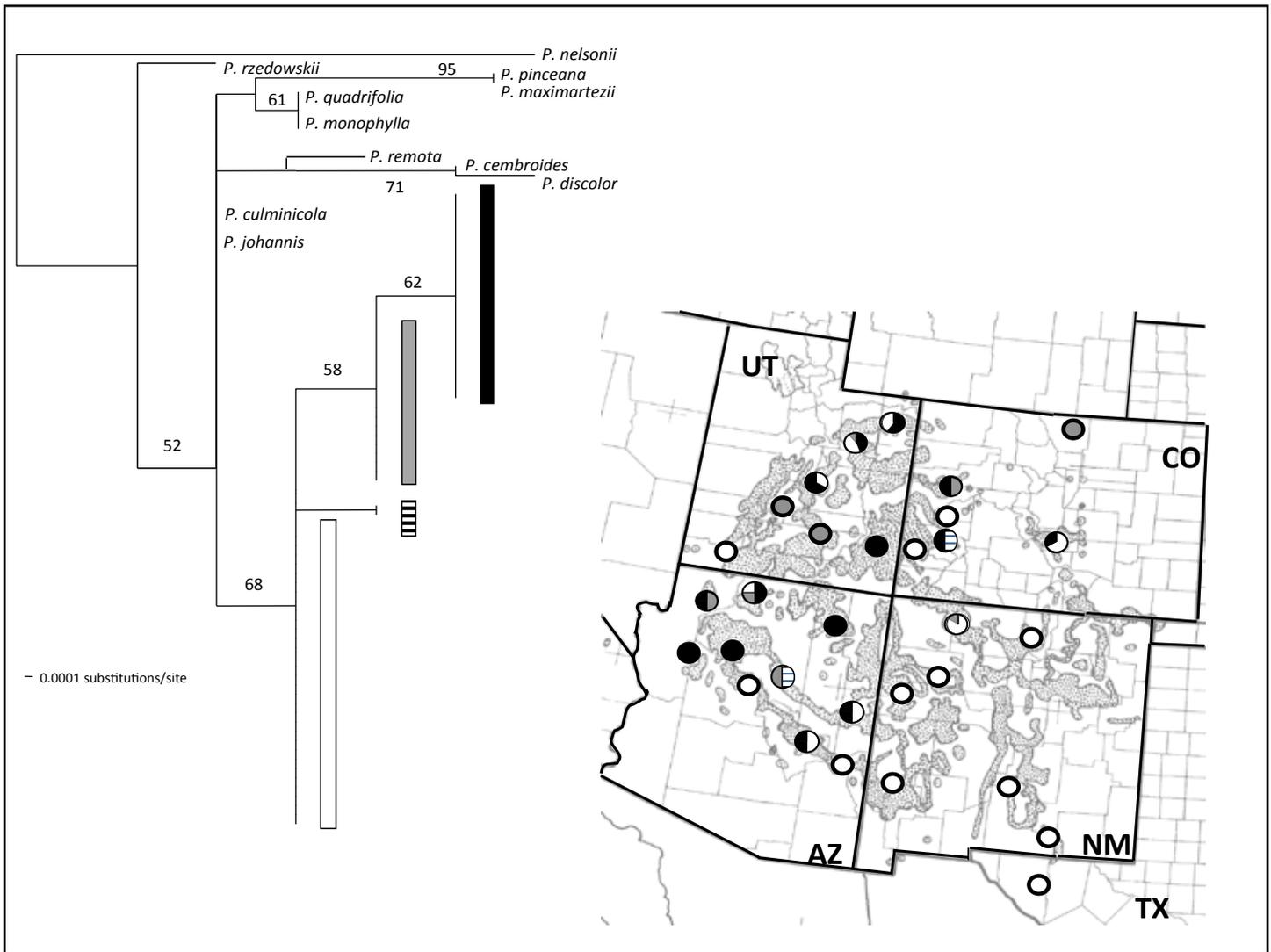


Figure 2: A phylogram depicting the evolutionary relationships among four haplotypes of mt DNA and the frequencies of the haplotypes in population samples. Each circle is a pie chart indicating the haplotypes present and their frequencies. Adapted from Duran and Mitton (2012)

The most ancestral haplotype, represented by the white circles, was found in 20 populations. The most derived haplotype, represented by black circles, was found in 14 populations. The other two haplotypes, represented by the grey circles and the hatched circles, were found in nine and two populations respectively.

The data support the hypothesis of migration out of two glacial refugia. The ancestral haplotype is the only haplotype found in western Texas and in all but one population in New Mexico. A severe bottleneck during the LGM would explain the lack of genetic diversity in these populations. This is consistent with packrat midden data (Betancourt et al., 1990), which indicate that *P. edulis* was more widespread in western Texas and southern New Mexico prior to the LGM and became severely reduced by 10,000 yr BP. It is likely that the Arizona refugium retained more genetic variation and a variety of haplotypes can be found in populations that migrated out of that refugium. Often, high levels of genetic variation are taken as an indicator of a refugium, while lower levels are more consistent with recently colonized areas (Petit et al., 1997; Opgenoorth et al., 2010). In this case, these molecular data suggest that north-

central Arizona is the sole refugium. However, interpreting the molecular data in light of packrat midden data suggest the migration out of two refugia. This study highlights the importance of interpreting molecular data using macrofossil data when available.

These data suggest that populations in New Mexico are descendants of the western Texas/southern New Mexico refugium and all other populations are descendants of the north-central Arizona refugium. In this case, most modern populations are descendant from Arizona. Their success may be due to higher levels of genetic diversity in this refugium.

Another interesting outcome of this study is the close genetic relationship between *P. edulis* and *P. californiarum* var. *fallax*. The species designation of *P. californiarum* var. *fallax* is controversial. Farjon and Styles (1997) argue that it is a phenotypic variant of *P. edulis*. Populations of *P. californiarum* var. *fallax* and *P. edulis* X *P. californiarum* var. *fallax* hybrids fall within the three *P. edulis* clades (Figure 2). These data support the combining of *P. californiarum* var. *fallax* with *P. edulis*.

This research was funded in part by a CoNPS Marr Fund Grant.

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Kristy Duran received a PhD from the University of Colorado, Boulder. She is Assistant Professor of Biology at Adams State University.

Photo on right by Jeffry B. Mitton



Photo by Loraine Yeatts

2013-2014 WORKSHOPS

The Colorado Native Plant Society workshops are exceptional learning experiences for professional and amateur botanists alike. If you enjoy identifying Colorado's flora and learning about its varied ecosystems, please join us! All workshops include a lecture and hands-on interaction with plant material. The cost is \$25 for members. You can register online at www.conps.org. Click on the "Activities" and "Workshops tabs". Please check our web page often for updates and full descriptions.

Lichen Biology—Exploring a Remarkable Symbiosis

Saturday, December 7 or Sunday, December 8, 2013
9 a.m. to 3 p.m. at CU Boulder Campus, Boulder
Presenter: Erin Tripp, PhD

Introduction to the Buckwheat Family

January 25 or January 26, 2014.
9 a.m. to 3 p.m. at CSU Extension, 9595 Nelson Rd,
NRCS Building, Longmont
Presenter: Rich Scully

This workshop will present an overview of the Polygonaceae plant family in Colorado. The family includes the buckwheats, docks, knotweeds, smartweeds, and more. We will study the terminology and morphological characteristics used to describe and separate the genera and species, using representative plants, mainly from the Front Range.

Rich Scully enjoys the study of Front Range species and sharing his work with others. This will be his seventh workshop for CoNPS.

Introduction to Asteraceae Identification

February 8 and 9, 2014 **Note: Date Change**
9 a.m. to 3 p.m. at Regis University, Biology Lab, Denver
Presenter: Lindsey Brandt

The Wonderful World of Cyperaceae

Saturday, February 22 or Sunday, February 23
9 a.m. to 3 p.m. at Colorado Natural Heritage Program office, Ft. Collins
Presenters: Denise Culver and Pam Smith

How to Collect Native Plants

Saturday, March 1 at USDA Forest Service Office, Ft. Collins
OR Saturday, March 8, Jefferson County Extension Office, Golden
9 a.m. to 3 p.m.
Presenters: Steve Popovich, Melissa Islam, and Pam Regensberg

Beardtongues of Colorado: A Primer on *Penstemon*

April 12 or April 13, 2014
High Plains Environmental Center, 1854 Piney River Drive,
Loveland. 9 a.m. - 3 p.m.
Presenter: Craig Freeman

Chapter Programs

BOULDER CHAPTER

Boulder Chapter programs are held on the second Thursday of each month (November through April) at 7 p.m. All meetings are held at Alfalfa's Market Community Room at 1651 Broadway, Boulder, CO 80302 (at the SW corner of Broadway and Arapahoe); free parking can be found ½ block NW in the Boulder Public Library parking lot. For more information, please email boulderconps@gmail.com.

Flood Effects Along the St. Vrain

Thursday, November 14, 2013

Presenter: Jim Krick, City of Longmont Natural Resources

September's torrential rains led to rising creek waters that were declared a "500-year flood" by Longmont city officials. The St Vrain Greenway and other Longmont Parks and Open Spaces remain closed as a result of the damages sustained during the massive flooding. Jim Krick will provide an update on the flooding effects along the St. Vrain and other Greenways and their impacts to the natural resources.

Jim Krick is a Natural Resources specialist with the Longmont Open Space Program.

(Cont. on p. 10)

Impacts of Russian Olive in Great Plains Riparian Ecosystems Thursday, December 12, 2013

Presenter: Gabrielle Katz, Colorado State University affiliate

Russian olive (*Elaeagnus angustifolia*) is a non-native tree that commonly invades riparian areas of the western US. This talk will provide an overview of Russian olive invasion and ecology, and will present results from an ongoing study of ecosystem impacts of Russian olive on the South Fork Republican River in eastern Colorado. We have found significant impacts of Russian olive to light levels, soil nitrogen and plant communities. However, these impacts are strongly mediated by fluvial geomorphic context and presence/absence of a cottonwood gallery forest overstory. This project is being conducted in collaboration with Dr. Andrew Norton and Graham Tuttle of Colorado State University.

Gabrielle Katz has recently returned to Colorado after 10 years as a faculty member in the Department of Geography and Planning at Appalachian State University in Boone, North Carolina. She has long standing research interests in bio-hydrology of western US riparian ecosystems, biological invasions, and ecological restoration.

Results from 2013 *Frasera coloradensis* Survey Thursday, January 9, 2014

Presenter: Dan Fosha, CoNPS research grant recipient

The Colorado Green Gentian, *Frasera coloradensis*, is a rare plant, endemic to southeast Colorado. We verified as many occurrences of the plant as possible, updating and mapping where we found the plants. We then took the information and using a GIS, worked on refining a habitat model in order to guide future research.

Dan Fosha is a current CoNPS research grant recipient and past SE chapter CoNPS president. He is pursuing the GIS program at Pikes Peak Community College.

Meet the New Curator of Botany at the University of Colorado-Boulder Herbarium (COLO) Thursday, February 13, 2014

Presenter: Dr. Erin Tripp, Curator of Botany, Assistant Professor, Department of Ecology & Evolutionary Biology
Dr. Erin Tripp serves as Curator of Botany (COLO Herbarium) of the CU Museum of Natural History as well as Assistant Professor of Ecology & Evolutionary Biology (EBIO). Erin is a biodiversity scientist whose research focuses on the diversity and evolution of flowering plants as well as lichens.

Vascular Plants in Urban Dry Washes of the Sonoran Desert Thursday, March 13, 2014

Presenter: Michael Denslow, National Ecological Observatory Network (NEON)

Relatively little is known about the vascular plants associated with washes in dryland regions. This study examined woody plant communities of dry washes in urban Tucson, Arizona. It also addressed how environmental and human activity affected species distributions and functional characteristics of riparian plant communities. An in-depth look at the species will be presented as well as a discussion of the important environmental and human drivers that shape these plant communities.

Michael Denslow is the Assistant Director for Scientific Research Collections at NEON, Inc where he is responsible for the museum specimens that are collected as part of the NEON Observatory. He is also a Museum Associate in the Botany Section of the University of Colorado Museum of Natural History.

Volunteers: A Vital Part of a Native Plant Materials Program Thursday, April 10, 2014

Presenter: Erica Christensen Cooper, Boulder County Parks and Open Space, and Amy Ansari, Wildlands Restoration Volunteers

METRO-DENVER CHAPTER

Complete descriptions of the programs and speakers can be found on the CoNPS website..

Alpine Plant Ecology of New Zealand – Similarities and Differences with Colorado (complete description in Fall issue of *Aquilegia*)

December 3rd, 2013, 7 pm

Location: Englewood Public Library, Altenbach Room

Speaker: Catherine Kleier, PhD.

New Zealand and Colorado both have mountain chains with alpine regions. However, despite the similarities, the flora is very different. From January to June, Catherine had the opportunity to teach and work in New Zealand on the South Island at the University of Otago. Catherine will make some general comparisons between Colorado and New Zealand plant communities in general, then in the flora specifically, and finally, she will discuss her research with *Raoulia*, the “vegetable sheep.”

Catherine Kleier has been a CoNPS member since first moving back to Colorado after completing her Ph.D. at UCLA, in 2001, under Dr. Phil Rundel. The work she will discuss resulted from a Fulbright that she was awarded in 2013 for travel to New Zealand as part of her sabbatical.

Budding Monkeyflower (*Mimulus gemmiparus*)

Tuesday, January 28th-

Presenter: Mark Beardsley-

Mark will talk about his research on one of Colorado's rarest plants. More details to follow.

Wetland/Riparian Topic TBA

Tuesday, February 25, 2014, 7 p.m. – Details to follow

Presenter: Andy Herb

Andy is the owner of the new AlpineEco Nursery which provides wetland and riparian plants, and installation services for ecological restoration projects in the Rocky Mountain Region. He is also has over 14 years of experience working as an ecologist in the Rocky Mountain Region and internationally, and is the owner of AlpineEco which is a sole-proprietorship ecological consulting firm focused on wetland, wildlife, and vegetation studies. He has spent most of his career focused on wetlands and is also the president of the Rocky Mountain Chapter of the Society of Wetland Scientists. He's been a member of the Colorado Native Plant Society since 1999.

Program TBA

Tuesday, March 25, 2014, 7p.m. – Details to follow

Results from 2013 Green Gentian (*Frasera coloradensis*) Survey

Tuesday, April 29, 2014, 7p.m.

Presenter: Dan Fosha

See description under Boulder program, Jan. 9, 2014.

NORTHERN CHAPTER

Complete program and presenter descriptions are in the Fall 2013 issue of *Aquilegia* and the CoNPS website.

We will be alternating the meeting location between the Gardens on Spring Creek in Fort Collins (where we have been meeting for some time) and High Plains Environmental Center in Loveland (located in the Centerra development near I-25). chapter e-newsletter or the CoNPS website (<http://www.conps.org/Chapters/northern.shtml>) for updates and more detailed information before the event. If you would like to be added to the chapter's e-newsletter distribution list, contact Connie Gray at cpowersgray@gmail.com

Watershed Restoration after High Park Fire: Dozens of Lessons Learned After One Growing Season, Miraculous Natives, and More

Thursday, November 7, 2013, 7 p.m.

Location: The Gardens on Spring Creek, 2145 Centre Ave. Fort Collins, CO 80526

Speaker: John Giordanengo

This will be a great opportunity to learn about the trials and tribulations involved in Emergency Watershed Restoration efforts after a natural disaster that was way too close for comfort for most of us. Besides the nuts and bolts of standard post-fire restoration efforts, the botanical/ecological trade-offs between natural post-fire succession and active restoration will be explored. Hot-off-the press post-fire restoration research findings will also be shared.

John Giordanengo is the Northern Regional Director of Wildland Restoration Volunteers. *John has been a member of the Colorado Native Plant Society, serving as a Board Member for three years, and currently serves on the High Altitude Revegetation Workshop Committee.*

Landscape Design and Successful Cultivation of Rocky Mountain Native Plants

Thursday, December 5, 2013, 7 p.m. (holiday potluck 6 p.m.)

Location: High Plains Environmental Center, 1854 Piney River Dr., Loveland, CO 80538

Speaker: Jim Tolstrup

In this workshop, CoNPS member Jim Tolstrup will draw on his extensive experience designing with native plants in Larimer County since 1998.

In this presentation, we will explore site design step by step and identify zones in your landscape based on hydrology, soil type, existing plants and other conditions in order to develop a garden plan. We will investigate seed preparation, seeding and transplanting various types of native plants, after-care during the establishment period, and long-term garden maintenance,

as well as some of the environmental benefits derived from utilizing native plants. For those who would like to plant wildflowers at home, Jim also will share native plant seeds that HPEC has collected for propagation.

Jim Tolstrup is Executive Director of the High Plains Environmental Center, a unique model for preserving native biodiversity in the midst of development, in Loveland, CO. As the State Outreach Chair for the Colorado Native Plant Society, Jim works to promote the conservation, restoration, and landscape use of native plants.

Scoping on the Trail – Plant Close-ups on the Hike and Back Home

Thursday, January 9, 2014 (NOTE THAT THIS IS 2ND THURSDAY IN JANUARY!)

Location: The Gardens on Spring Creek

Speaker: Cindy Henk

The Proscope Mobile is a digital wireless handheld microscope that can transmit magnified live images instantly to up to 254 iPods, iPhones, or iPads on the trail – no wifi, G3, or G4 necessary! Well-lighted and focused images of microscopic features – grass flowers, anthers, leaf hairs - can be observed and saved on your “devices” for on-site examination and discussion, and later documentation or publication. Cindy will provide a scope demonstration and hands-on opportunities. Bring a sample to scope! (Got an iDevice? Bring that, too!)

Cindy Henk has had a 40-year career as a biologist/microscopist at the University of Georgia and Louisiana State University and is now gleefully discovering Colorado's many tiny treasures. In 1992 she began helping to develop a handheld microscope for educational applications, and since then has never been without a handy scope or two. And you can borrow them! You can contact Cindy at cindy.henk@gmail.com for more information.

San Juan/Four Corners Native Plant Society

Meetings are held at the Lyceum Room, Center of Southwest Studies, Fort Lewis College, Durango at 6:30 p.m. For information see <http://www.swcoloradowildflowers.com>

Forests, Fens, and Medicinal Plants

November 20, 2013

Presenters: From Mountain Studies Institute: Tom Grant, Anthony Culpepper, and Katie Clark

The Mountain Studies Institute (MSI) is a non-profit science and education center that works with land managers and communities to develop science-based projects. The MSI presentation will highlight three distinct projects: 1) community-based forest management to mitigate wildfire, 2) restoration of fen vegetation and hydrologic flow, and 3) sustainability of Osha (*Ligusticum porteri*) root harvesting for medicinal plant use.

The Impact of Tamarix on Arthropod Abundance in Big Gypsum Valley

December 18, 2013 Presenters: Fort Lewis College Students, Derek Uhey and Amanda Rowe

Derek and Amanda's study aims to see how the invasive tamarisk shrub (*Tamarix* spp.) impacts arthropod abundance and diversification. Pit fall traps were set for a 48 hour period, 7 different times over the summer of 2013. Results from previous **Chapter Programs Cont. on p. 16**

Native Pollinators, Native Plants

by Amy Yarger

When I first began my career at Butterfly Pavilion, visitors often would ask me, "How do I attract butterflies without attracting bees?" I rarely hear that question now. With threats from habitat destruction to chemical pollution to invasive species, pollinator populations may be at an all-time low, but concern for their survival has blossomed. Rightly so - the health of ecosystems rides on the back of these (mostly) small creatures. Pollinator declines may hit our pantry as well. According to *The Forgotten Pollinators* by Steven Buchmann and Gary Paul Nabhan, every third bite of food we eat is a result of pollinator-plant interactions. With Colony Collapse Disorder and other challenges facing introduced European honeybees, farmers and land managers are turning to our native pollinators for help.



Hummingbird and Rocky Mountain Beeplant (*Cleome serrulata*)
Photo by Charlie Turner



Showy Milkweed (*Asclepias speciosa*) Photo by Amy Yarger

Colorado's native pollinators are truly a motley crew, ranging from the majestic Two-Tailed Swallowtail Butterfly (*Papilio multicaudatus*) to the jewel-like Metallic Green Bee (*Agapostemon coloradinus*) to the often clumsy Pennsylvania Leatherwing beetle (*Chauliognathus pennsylvanicus*). At last count, Colorado was home to 946 species of bees and 233 species of butterflies. Colorado's habitat diversity and open spaces have a lot to do with that high insect diversity, which is higher than almost every other state. Pollinators, and the native plants they visit, are a significant part of Colorado's natural heritage.

Native plants are especially important to support these beneficial insects for a number of reasons. Pollinators have adapted over countless generations to identify the flowers that will provide them pollen and nectar and to access those rewards. Every adaptation from sensory perception to mouthparts to chemical tolerance plays a role in determining whether a plant attracts a pollinator. Researcher Gordon Frankie conducted the Urban Bee Project and found that native bees are four times more likely to visit native flowers than non-native flowers.

Native plants also play essential roles in the life cycles of many pollinators, especially those that are herbivores in the larval stage. Butterfly and moth species each have a narrow range of host plants that are suitable for egg-laying; over generations, larva have adapted to specific secondary chemical compounds contained in the plant tissues. The most famous example that comes to mind is milkweed's relationship with Monarch butterflies (*Danaus plexippus*). For many insects, milkweed is a distasteful or poisonous plant, but Monarch caterpillars can actually incorporate the toxins and use them for defense against predators. Monarch caterpillars cannot thrive on plants in other families, because they haven't adapted to those different secondary compounds. Research by Douglas Tallamy has found that native plant genera support three times as many butterfly and moth species, so that areas with more native plants have higher biodiversity overall.

The main virtue in growing native plants for pollinators is that the native plants fit well into the environment and make for a more balanced habitat. Native plants, well adapted to the temperatures, soil, and water availability of a region, can thrive without heavy pesticide use, fertilizers or other chemicals that might interfere with a pollinator's ability to forage and reproduce. Pesticides especially can have a negative impact on pollinators. Some of the first organisms to be affected by pollution in the environment are the invertebrates like butterflies. Ecologists often use butterfly populations as an indicator of environmental health for that reason.

The best thing a gardener can do for pollinators is to make space for them in the garden. Flowers of different seasons, sizes, colors, and shapes support more kinds of pollinators; plant diversity leads to pollinator diversity. In gardens with more than eight species of flowering plants, diversity and abundance of native bees was found to be significantly higher. By planting the same flowering plants in clumps or swaths, the gardener

can create a bigger “advertisement” to attract pollinators, while maintaining a diverse and interesting garden. Some of the most visited native plants at Butterfly Pavilion are Rocky Mountain beeplant (*Cleome serrulata*), Rabbitbrush (*Ericameria nauseosus* aka *Chrysothamnus nauseosus*), blanketflower (*Gaillardia aristata*), and golden currant (*Ribes aureum*). Butterfly Pavilion gardeners seek to create as long a bloom season as possible, with a planting plan that can feed everything from the tiniest sweat bee to the biggest butterfly.

Your garden design makes a difference to pollinators as well. Pollinators get little benefit from perfect lawns and trimmed hedges. Instead, gardens that more closely resemble natural habitat can support more pollinators. Open ground with bunch grasses and shrubs can allow native bees, such as bumblebees and digger bees, to dig burrows. Shrubs with soft wood or hollow stems, such as golden currant (*Ribes aureum*), can also provide nesting sites for solitary bees. By planting in layers, tall shrubs and grasses next to shorter plants and groundcovers, the gardener can create more shelter for a variety of pollinators and other beneficial insects. These sorts of habitats tend to be better balanced and healthy as well, attracting precisely those insects that will eat potential pests – a boon to the gardener wanting to avoid pesticides.

Growing native plants for pollinators is rewarding, surprising and not all that difficult. Many gardeners are providing pollinator habitat without consciously thinking about it, if they are following sustainable gardening practices using native plants. Gardeners can be ideal citizen scientists, too. Projects such as The Great Sunflower Project can be great for helping the gardener learn more about native pollinators, as well as for contributing data to the larger pollinator conservation effort. What a revelation to watch the gardens over the year and note the dozens of different insects, all with their own amazing traits, foraging. The garden would be poorer without them, and so would we.

Reading List

The Forgotten Pollinators by Stephen Buchmann and Gary Paul Nabhan
Bringing Nature Home: How You Can Sustain Wildlife With Native Plants by Douglas Tallamy
Attracting Native Pollinators: Protecting North America’s Bees and Butterflies (Xerces Society Guide)
The Urban Bee Project - <http://urbanbeeproject.tumblr.com/>
Great Sunflower Project - <http://www.greatsunflower.org/>

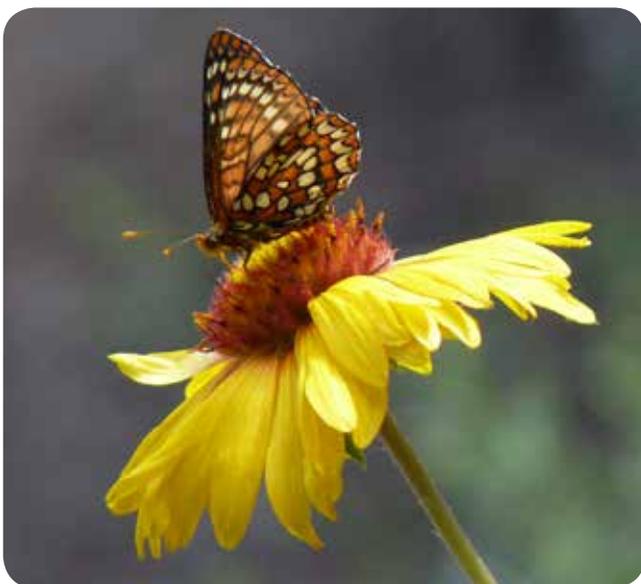
Amy Yarger has worked in the public horticulture field since 1996. She received a bachelor’s degree in ecology and evolutionary biology at the University of California, Irvine, and then went on to study the effects of noxious weeds on pollinator-plant relationships at the University of Michigan. Her work as Horticulture Director at Butterfly Pavilion touches on many of her passions: plants, insects, habitat conservation, and science education.



Rocky Mountain Beeplant



Rabbitbrush



Blanketflower



Golden Currant

Photos on this page by Charles and Jan Turner

Notes from Nantucket: Glaciers and Plants

by Mo Ewing



Pedicularis groenlandica Photo by Mo Ewing

Each fall I spend a couple of weeks on Nantucket Island in Massachusetts. Nantucket could not be more different from Colorado, but I am always interested in discovering similarities as well as the obvious differences. In the October 2011 issue of *Aquilegia* (2011 v35 no3), I wrote about why it is possible to find two grasses, little bluestem (*Schizachyrium scoparium*) and saltmarsh switchgrass (*Panicum virgatum*) as the two dominant grasses in the sandplain grasslands of Nantucket and the Colorado tallgrass prairie in Boulder.

This year, I have become fascinated with geology and how geology affects where plants are located world-wide. In this vein, I read two fascinating books which have lead me to think about the links between Colorado's Rocky Mountains and Nantucket. The first of these is a new book written by Lon Abbott and Terri Cook called *Geology Underfoot Along Colorado's Front Range*, a very readable and informative book about how our Front Range was created geologically. The second is *Nantucket: A Natural History* by Peter Brace. This is not a geology book, but contains some fascinating chapters on how the island was formed.

So, lest you think that I have just returned from my local marijuana dispensary, I would like to compare Rocky Mountain National Park with Nantucket Island. It probably is not possible to choose two more different landscapes, but there are interesting comparisons. Both places were created by the same geologic forces, but the results were completely different; however, for plants, in spite of these geologic differences, as the climate changes, the issues of survival are essentially the same.

Nantucket is a 48.9 square mile island that sits 30 miles south of Cape Cod, Massachusetts. Like Rocky Mountain National Park, the major land forms that you see on its surface were created by glaciers over the last 2.6 million years, during what is called the Quaternary Period. During this time the climate alternated between warm and cold intervals with glaciers growing during the cold periods and receding during the warm periods. These climatic variations, called the Milankovitch Cycles, were caused by a combination of slight changes of the Earth's tilt, its wobble on its axis and its distance from the sun. It is estimated that there were at least eighteen glacial periods during this time. Calculations suggest that we are now in a warm period with the next glacial period starting in about 1,000 years.

Whereas the topography of the Rocky Mountain National Park was created as a result of the work of all eighteen glacial periods, what we see on the surface of Nantucket was created by the last glacier only 21,000 – 25,000 years ago. Rocky Mountain National Park geologically is very old, Nantucket is very new.

Beginning about 75,000 years ago, the Earth descended into its last glacial period called, in the east, the Wisconsin Glacial Stage. In eastern Canada a huge sheet of ice called the Laurentide Ice Sheet began to form in the Saint Lawrence region. As it became thicker and thicker, its massive weight pressed its edges out in lobes of ice that covered all of New England, south to New York City, all of the Great Lakes in the Midwest to south of Chicago, and in the west, all the way to the west coast of Canada, and south to just over the US border. It had a huge effect on Nantucket, but none on the Southern Rocky Mountains.

This ice sheet was as much as two miles thick in its center, near Nunavik, Quebec, but towards its edges, was thinner, 1,500 feet thick on the coast of New England at Cape Cod, and only 500 feet thick over Nantucket. As it slowly spread out over a period of 50,000 years, it scoured everything in its path, picking up soil, rocks, gravel and sand along the way. In Massachusetts, the ice sheet extended southeast to Nantucket, and there, over thousands of years, its far edge melted, creating a pile of debris called a terminal glacial moraine; as Brace calls it, a "Laurentide Junk Heap."

If you stand on the high point of Nantucket, Altar Rock, elevation 101 feet, you will find a mix of sand, gravel and stones, including everything from 1.8 billion year old rocks from the Canadian Shield hundreds of miles away to 66-245 million year old rocks picked up from across New England. The junk heap is young, 21,000 – 13,000 years old, but its contents are ancient.



Andrews Glacier, Colorado, This work has been released into the public domain by its author at the wikipedia project.

When the ice age reached its maximum, about 21,000 years ago, the Nantucket junk heap did not sit in the Atlantic Ocean. Because such a tremendous volume of ocean water was bound up in the massive glaciers, the sea was 300 feet below its present levels. The pile of debris we call Nantucket sat on dry land. In fact, the coast lay roughly 50 miles east and 75 miles south of the island along the Continental Shelf. As the Laurentide Ice Sheet began to melt, the ocean level rose about 50 feet per 1,000 years and gradually the lower lands around Nantucket filled with water, which reached its current level about 6,000 years ago. Nantucket, a line of hills formed from the terminal moraine of the glacier, became an island.

In Rocky Mountain National Park the visible surface we see today was also created by glaciers over the last 2.5 million years during the Quaternary Period. However, in order to understand what we are seeing, we have to go back 300 million years when the first mountain-building episode occurred in Colorado during the formation of the giant continent of Pangaea. The result of that mountain-building was the formation of the Ancestral Rocky Mountains. Over the next 250 million years, erosion buried the Ancestral Rockies in their own sediments. Then 74 to 43 million years ago the area was convulsed with another mountain-building episode called the Laramide Orogeny. And again over the next 41 million years, the mountains were worn down by erosion and buried in their own sediments.

If we were around five million years ago to see the area now called Rocky Mountain National Park, it would have looked completely different than today. Rather than the sharp, steep, craggy mountains standing sharply above the great plains, the great plains gradually rose to undulating highlands of eroded ancient sediments.

Then, about 2.5 million years ago the Earth entered the Quaternary Period when glaciers formed and receded at roughly 100,000 year intervals. Unlike Nantucket and the east, the Rocky Mountains were never covered by one massive ice sheet like the Laurentide. Instead, small glaciers formed along the ridge of the highlands. Each successive ice age created glaciers that gradually carved the highlands down, scouring away the debris accumulated over millions of years and exposing 1,400 million year old mountain cores from before the Ancestral Rockies. It is unclear whether there was another period of mountain-building during this period because there is no way to know how tall the undulating highlands were.

In any case, as in Canada and northern New England, the glaciers repeatedly carved the cirques, arêtes, and U-shaped valleys that we now find in Rocky Mountain National Park. The glaciers repeatedly extended down to about 7,600 feet, about the altitude of Estes Park. In Nantucket we are only able to see the latest glacial moraine from the Wisconsin Ice Age on the surface because the Laurentide Ice Sheet obliterated all moraines from previous ages.

In Rocky Mountain National Park, however, we can see the glacial moraine from the same glacial period 20,000 years ago (in the west called the Pinedale Glacial Episode) 0.5 miles inside the Fall River entrance to the Park. However, we can also see another glacial moraine from the older Bull Lake Glacial Episode, deposited farther down the valley right at the entrance to the Park; it was deposited there 130,000 years ago. Because it was larger and traveled down the valley further, it was never obliterated by the later Pinedale glaciers.

In Canada and the northern parts of the midwest and eastern part of the United States, the massive glaciers were catastrophic for all plant life. Nothing survived. The surface was scraped bare. Fortunately, however, the expansion of the Laurentide Ice Sheet occurred over a very long period of time, 75,000 years. During this time as temperatures dropped and the ice sheet moved south, plants were able to migrate ahead of the glaciers.

In Massachusetts, although the ice sheet extended south to New York, it did not extend all the way to the coast. The glacier extended only out to Nantucket, but not to the edge of the continental shelf, and this area became a refuge for the plants that had lived in areas covered by ice. When the glaciers started to melt north and temperatures began to rise, from about 18,000 to perhaps 13,800 years ago, tundra plants began to take hold. These were followed by boreal forest species such as *Pinus banksiana* (Jack Pine), *Pinus strobus* (White Pine) and *Picea mariana* (Black Spruce), which migrated north from their refuges south and east of the glacier.

Importantly, however, this migration stopped abruptly 6,000 years ago when ocean water flooded the land around the island. The plants that had migrated there were immediately cut off from the mainland and the existing plant communities were frozen in time. From that time on, the only ways new species could get to the island were by wind, water, birds, animals or humans. For instance, one of these plants, *Ammophila breviligulata* (American Beachgrass), which today is found on sand dunes along the beaches, was probably not present when Nantucket became an island because beaches did not exist then. They were created later by the action of the ocean on the island shores. Beachgrass seeds were probably brought in by ducks and other aquatic birds on their feathers or on mud caked on their feet.

In Rocky Mountain National Park at the beginning of the ice age 110,000 years ago, the alpine plant communities currently found in the park would have been found along the upper ridge of the highlands. Over the next 90,000 years as the glaciers slowly grew on the mountains, the plants migrated ahead of the glaciers down onto the plains. When the glaciers dropped to altitudes as low as 7,500 feet, Denver and Boulder would have been cold tundra. Some of our plants like *Saxifraga rivularis* (Alpine Brook Saxifrage) and *Pedicularis groenlandica* (Elephant Lousewort) would have been growing there.



Saxifraga rivularis Photo by Mo Ewing

But as the glacial age waned, and the temperatures began to rise, these plants, unlike those around Nantucket were able to migrate in two directions. First, some migrated north as the climate warmed. Remember, 25,000 years ago most plant life in Canada was completely obliterated; but today both *Saxifraga rivularis* and *Pedicularis groenlandica*, and many other species in the Colorado alpine, are found all the way to the northern provinces of Canada. It is possible that there were some refuges in Canada where these plants survived the glaciers, but it is more likely that most came from the United States.

Second, in order to follow the cold and avoid having to compete with larger, hardier temperate plants, these species migrated to higher altitudes, up the Rocky Mountain slopes, to areas that had been denuded by local glaciers. And here is where the plant communities of Nantucket and Rocky Mountain National Park find their greatest similarities. Whereas Nantucket became an island by rising seas, the alpine plant communities of Rocky Mountain National Park also became islands of cold tundra, surrounded by larger, more robust plant communities (spruce-fir forests of the

subalpine) with which they are unable to compete. Scientists studying these types of plant communities specialize in a subject called "island biogeography" for the issues of diversity and survival are essentially the same in both places.

Plants in Nantucket and the Colorado alpine will also face similar issues regarding climate change. Nantucket is being eroded away by rising oceans at the rate of 15 feet per year. Twenty years ago, climate scientists estimated that the island would be gone, washed into the sea, in 1,000 years. But, because both world-wide temperatures and ocean levels are rising faster than predicted, scientists are now predicting that the island will be gone in 400 years.

In Rocky Mountain National Park, as climate temperatures rise, spruce-fir forests and other subalpine and montane plants, better adapted to warmer temperatures, will gradually creep up-slope and out-compete the small alpine plants. Unlike the alpine plants that migrated north into Canada, these plants have nowhere to go and may end up with the same fate as those on Nantucket.

References

- Abbott, Lon and Cook, Terri. *Geology Underfoot Along Colorado's Front Range*. Missoula, Montana: Mountain Press Publishing Company. 2012.
- Brace, Peter B. *Nantucket: A Natural History*. Nantucket: Mill Hill Press. 2012.
- Wikipedia The Free Encyclopedia. Laurentide Ice Sheet. Web. October 23, 2012. http://en.wikipedia.org/wiki/Laurentide_ice_sheet

Chapter Programs (Cont. from p. 11)

years of study and preliminary results show that *Tamarix* communities have similar, sometimes higher, abundance and diversification, when compared to *Salix* spp. and native shrub communities.

Landscaping With Native Plants

Presenter: Linda Robinson, Landscape Architect, Jan. 15, 2014

This presentation will explore the aesthetic, cultural, and environmental factors of using native plants in a garden. Specific plants discussed will be for various areas of the Four Corners region of southwest Colorado.

Botanical Surveys for Rare Plant Species: Difficult, Controversial, and Necessary

Presenters: Julia Hanson and Amanda Kuenzi, Environmental Consultants, February 19, 2014

Julia and Amanda will discuss the steps involved in conducting a botanical survey for rare plant species, describing how certain plant species are protected by various levels of regulations. They will illustrate the process, using as a case study a recent survey for the Mesa Verde cactus (*Sclerocactus mesae verdae*), a federal threatened species in Colorado.

Alpine Wildflowers of the Western San Juans

Presenter: John Bregar, Retired Geologist, Amateur Botanist and Birder, and Accomplished Climber, March 19, 2014

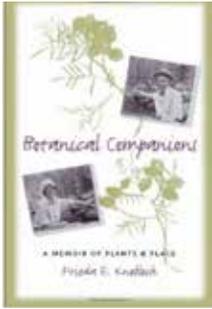
John will share his great photography and enthusiasm for alpine plants with us. Since moving to Durango 7 years ago, John has climbed many of the peaks of our area and has always been looking down at his feet for wildflowers.

BOOKS & MEDIA

Botanical Companions: A Memoir of Plants and Place

Review by Larry Hufford

Knobloch, Frieda. *Botanical Companions: A Memoir of Plants and Place* by Iowa City: University of Iowa Press, 2005.



Aven Nelson's childhood and mine were separated by little more than ten miles and 100 years. Our childhoods were played out on the agricultural plains and in the wooded ravines where the acute angle made by the Mississippi and Des Moines rivers comes to a point in southeastern Iowa. My ancestors had moved west from Ohio, settling in the vicinity of the Nelson's farm, and later

moved the ten miles to Farmington, where I was reared. Aven Nelson was born in 1859, and I in 1958. We both became botanists interested in the plant diversity of the American West.

I've been thinking about Aven Nelson because of Frieda Knobloch's book *Botanical Companions*. While in the library last week to get a volume on the life and letters of a 19th century botanist, I noticed on the shelf the slim, black *Botanical Companions*. I hadn't seen it before, and it looked new. What I found in *Botanical Companions* was wonderful. Knobloch has explored many of the same ideas of botanical travel, collection, and memory through which I've been treading. She explores these ideas in regard to Aven and Ruth Ashton Nelson.

The marriage of Ruth Ashton to Aven Nelson is one of Knobloch's major themes. They married in 1931, following the death of Aven Nelson's first wife in 1929. Ruth Ashton and Aven Nelson were married on her 35th birthday; Aven was 72. The disparity in their ages is always a curiosity, and Knobloch tries to explore it, although little material remains to inform us of their married life or even the botanical experiences they shared. In the few photographs of the couple in Knobloch's book, they are always apart, never touching, but they share broad smiles.

My first sense of Ruth Ashton Nelson was that she provided late in the 20th century a link to the frontier botany of the American West, in which Aven Nelson played an important role. That link was on my mind when I met Ruth.

The pasque flowers had recently turned to fruit in the spring of 1984. Ruth Ashton Nelson was 88 and might have suffered a minor stroke the year before. Through mutual acquaintances, I was invited to meet her at Skyland Ranch, her property in the hills above Estes Park, Colorado. Ruth wore a pale, weathered yellow sweater in the log house that was heated by a fire in a wood stove. She moved well but with a slight stoop and lowered herself into a comfortable chair. Her chair faced a broad window that framed a view of the peaks of the Front Range. Those peaks—Powell, Otis, Hallet's and Taylor—had fresh snow from earlier in the day, and they were shaded by low clouds.



"Dr. and Mrs. Aven Nelson, 1935" Photo Courtesy American Heritage Center (AHC) Collection, University of Wyoming

I asked Ruth about the early days of collecting in the Rocky Mountains, and she told me the already well known story of Aven Nelson's appointment at the University of Wyoming and how he began to collect plants. Ruth spoke only generally about the numerous trips she and Aven Nelson had made throughout the Rocky Mountains to collect. As we talked, her eyes were still; her arms on the chair's arms lay without movement. It was only when she began to talk about Alaska that her eyes seemed to focus, to shine more. She and Aven were at Denali in 1936 to make a plant collection for the National Park Service. The park superintendent drove them each day in his passenger car to collection sites until the car broke down on the rough roads. After that, Ruth and Aven took whatever service truck went out to get into the field to collect. She smiled at the fond memory. Ruth and Aven prepared a manuscript on the flora of the park and left it with the Park Service to publish, which they never did, Ruth recalled with frustration. Although Ruth answered my questions, she seemed to have little interest in or energy for telling stories. I wasn't sure of her reticence but respected her short answers by not probing too deeply or for too long.

Ruth Ashton Nelson had died by the time that Frieda Knobloch began *Botanical Companions*, but Knobloch includes in the center of the book a set of letters to the late Ruth. They are the letters of inquiry a scholar would send to an important informant. The letters, I found, were crucial to the book. They present the dilemma of understanding—the sparseness of relics, the absence of telling details, and the way we project ourselves into the things we want to understand.

Later in the book, Knobloch tells us when she looks in the direction of Ruth Ashton Nelson, she recognizes "that I cannot look directly at her, a very complicated amalgam of her and me looks back." What Knobloch finds is a relationship, although certainly a one-sided affair, with the late Ruth. Knobloch suggests the point is to "understand some of the texture of relationship" through a sort of scholarly empathy enacted by creating her own personal narrative that interacts with the botanical experience and marriage of Aven and Ruth Nelson. When the facts of Ruth Ashton Nelson's life and marriage become too tenuous for scholarship, Knobloch turns to a

parallel story of her grandmother and mother, substituting another history for the missing pieces of Ruth's story. As I look at what Knobloch has done, I think how miscible separate histories may be, how we may mix them to make stories that have contemporary sense.

The tangible senses of Frieda Knobloch's *Botanical Companions* are the taste of the unknowable, the touch of relics, the delight of new collections, and our desire to create from our senses a story.

Larry Hufford is a botanist at Washington State University, where he directs the Ownbey Herbarium and the School of Biological Sciences. His research explores plant diversity and evolution in the American West and has included studies of *Claytonia*, *Gaillardia*, *Mentzelia*, *Mertensia*, and *Synthyris* among other groups.

Note: This book is out of print but it may be borrowed from your public library. Even if your library does not own the book, they can probably borrow it through the Prospector system (<http://prospectorhome.coalliance.org/>), a consortium of most of the public and academic libraries in Colorado.

Flora ID Colorado (CD) by Bruce Barnes Review by Patrick Murphy

Plant identification really is where the rubber hits the road in field botany and plant ecology. It is not possible for me (or most normal humans) to remember the names and range of variability of even a small percentage of the more than 3,000 plant species in Colorado. Without plant keys, I would be lost. Plant identification is a lot of fun, but it is not easy. *Flora ID Colorado* (\$75 from CoNPS) is a polyclave key to the plants of Colorado that comes on a CD and operates on a Windows computer. What is a polyclave key? It is certainly the wave of the future in my opinion. Is it perfect? No. Is it wonderful? Yes.

The typical key is known as a dichotomous key (di - two; chotomy - forked). At each step on the logic trail to identification you have two sets of options to evaluate. For example, Option 1, the flower is red; Option 2, the flower is not red. This is fast and efficient, but what if you don't have the flower, or the correct character to look at? A polyclave (poly - many, clave - cuts) key lets you select from a range of different characteristics rather than just one. That way if all you have are leaves, you can start with leaf characteristics. The advantages of that approach are obvious. However, only a computer can handle the huge data burden. A paper field polyclave key would

probably require a wheelbarrow to haul around.

For example, suppose that each plant had 12 characteristics that are recorded in the key and suppose that each characteristic had an average of about 3 options. The sum of all possible pathways to all of the species on average would be $12 \times 3 \times 3000 = 108,000$. So how does *Flora ID Colorado* do this? Very well actually. *Flora ID Colorado* is a huge but efficient database. Huge because it not only contains all of the standard characteristics, like flowers, leaves, stems, fruits, hairs, but also the range of variability of some of these characteristics. For example, leaf size is rarely fixed for a single species and may range in size from say, 5mm to 10mm in width. In *Flora ID Colorado* when you need to select leaf width, you can check the multiple value options between 5mm and 10mm. Here is where the magic begins. Next to each option is a number that shows you how many species in the database have that width. After you make that selection, the entire database is whittled down to a smaller subset, and that entire subset is listed. At this point you can select each species and see a description and possibly a photo. Typically your list is still too long, but there is an option to analyze the data. The analyze process gives you a list of characteristics that will do the best job of quickly narrowing down the list. This process lets you use the characteristics you have in front of you instead of requiring that you use a specific character that perhaps you don't have.

This key, as every key that has ever been created, is imperfect but this polyclave key is both valuable and part of the future. I use Weber & Wittmann's *Colorado Flora* every day when doing fieldwork. I use *Flora ID Colorado* about three to six times a summer when I get stumped, so I have to collect a specimen and bring it back to the office. Almost always I then get to the correct ID. The only flaw of *Flora ID Colorado* is the fact that it only runs on a computer. Guess what, an Android version may be available soon!

Here are some specifications of the program. There are 3,091 species in the database. The nomenclature gets updated on a regular basis, but as we all know, nomenclature is a moving target. The initial options on the program divide the database into 4 categories; Conifers/Gymnosperms, Spore-bearing Plants, Grasslike plants, and Flowering plants. There are photographs of live plants, or herbarium specimens and some line drawings are available for almost all plants. Some of these are of variable resolution, but useful. The descriptions are helpful and often include distinguishing characteristics for similar species as well as habitat clues.

Geek paragraph warning! So how precisely does *Flora ID Colorado* do this? It uses a skeleton software called XID and then adds a bazillion of data bits for each species. It really is bits, since each characteristic is a Boolean data type. Boolean is just a yes-versus-no data type, and that is the smallest possible storage size for any plant character. However, there are zillions of data fields, one for each character. So lots of Boolean fields filled with tiny yes/no data. When the logic of the program is dealing with Boolean data, the results come at high velocity. *Flora ID* is the creation of Bruce Barnes, and you can get to the *Flora ID* web site at <http://flora-id-northwest.com/> I am going to get the Android version as soon as it comes out and will report

back on that.

The Flora ID - Colorado (cd) can be purchased from the CoNPS Bookstore.

Patrick Murphy is a botanist and plant ecologist. Since 1979, he has been a botanical fieldworker in the Rocky Mountain region and from Texas to Alaska. He graduated from the University of Colorado with an M.A. His master's thesis topic was "The forest vegetation of the Lost Creek area in the southern Front Range, Colorado." Pat has created desktop and mobile software for vegetation data collection and wetland delineation. He is an active member of the CoNPS Sales Committee and can be found selling books at CoNPS events.

Tamarix: A Case Study of Ecological Change in the American West

Excerpt from Review by Rudolf Schmid

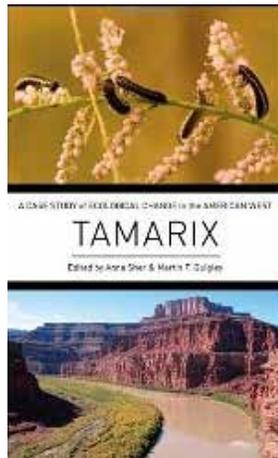
Sher, Anna & Quigley, Martin.
*Tamarix: A Case Study of Ecological
Change in the American West*. Oxford
University Press, 2013.

Note: Anna Sher and Martin Quigley are on the faculty of the Department of Biological Sciences at the University of Denver, where Quigley is Director of the Arboretum. Sher is former Director of Research, Herbaria, and Records at the Denver Botanic Gardens.

Excerpt below from a review by Rudolf Schmid in *TAXON* 62 (5), October 2013, p. 1097:

Sher & Quigley's 511-page book *Tamarix* is the first to synthesize the multifaceted information on this controversial alien scourge. The preface suggests using *Tamarix* as a "teaching tool" for "invasive species ecology," "water issues in the West," "interactions between humans and their environment," "range management and restoration ecology," and "philosophy of science and environmental ethics." These descriptors indicate the range of this superb, technically oriented synthesis. "*Tamarix* as used in this book refers to *T. ramosissima*, *T. chinensis*, and their hybrids" (p. 5).

Rudolf "Rudi" Schmid is Professor Emeritus, Department of Integrative Botany, UC Berkeley.

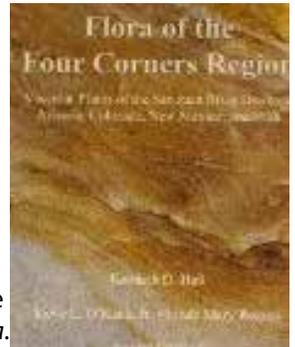


Flora of the Four Corners Region: Vascular Plants of the San Juan River Drainage: Arizona, Colorado, New Mexico, and Utah

Heil, Kenneth, O'Kane, Steve, Reeve, Linda Mary, and Arnold Clifford. *Flora of the Four Corners Region: Vascular Plants of the San Juan River Drainage: Arizona, Colorado, New Mexico, and Utah*. St Louis: Missouri Botanical Garden Press, 2013.

Available from CoNPS Bookstore!

Flora of the Four Corners Region will be reviewed in the Spring 2014 *Aquilegia*.



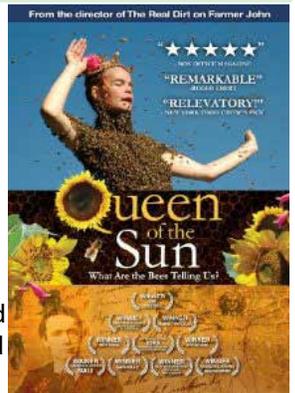
Women in the Field: America's Pioneering Women Naturalists

Bonta, Marcia Myers. *Women in the Field: America's Pioneering Women Naturalists*. College Station: Texas A & M Press, 1991.

Each chapter of this engaging book focuses on a woman naturalist. The biographies are grouped in categories including pioneers (Jane Colden, Colonial Botanist and Marcia Martin, Audubon's sweetheart), naturalists, botanists, ornithologists, and ecologists. The section on botanists contains biographies of Kate Furbish, Kate Brandegee, Alice Eastwood, Ynes Mexia, Mary Sophie Young, Elizabeth Gertrude Knight Britton, and Agnes Chase. This book is out-of-print but can be checked out from libraries or can be obtained from used bookstores (through Amazon and other sources). Summary by J. L. Turner

Queen of the Sun: What are the Bees Telling Us? [Video]

This is a "must see" video that focuses on the decline of honeybees in Europe and the United States and the various causes for the decrease in numbers. It can inspire us all to plant a variety of flowers that will provide nectar and pollen through spring, summer, and fall for honeybees and other pollinators. The film has won numerous awards. It can be borrowed from your public library. or purchased online. J. L. Turner



A Primer of Botanical Latin with Vocabulary

Short, Emma & George, Alex. May 2013. *A Primer of Botanical Latin with Vocabulary*. Cambridge University Press, Cambridge

From review by R. K. Brummitt, Royal Botanic Gardens, Kew on Cambridge University Press website, www.cambridge.org:

"The classical work *Botanical Latin* [4 eds., 1966, 1973, 1983, 1992] by W.T. Stearn has been a standard reference work for nearly 50 years, but it is not a starting point for those without prior knowledge of Latin. The new book by Emma Short and Alex George... will stand alongside Stearn's work as an essential. tool for many botanists for years to come."

The Native Plant Garden: The Native No Water Garden at 10 Yates

by Jim Borland



During the winter of 1996-1997 1500 packets of seed, most more than 15 years old, were sown in 4-inch pots and placed out-of-doors where they were covered deeply with snow when possible. Not dreaming that much of this old seed would germinate, anticipation turned into a happy nightmare as most of the pots showed germinating seedlings the following spring. The germinating seedlings were soon transplanted to 2 ¼ inch pots and placed in a flat for further growth. Soon, 10,000 seedlings were ready for their final planting to the front yard that had recently been stripped of the Round-up killed bluegrass and had the existing trees and shrubs removed. Aside from a thorough rototilling, no amendment was used and no mulch or supplemental watering was planned beyond the initial establishment period of a week or two.

The plan was to plant 100 plants during weekdays and 300 each day of the weekend. By August, most of the 10,000 plants were in their final resting place when the skies opened and let loose

with a hailstorm the likes of which had not been seen here before. The front yard was a mass of mud and shredded seedlings. The backyard vegetable garden was thoroughly masticated and the bark was stripped from the windward side of every tree and shrub. An eighteen wheeler truck was immobilized in a nearby intersection due to the depth of hailstones. Consequently, all the roofs in the neighborhood had to be replaced as well as many windows and windshields of cars caught in that freak storm.

Remarkably, in the following September all the normally spring-blooming shrubs and trees bloomed profusely. Subsequently, no tree or shrub bloomed during the following spring.

Although many plants were lost during the hailstorm, replacements have been found for most and thus, planting continued and continues. The current planting technique involves the use of tubelings for growing the seedlings and a portable drill and auger for planting. Late winter/early spring plantings are done without the aid of supplemental water. The entire garden has been watered only once in twelve years. Maintenance has consisted of doing as little as nothing to weeding



Yucca glauca



Amorpha fruticosa



Thermopsis divaricarpa



Leucocrinum montanum



Castilleja integra



Purshia tridentata

(elm and catalpa tree seedlings & cheat grass mostly), cutting back rambunctious plants or not, raking out the neighbor's tree leaves and experimenting with pruning techniques. Perennials and annuals move of their own free will even though they were originally planted where it was thought they would do best. Visitors are welcome at anytime. Pictures, images, drawings, paintings, etc. at no charge. Enjoy!

Jim, along with his wife Dorothy, has been growing, talking about, collecting seed of, propagating, and showing pictures of western native plants for more than 30 years. His no-water gardens have been toured by hundreds, written about in newspapers, books and in national garden magazines. His work experience includes working at the Denver Botanic Gardens several times, starting up a native plant nursery and instructing people how to live within a ponderosa pine forest without seriously affecting their surrounding natural environment.



Jim and Dorothy Borland Photo by Jan L Turner

All photos by Jim Borland except where noted.

Summary of the 2013 CoNPS Annual Meeting & Colorado Rare Plant Symposium, Sept. 27-29

Congratulations to the Boulder Chapter for the excellent 2013 Annual Meeting. The meeting was a great success in spite of the horrible floods that occurred in Boulder earlier. Boulder Chapter President, Danielle Cassidy Levine, chaired the Annual Meeting Committee but was unable to attend the meeting because she had given birth to her son, Emerson, on September 8, 2013. Other members of the hard-working committee included Megan Bowes, Melissa Dozier, Jillian Mauer, Chris Prah (who organized the silent auction), and Lynn Riedel. Patrick Murphy, Denise Wilson, and Linda Smith did a great job with book sales. CoNPS vice-president, Bernadette Kuhn, worked closely with the Annual Meeting committee and Rare Plant Symposium organizers to secure a meeting place for the symposium.



Mark Gershman

Mark Gershman of City of Boulder Open Space and member of the Boulder Chapter of CoNPS welcomed attendees to a day of lectures which examined the potential for Colorado's flora in a rapidly changing climate. Keynote speaker, David Lawrence, of the Climate and Global Dynamics Division of the National Center for Atmospheric Research, discussed the role of Earth System Models in climate projections.



Scott Ferrenberg

Brett Wolk, Former Lab and Field Studies Director with Colorado State University's Restoration Ecology Lab, gave an overview of the many restoration treatments his colleagues have performed in an effort to assist ecosystem resiliency amid future climate change. On a similar note, Dana Blumenthal of the USDA Agricultural Research Service discussed the effects of climatic conditions on various invasive species and noted the challenges the suggested interactions will pose on restoration.

University of Denver's Donald Sullivan explained how the composition and distribution of Colorado's flora today reflects the interaction of biogeography with major global climate fluctuations as well as shorter, lower magnitude changes in climate. Finally, Colorado Natural Heritage botanist Susan Spackman Panjabi summarized results of analyses on Colorado's rare plant species using a Climate Change Vulnerability Index; although most species were found to be vulnerable to climate change, Susan challenged land management to adapt habitat management actions to abate these predictions.



Bernadette Kuhn and Megan Bowes

Steve Popovich, CoNPS Field Studies Committee chair, discussed the updated "Ethics and Protocols for Plant Collecting" and explained details of the training that will be available in workshops and online for field trip leaders who collect while representing CoNPS and for others who are interested in plant collection. See pages 26-27 for more information.

CoNPS Board member, Brian Kurzel, provided background regarding the Board's discussions on the pros and cons of CoNPS playing a stronger role in advocacy for native plants and their habitats. He alerted members that their opinions would be solicited through an online Survey Monkey survey (emailed to them) and through the survey provided in print in this issue of *Aquilegia* (pages 5-6).



Patrick Murphy staffs the sales desk while Mo Ewing makes a purchase at the book sale.

The Annual Meeting was preceded on Friday by the Annual Colorado Rare Plant Symposium. This year marked the 10th anniversary of the Symposium, with over 70 people



Book Sale and Silent Auction

Photos on this page by Jan L. Turner

in attendance despite a last-minute change in location from Boulder to Lafayette due to the recent flood damage. As with past symposia, much knowledge was exchanged and updates to the status of Colorado's rarest plants were discussed. To celebrate 10 years of successful get-togethers, cakes were devoured and customized coffee mugs were dispensed. Dr. William A. Weber presented a talk entitled "The Most Endangered Species." On behalf of the Colorado Rare Plant Technical Committee, the Colorado Natural Heritage Program, and the U.S. Forest Service, Steve Popovich and Jill Handwerk presented achievement awards to Dr. Weber and Ronald Wittmann, who were taken by

(Cont. on next page)

surprise, and who received a healthy standing ovation. The awards recognized their significant contribution to our understanding of Colorado as well as world-wide flora, including bryophytes and lichens. Dr. Weber's work in raising awareness about conservation needs of Colorado's incredible botanical resources as well as his authorship in biographies of historical naturalists were also noted. Jill Handwerk presented an award to Mr. Popovich to recognize his role in the inception of and contribution to the Symposium. Mr. Popovich announced that he will step down as Moderator after 10 enjoyable years.

The Annual Meeting concluded with the Sunday field trips.



AWARDS

David Buckner



David Buckner received a Lifetime Achievement Award for his exceptional botanical knowledge and his lasting contributions as a skilled instructor. Through his teaching, David has sparked a keen appreciation for Colorado's flora and has cultivated a strong conservation ethic. David is well known for his popular classes on *Poaceae* and *Asteraceae* identification.

Megan Bowes



Megan Bowes received a Certificate of Merit in honor of her outstanding efforts as the current chair of the Horticulture and Restoration Committee and past service as the chair of the Education and Outreach Committee. She was also recognized for her continuing leadership service as workshop instructor, field trip leader and garden tour organizer for the benefit of new generations of botanists on behalf of Colorado's native flora.

Cross Pollination: News from Other Native Plant Societies

Learning what other native plant societies are doing can be instructive for us. In the future, this occasional column will feature information about native plant societies in other states, informing us of their societies' activities, accomplishments, and challenges. In this first column, you will be presented with some of the activities reported in the newsletters of the native plant societies of Arizona, California, and New Mexico.

Arizona Native Plant Society:

The Arizona Atlas Project trains volunteers to perform floristic surveys of little-studied areas in the state. The AZNPS Annual Meetings (called Arizona Botanists Meeting) take place in the winter, alternating between Tucson and Phoenix. The next meeting will take place February 22, 2014, at the Arizona Sonora Desert Museum in Tucson and the theme will be "Interdisciplinary Botany- How Related Scientific Fields Support Our Understanding of Native Plants."

<http://www.aznps.com/>



Cryptantha gypsophila with *Anthophora* bee Photo © Dave Elin

California Native Plant Society:

CNPS has started the CNPS Rare Campaign, celebrating California's rare plants and rare places. They are asking members to pledge a gift to the campaign and to volunteer their time in some aspect of rare plant work to help support the CNPS Rare Plant Program, protecting rare plants and rare habitats. California is a populous state with 34 CNPS chapters. Each chapter has a Rare Plant Coordinator and its own e-newsletter. Members also receive the statewide *CNPS Bulletin*, published quarterly, and the journal, *Fremontia*, which is published 3 times a year. The 34th chapter was formed recently and is CNPS' first international chapter, the Baja Chapter, that includes the Mexican part of the California Floristic Province. <http://www.cnps.org/>

Native Plant Society of New Mexico:

Native Plant Day is celebrated on August 17th by the state of New Mexico.

Dr. Jack Carter's article, "The Awkward Relationship Between *Homo sapiens* and Plant Earth," gives Jack's responses to the question: "What are the major issues in society to which we must attend if this Earth is going to continue to be a place where large destructive mammals like *Homo sapiens* can survive?" (*NPSNM Newsletter*, Vol 38, no. 4, pp. 11-12). In Vol. 38(2), p. 7, Jack asked the question, "How Can NPSNM's Grants Program Better Support Education in the Plant Sciences?" His suggestions for proposals include: "Proposals that would educate teachers from K-12 and prepare them to make use of the local flora in their classes; Proposals for summer activities, as the ideal time to teach basic botany to K-12 students is the growing season; Floristic research programs for secondary school students that might provide a first real field study experience and might become a stepping stone into a career in the plant sciences; Requests for short courses and workshops in botany that would assist teachers in expanding their knowledge of the New Mexico flora and the use of plants in teaching science." The *NPSNM Newsletters* are online at <http://www.npsnm.org/>

From the Archives: 1983

What was going on **thirty years ago** in CoNPS? Take a look!

- *Florissant Fossil Beds National Monument Plant Inventory (plant list continued from previous issue)
- *The Yampa Valley Chapter (Craig/Steamboat Springs) announced a winter field trip (cross-country skiing) at Rabbit Ears Pass.
- *The 6th High Altitude Vegetation Workshop was held at CSU
- *Article: Piceance Basin Development Threatens Plants & Vegetation
- *Brief Article: New Plants Found in Piceance Basin: *Thalictrum heliophilus*, *Physaria obcordata*, and *Lesquerella parviflora*
- *News item: MX Missile System May Affect a Candidate Endangered Plant (*Gaura neomexicana* ssp. *coloradensis* in the area of Warren Air Force Base, Cheyenne, WY)
- *Poem: "The Uses of Botany" by Brenton Braley; Book Review: *Weeds of Colorado*
- *Field trip report: Shrine Pass (plant list included); Moffat County Trek
- *CoNPS had 3 chapters: Boulder, Fort Collins, Yampa; Sue Martin was president; CoNPS had a Governmental Affairs Committee

You can view the complete Colorado Native Plant Society Newsletter Winter 1983 issue at <http://rudr.coalliance.org/fedora/repository/codr:862> or by going to the CoNPS Newsletter webpage, <http://www.conps.org/News/newsletters.shtml>

News & Announcements

Request for Proposals - The John W. Marr and Myrna P. Steinkamp Funds

The Colorado Native Plant Society supports research projects in plant biology from the John W. Marr and Myrna P. Steinkamp funds. These separate funds honor the late Dr. John Marr, Professor at the University of Colorado and the first President of the CoNPS, and Myrna Steinkamp, a founding member of CoNPS who worked on behalf of the Society for many years in a variety of capacities. Both funds were established to support research on the biology and natural history of Colorado native plants by means of small grants. The Steinkamp Fund targets rare species and those of conservation concern. Both field and laboratory studies are eligible for funding.

Thanks to the generous contributions of many members and supporters, a total of nearly \$3,000 is available, although individual awards will not exceed \$1,000. Recipients of the awards must agree to summarize their studies for publication in *Aquilegia* and on the CoNPS website.

The Board of Directors is now soliciting proposals for a February

15, 2014, deadline. Information on guidelines and requirements for proposals may be obtained on our web site at http://www.conps.org/research_grants.html. If additional information is needed, contact Board member Catherine Kleier at ckleier@regis.edu.

Congratulations!

Congratulations to Danielle Cassidy Levine and her husband, Jake Levine, on the birth of their son, Emerson, on September 8, 2013. As the President of the Boulder Chapter, Danielle chaired the 2013 Annual Meeting Committee.

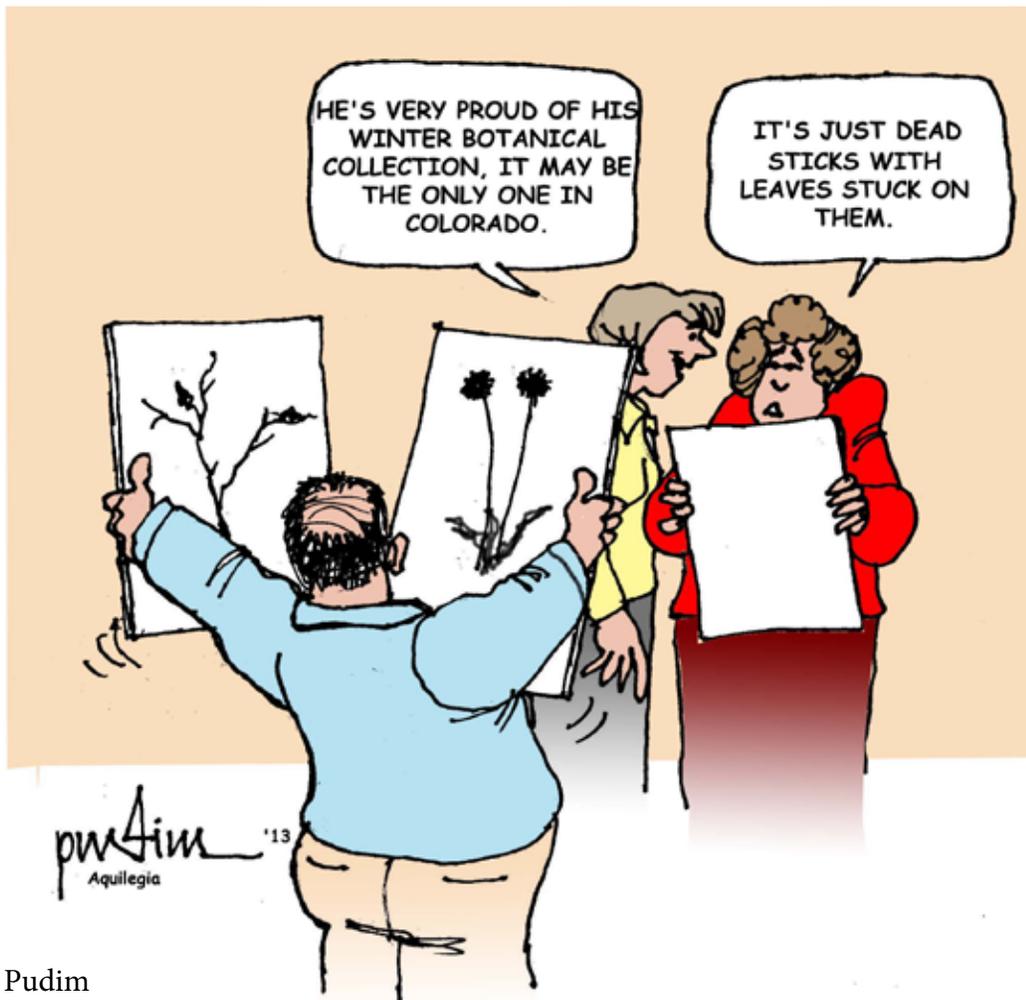
Photo by Katherine Skilar



The 5th Annual Natural History of the Gila Symposium

will take place Feb 27 (1-5 p.m.) and Feb. 28, 2014 (9 a.m. -noon, 1-5 p.m.) at the Besse-Forward Global Resource Center on the campus of Western New Mexico University in Silver City, NM. Sessions are free. Optional field trips March 1st. Call 575-388-2386 for information.

Botanicum absurdum by Rob Pudim



New CoNPS President

Charlie Turner was elected President of CoNPS at the October 5, 2013, Board of Directors meeting at Regis University. Charlie has served on the CoNPS Board of Directors since 2008, was Co-President with Jan Turner in 2008 and 2009, and has helped on committees including Membership and Media. He has been active in updating bylaws and designing and producing the 2014 CoNPS calendar.



Charlie Turner Photo by Jan L. Turner

Outgoing Board Members

Crystal Strouse decided to step down after serving as President of CoNPS for the past 3 years. Crystal has done a wonderful job as president and the Board is grateful to her for her many accomplishments. Fortunately she will continue being active in CoNPS.

The Board said farewell to members Brian Kurzel, Steve Yarbrough, and Bob Powell, all of whom decided not to run



Crystal Strouse
Photo by Garrett Paul

again after participating for many years. They contributed greatly to CoNPS and its mission.

Welcome New Board Members

Newly elected members Andrea Cummins and Lynn Rubright were not able to serve as Board members because of other commitments. Therefore, Jenny Neale and Jan Turner volunteered to continue on the Board and were voted in. Also joining the Board will be Erin Tripp, Curator of the University of Colorado (Boulder) Herbarium, Jessica Smith, and Lenore Mitchell, Native Plant Master Trainer. The 2013-2014 Board consists of Betsy Bultema, Lenore Mitchell, Jenny Neale, Steve Olson, Jessica Smith, Erin Tripp, and Jan Turner.

Minutes of the Board meetings are posted on the CoNPS website. The most recent Board meeting was held November 2, 2013 at the Regis University Library in the Tracy Room. Once the 2014 schedule has been decided, it will be posted on the website and in the next issue of *Aquilegia*.

The next Board meeting will take place February 1, 2014 from 9-11 a.m. in the Tracy Room of the Regis University Library.

Happy Birthday!

Congratulations to Bill Weber on his 95th birthday November 16.

Colorado Environmental Film Festival

From February 20-23, 2014, the Colorado Environmental Film Festival will be held at the American Mountaineering Center in Golden, Colorado. The festival attracts independent filmmakers from around the world. You can purchase, for a bargain price, a ticket so you can view a group of movies (some might be 10 minutes, others might be 20 minutes or more) that are played consecutively. You will learn much in a short period of time. Information is available at <http://www.ceff.net/>

HELP WANTED WORKSHOP COORDINATOR for CoNPS

This is a paid contract position

The CoNPS board of directors is looking for an entrepreneurial person to run our workshop program. The Workshop Coordinator will work with the Workshop Committee to develop, organize, publicize, and run workshops on the Front Range and possibly in other chapter areas of the state. 50% of the profits generated by the workshops will be shared with the workshop coordinator.

The workshop coordinator's duties will be as follows:

1. Meet with the workshop committee to develop ideas for workshops, suggest workshop presenters, identify locations to hold workshops, and decide how workshops will be run.
2. Sign up instructors to present the workshops.
3. Publicize the workshops in *Aquilegia*, on our web site and other media.
4. Work with the CoNPS administrative assistant, making sure that the registration process runs smoothly and assure that all registration fees are collected.
5. Develop entry level workshops that are open to the public to introduce members and nonmembers to Colorado flora.
6. Attend all workshops to monitor attendance, provide food and drinks, assist with book sales, make announcements about the Society, and provide microscopes, audiovisuals and other supplies and equipment as necessary.

Interested parties should contact CoNPS president Charlie Turner at conpscturner@gmail.com, or at Colorado Native Plant Society, P.O. Box 200, Fort Collins, CO 80522. Resumés should be submitted to Charlie by February 15, 2014.

Ethics of Plant Collecting: CoNPS' Revised Policy and Opportunities for Training

by Steve Popovich

The CoNPS Board recently reviewed our *Ethics of Plant Collecting* policy posted on the CoNPS web site. The need to revise our policy to reflect current philosophies regarding the ethical collection of plants and plant parts (flowers, seeds, etc.) has been addressed in several *Aquilegia* articles.

At the 2013 annual meeting in Boulder, I presented a brief overview of proposed changes in policy, and solicited feedback from attendees who wished to express concerns or to improve our proposed concepts. The Board has reviewed that feedback and approved a new ethics policy. The new policy appears below.

Based on concerns raised by Board members and other CoNPS members, the Board has developed or revised eight plant collecting ethics guidelines. Additionally, one change that affects CoNPS members is that training, through a workshop or online module, will be required for: 1) those members who will lead field trips or workshops that involve the collection of plants while representing CoNPS; 2) members who will teach collecting protocols while representing the Society (see the third paragraph in the *Ethics* introduction). It was felt that training was needed to raise general awareness by members regarding when permission/permits are needed, how to determine land ownership and access, and how to collect under special conditions. Training will help ensure a greater level of consistency in plant collecting approach across field trips and workshops. The purpose of the training is simple:

to conserve our plant communities, natural resources, protect members, and protect the Society.

An effective date for the training requirement has not been determined, but is expected to be sometime before next summer. Training may be accomplished by taking an online module or by attending a workshop. Two such workshops are currently scheduled: one will be held Saturday, March 1, 2014 in Fort Collins and other will be in Golden on Saturday, March 8, 2014. Once the online training module is developed and is approved by the Board, the new ethics policy will take effect and will be posted online. Field and workshop leaders who will be representing the Society while collecting plants will be contacted by CoNPS to ensure they complete the training in a timely manner.

Although the training will be required only for those field or classroom leaders who represent CoNPS when collecting or teaching collecting, the Board encourages all members to take the training so that they may increase their awareness of the ethical plant collecting procedures endorsed by CoNPS and of the permissions or permits that may be needed when collecting.

The Board is looking for volunteers who are interested in helping to develop the online training module. To offer assistance or provide feedback, contact Steve Popovich, (970) 295-6641, stevepopovich@hotmail.com.

Colorado Native Plant Society Ethics of Plant Collecting Revised Policy

Approved by the Board October 5th, 2013

The Colorado Native Plant Society (CoNPS) encourages the ethical collection and use of Colorado's flora. Lack of commercial availability of many plant species, greater demand for native plants in horticultural settings and the reestablishment of native plants in restoration efforts can require that seed and/or other plant material be prudently collected from plants in their native habitats. Likewise, plant material necessary for study and research purposes must also be collected under ethical guidelines.

Good land stewardship emphasizes that we recognize the sensitivity of native plants as well as the environments in which they grow. Picking wildflowers or collecting seed may reduce a plant's ability to reproduce and can affect pollinators, adversely impacting the long-term survival of a population. When plants are removed from their natural environment, habitat is reduced for animals that depend on that species for food and cover; further, many species do not survive being transplanted. Likewise, the ecological effects of escaped exotics or misplaced natives can occur either through competitive replacement of native species or through alteration of native plant population genetics.

CoNPS members who are collecting plants or teaching collecting protocols while representing the Society must first complete the CoNPS training "Ethics and Protocols of Plant Collecting." Members can satisfy this requirement by completing any Society-sanctioned training; one such avenue is the training module posted on the Society's webpage.

CoNPS has developed the following guidelines for the ethical collection of native plant materials (including seeds or flower parts, leaf or stem material, or any other plant part):

1. Become informed about Colorado and regional species that are Threatened, Endangered, Sensitive, or otherwise of Special Concern. A listing of these species can be found at the Colorado Natural Heritage Program's website: <http://www.cnhp.colostate.edu/download/list/vascular.asp>. Federal, State and local natural resource agencies often have additional listings. Such plants should never be collected unless authorized by the land owner or administrator and the collection would not result in a loss of population viability. The viability concern can be lifted if special circumstances exist (see #4 below).
2. Collect only if you are a trained individual, or are accompanied by a trained individual, who is knowledgeable of the proper collection methods and can propagate, curate or otherwise process all of the plant material collected.
3. Collect only if you have all necessary permits and/or permissions allowing collection on public and private lands, and adhere to all terms and conditions. It is the responsibility of the collector to know property ownership at all times; obtain permission from private property owners before entering the property. There may be specific locations where collection is prohibited; seasonal or other restrictions may also apply.
4. Collecting methods should conform to accepted industry standards. Leave enough of each plant or an adequate number of seeds or propagules to allow for regeneration and for wildlife that may depend on the leaves, roots or seeds for food. Do not collect whole plants unless needed for appropriate reasons, such as research, salvage, or if underground parts are needed for identification purposes. When circumstances exist that will result in destruction of plants, salvage of those plants may be appropriate if authorized by the land owner or administrator.
5. Keep good records of the location, habitat and geography of the environment in which a collection is made. Transfer this information whenever the plant materials change hands. Always consider preparing a voucher specimen with proper labeling for deposit in a recognized, publicly accessible herbarium, so as to provide absolute identification of the plants collected and for scientific and biodiversity documentation.
6. Leave no trace of your visit. Be sensitive to any area in which you collect plant materials. Tread lightly when off designated trails and, whenever collecting, minimize collection material needed.
7. Use good judgment. You should pass up a plant for seed or collection if it is not abundant. If a plant or population looks weak or unhealthy, do not collect from it – the extra stress may harm the plant, and you may transport a disease to or away from the site.
8. CoNPS stresses the importance of protecting the genetic integrity of the surrounding native species and natural vegetation. Avoid collecting species for propagation that have shown tendencies to compete with or replace other plants, or that are listed as Noxious or Watch List in the State of Colorado and its Counties, unless for special purposes (research, documentation, eradication of noxious weeds, etc.). When collecting non-native species, use accepted precautionary measures to prevent seed or propagative plant parts from escaping the collection. Dispose of uncurated material in an accepted manner and at an appropriate disposal repository.

Colorado's native flora is one of our most valuable natural resources. We have the ability and knowledge to use it wisely and the ethical responsibility to protect it.

WORKSHOP: How to Collect Native Plants

**Saturday, March 1, 2014, at USDA Forest Service Office, Ft. Collins, 9 am to 3 pm
OR**

Saturday, March 8, 2014, Jefferson County Extension Office, Golden, 9 am to 3 pm

Presenters: Steve Popovich, Melissa Islam and Pam Regensberg

Collecting our native flora is necessary for scientific study but how can it be done without harming our sometimes fragile populations? When and where is it legal to collect? This workshop will cover how to acquire the proper permits, determine land ownership, and avoid collecting sensitive species. We'll also walk you through the process of collecting scientific specimens, including how to take field notes. This workshop is perfect for those conducting workshops, field trips or field studies.

Can't attend one of these sessions but you would like to learn more about plant collection or to qualify to lead a CoNPS field trip involving plant collection? An ONLINE tutorial will be available on the CoNPS website this spring.

QUIZ! The first person to email the correct answer wins a free 2014 CONPS Wall Calendar!

What year did the CoNPS publication change its name from *Colorado Native Plant Society Newsletter* to *Aquilegia: Newsletter of the Colorado Native Plant Society*?

Email your response to JLTurner@regis.edu



Colorado Native Plant Society

The Colorado Native Plant Society is dedicated to furthering the knowledge, appreciation and conservation of native plants and habitats of Colorado through education, stewardship and advocacy.

Membership is open to all with an interest in our native plants and is composed of plant enthusiasts, both professional and non-professional.

CoNPS Administrative Assistant Linda Smith CoNPSoffice@aol.com

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AQUILEGIA

Newsletter of the Colorado Native Plant Society

Aquilegia is the newsletter of the Colorado Native Plant Society and is available to members of the Society and to others with an interest in native plants. Four regular issues are published each year plus a special issue for the Society Annual Meeting held in the Fall.

Announcements, news, articles, book reviews, poems, botanical illustrations, photographs and other contributions should be sent to Jan Loechell Turner at JLTurner@regis.edu.

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 author and attributed to *Aquilegia*.

Deadlines: Submissions to *Aquilegia* are accepted throughout the year, although the usual deadlines for publication are:

February 15 (Spring issue, sent out mid to late March)

April 15 (Summer issue, sent out mid to late May)

June 15 (Annual Meeting issue, sent out mid to late July)

July 15 (Fall issue, sent out mid to late August)

November 15 (Winter issue, sent out mid December)

Aquilegia Editor: Jan Loechell Turner
JLTurner@regis.edu

Aquilegia Staff & Contributors: Mo Ewing, Charlie Turner, Sally L. White, Linda Smith, Rob Pudim, John Vickery

"Friend" us on Facebook!

www.facebook.com

Want to find out the latest CoNPS news? Have news to share? Have a photo of a plant you need help identifying?

Want reminders about upcoming field trips or workshops?

Sign in to Facebook and type in Colorado Native Plant Society. You can "friend" CoNPS (our main Facebook page) and the CoNPS Northern Chapter.



Join the Colorado Native Plant Society



Membership in CoNPS entitles you to:

- Subscription to the CoNPS newsletter, *Aquilegia*
- Field Trips to see wildflowers
- Educational Workshops by expert botanists
- Annual Conference
- Conservation and Restoration Activities
- Camaraderie of Plant Lovers from Colorado
- Local Chapter Educational Programs & Email Updates

MEMBER APPLICATION FORM

Name(s).....

Address

City.....State.....Zip

Phone ____ - ____ - ____ E-mail

MEMBERSHIP CLASS

Dues cover a 12-month period.

- Individual (\$20)
- Family / dual (\$30)
- Senior (65+) (\$12)
- Student (\$12)
- Organization (\$30)
- Supporting (\$50)
- Lifetime (\$300)

CHAPTERS

You are free to affiliate with any chapter you choose and to attend the meetings of any chapter. Chapters do not have drawn map boundaries.

Boulder Gore Range Metro-Denver Northern Plateau Southeast Unaffiliated

Send information about **volunteer opportunities**

OPTIONAL PRINT DELIVERY OF AQUILEGIA NEWSLETTER

Most members prefer to receive the newsletter electronically via e-mail (pdf file), and this saves the Society considerable printing and postage expense. If you would like to receive a print copy of the newsletter instead, check this box. Please note that print copies usually arrive about a week later than the electronic version. Please deliver a printed copy of *Aquilegia* by mail.

DONATION

\$ _____ General Fund

Endowments in support of small grants-in-aid of research:

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

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

\$ _____ **TOTAL**

Mail to: CoNPS Office, P.O. Box 200, Fort Collins, CO 80522.

Please make checks payable to "Colorado Native Plant Society." Dues and contributions are tax-deductible.

CONPS 2013-2014 CALENDAR

NOVEMBER 2013

- Nov 7...Watershed Restoration after High Park Fire: Dozens of Lessons Learned After One Growing Season, Miraculous Natives and More (N)
Nov 14..Flood Effects Along the St. Vrain (B)
Nov 16.. Dr Bill Weber's 95th birthday
Nov 20..Forests, Fens, and Medicinal Plants (SJ)

DECEMBER 2013

- Dec 3....Alpine Plant Ecology of New Zealand Program, 7 p.m. (MD)
Dec 4-5... Colorado Weed Management Association 2013 Annual Conference, Cheyenne Mountain Resort, Colorado Springs
Dec 5....Landscape Design and Cultivation of Rocky Mountain Native Plants, 7 p.m. (N)
Dec 7... Lichen Biology Workshop, Boulder
Dec 8....Lichen Biology Workshop, Boulder
Dec 12 ..Impact of Russian-Olive in Great Plains Riparian Ecosystems (B)
Dec 18...Impact of *Tamarix* on Arthropod Abundance (SJ)
Dec 28...40th Anniversary of the Endangered Species Act

JANUARY 2014

- Jan 1.....Happy New Year!
Jan 9....Scoping on the Trail Program (N)
Jan 9....Results from the 2013 Green Gentian (*Frasera speciosa*) Survey (B)
Jan 15...Landscaping with Native Plants (SJ)
Jan 25...Intro to the Buckwheat Family Workshop, Longmont
Jan 26 ...Intro to the Buckwheat Family Workshop, Longmont
Jan 28...Budding Monkeyflower (*Mimulus gemmiparus*), 7 p.m. (MD)

KEY

B	Boulder Chapter
GR	Gore Range Chapter
MD	Metro-Denver Chapter
N	Northern Chapter
P	Plateau Chapter
SE	Southeast Chapter
SJ	San Juan/Four Corners Native Plant Society

December 28th is the 40th anniversary of the Endangered Species Act!

**Buy Your Holiday Gifts at the CoNPS Bookstore!
Books, T-shirts, Memberships,
and 2014 Calendars!**

FEBRUARY 2014

- Feb 1...CoNPS Board Meeting, Regis University Library, 9-11 a.m.
Feb 8....Intro to Asteraceae Identification Workshop, Denver
Feb 9....Intro to Asteraceae Identification Workshop, Denver
Feb 13..Meet the New Curator of Botany at the University of Colorado-Boulder Herbarium, COLO (B)
Feb 19...Botanical Surveys for Rare Plant Species (SJ)
Feb 20-23...Colorado Environmental Film Festival, Golden
Feb 22...Arizona Native Plant Society Annual Meeting, Tucson
Feb 22...Wonderful World of Cyperaceae Workshop, Longmont
Feb 23 ...Wonderful World of Cyperaceae Workshop, Longmont
Feb 25.... Wetland/Riparian Topic 7 p.m. (MD)
Feb 27...March 1 Natural History of the Gila Symposium, WNMU campus, Silver City, NM (Free) 575-388-2386 for information.

MARCH 2014

- Mar 1...How to Collect Native Plants Workshop, Ft. Collins
Mar 8 ...How to Collect Native Plants Workshop, Golden
Mar 13...Vascular Plants in Urban Dry Washes of the Sonoran Desert (B)
Mar 19...Alpine Wildflowers of the Western San Juans (SJ)

APRIL 2014

- Apr 10...Volunteers: A Vital Part of a Native Plant Materials Program
Apr 12...Beardtongues of Colorado Workshop, Loveland
Apr 13...Beardtongues of Colorado Workshop, Loveland
Apr 29...Results from the 2013 Green Gentian (*Frasera speciosa*) Survey 7 p.m. (MD)

FALL 2014

The 2014 Annual Meeting will be hosted by the Northern Chapter of CoNPS!

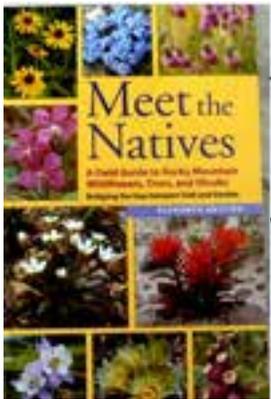


Great Christmas Gift!

This calendar is only \$8 from the CoNPS Bookstore.
<http://www.conps.org/Bookstore/index.shtml>.

SHOP CoNPS!

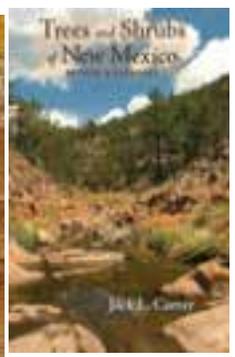
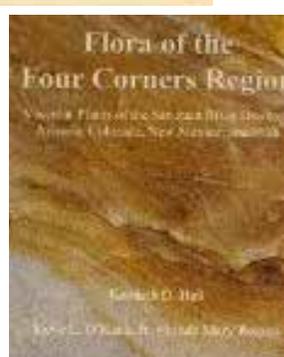
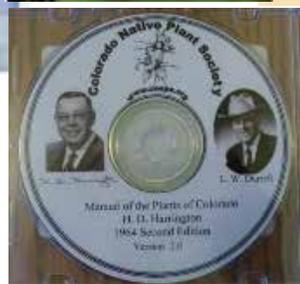
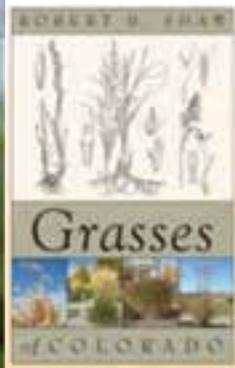
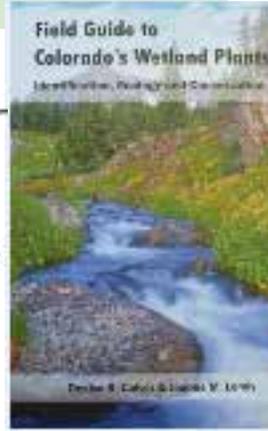
These items and many more are available through the CoNPS Bookstore <http://www.conps.org/Bookstore/index.shtml> Check website for prices.



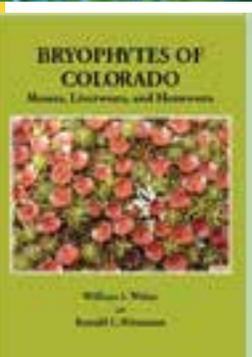
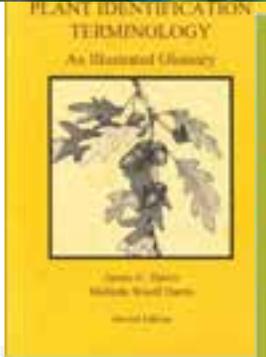
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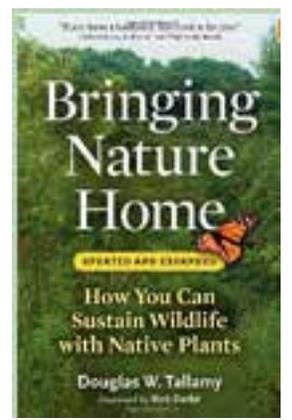
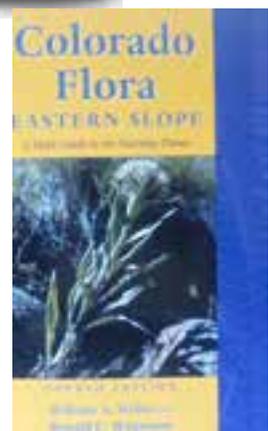
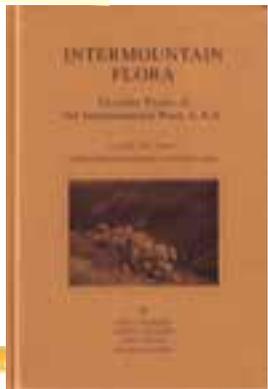


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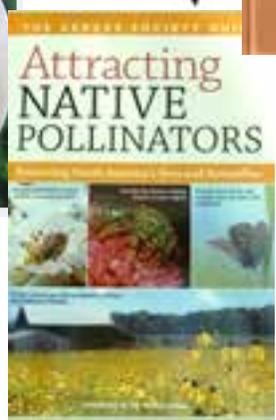
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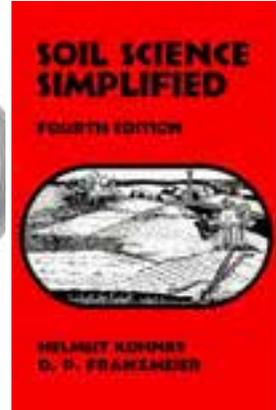


\$75

\$23



\$13.19



MORE COLORS AVAILABLE

Colorado Native Plant Society Women's Zip Hoodie \$41.99



\$6



**December 28th is the
40th anniversary of
the
Endangered Species
Act!**



Colorado Native Plant Society

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

Lichen Profile

by Sally L. White

PELTIGERA

***Peltigera aphthosa*,
*Peltigera leucophlebia***

Broad, ruffled lobes would place the abundant “pelt” lichens among the most noticeable of our montane lichens, were it not for their usual cryptic brown and gray coloring, which is partly attributable to their primarily cyanobacteria photobionts.. Fortunately three of our 15 species stand out, at least when wet, thanks to the chlorophytes (rather than cyanobacteria) that are their primary photobionts. *Peltigera aphthosa* and *Peltigera leucophlebia* (clear veins) are large lichens with bright green coloring that helps us spot them when the forest floor is moist. The 2-4 cm wide lobes radiate to form a thallus 30 cm or more across.



Photo by Rick Brune

To distinguish these two species, you’ll probably have to take a peek at the underside. *P. leucophlebia*, as its name implies, has distinct veins that change from light colored near the margin to black toward the center. Carefully loosen the lichen from the soil or mosses to check for this. In *P. aphthosa*, the veins tend to be broad and undefined. The uplifted lobes bearing brownish apothecia have, in *P. aphthosa*, green cortex on the underside of these reproductive structures, but in *P. leucophlebia*, the cortex is absent or present only as green specks on the white background.

Fun fact: Small round structures on the upper surface, called cephalodia, contain cyanobacteria, giving these lichens claim to a three-kingdom symbiosis.

Don’t be fooled: Species of *Sticta* look like *Peltigera* and are in the same family, but the underside is black with white spots instead of the characteristic veins. Our third green *Peltigera*, *P. venosa*, is smaller (less than 2 cm diameter) and each fan-shaped thallus consists of a single lobe, usually with black marginal apothecia.

Sally L. White celebrates lichens at coloradolichens.org