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Publication of the Wyoming Native Plant Society

October 2024, Volume 43(3)

Posted at www.wynps.org

Sagebrush Steppe Theatrics:

Investigating perennial forb microsites in big sagebrush ecosystems

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One of the most widely recognized patterns in ecological communities is the unevenness of species abundances. Most ecosystems support a few very common species, and many uncommon and rare species.

Wyoming's state shrub, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), plays a starring role in defining the structure and character of ecosystems and landscapes across the state. In some places, perennial grasses co-star with big sagebrush, adding brighter shades of green to the plant community and filling in the spaces between shrubs. In others, perennial grasses play a minor role, tucked here and there under and between big sagebrush across the vast region (Figure 1).

Grasses and big sagebrush can be gracious neighbors to one another, preferentially using water at different depths to avoid competition (Walter, 1971). Grasses tend to use water in shallow soil layers, while deeper roots allow shrubs to access water that is inaccessible to shallower-rooted grasses (Kulmatiski et al., 2020). As a result, the average amount of water in shallow and deep soils determines the abundance of shrubs and grasses at a site (Sala et al., 1997). Environmental factors that influence the depth distribution of water in the soil (e.g., soil texture, precipitation seasonality) are good predictors of shrub and grass abundance in big sagebrush ecosystems (Paruelo and Lauenroth, 1996; Renne et al., 2019).

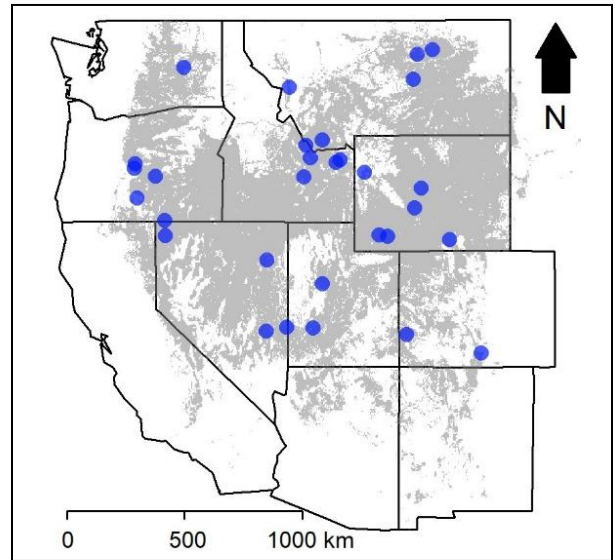


Figure 1: Thirty relatively undisturbed sites (blue points) in the region of potential big sagebrush habitat (grey area) that I visited in 2023.

Most big sagebrush plant communities also include a motley cast of extras—broadleaf, flowering plants that span a remarkable range of phenology, growth forms, and rooting strategies. This group, known as forbs, contributes very little to total plant cover and biomass at most sites. Yet, these plants are the main source of plant biodiversity in most big sagebrush ecosystems (Jordan et al., 2020; Pennington et al., 2017) and provide important food sources for wildlife such as the greater sage-grouse and pronghorn antelope (Bender et al. 2023; Pennington et al. 2016). Cont. p. 3

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WYNPS News

Call for Nominations: Are YOU interested in being on the Board of Wyoming Native Plant Society? Nominations for 2025 are invited for Board-at-Large, or willingness to consider officer roles. The ballot will appear in the next issue – please send your name to wynps@wynps.org or contact the Secretary-Treasurer. *Time to think about our elections!!*

New members: Please welcome the following new members to WYNPS: Dan Bach, Cheyenne; Heather Bailey, Laramie; Irene Beardsley, Palo Alto CA and Moose; Doug Brown, Jackson; Margret Ellwanger, Bedford; Lyle Gingerich, Johnston, IA; Chuck Harris, Jackson; Bronwyn Queen & Craig Taylor, Pinedale; Claire Kett Yoga, Alexandria, VA.

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Treasurer's Report: Balance as of 7 October: Scholarship = \$2,261; General = \$12,086; Total = \$14,347.

Next issue: Please send articles and announcements for the next newsletter by 15 November to:

Wyoming Native Plant Society
P.O. Box 2449
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Message from the Co-Presidents!

There is a crispness in the air, even if temperatures and conditions remain summer-like. We all know, and hope, that wetter, cooler weather is lurking around the next page of the calendar. The real botanists and scientists among us are oiling their hiking boots, polishing their loupes and preparing all those summer collections for a winter of study. The rest of us are ready to put the garden to sleep and perhaps are gathering a bit of firewood. It is time to reflect on the high points of last season and to look to the events of the future.

WYNPS was fortunate to share in the BioBlitz and to observe the excitement around the Wind River Tribal Buffalo Initiative. There were many opportunities for science and for cultural exchange. Hopefully, the data gathered will serve to inform the land-use decisions made in the future. The Board is meeting and is beginning to plan our next year's annual meeting, and as we do that, we hope you know how much we value our members and their amazing reserve of collective knowledge.

~Joyce & Mike Evans

From September to May [JH Bird and Nature Club](#) and Teton Plants co-sponsor monthly programs at the Teton County Library on the 2nd Tuesday of each month as part of Nature Night Series. 6:00pm, Ordway Auditorium, Teton County Library, 125 Virginian Ln, Jackson, WY 83001. Check the calendar at: <https://tetonplants.org/>

Contributors to this Issue: Joyce and Mike Evans, Bonnie Heidel, Ben Legler, Greg Pappas, Rachel Renne, Meredith Taylor, Dorothy Tuthill.



2024 Annual Meeting Phenomena

Thank you to the Wind River Tribal Bison Initiative (WRTBI) for hosting the Wyoming Bioblitz and joint Annual Meeting of Wyoming Native Plant Society! We gathered at WRTBI headquarters June 13-15, 2024.

Organizers prepared an amazing agenda that was all the more remarkable in its spontaneous elements. For example, a live concert unfolded at



dusk in the middle of a Buffalo Pasture one evening, and a highlight of one plant hike was a tribal elder speaking about cultural plant harvests at the culmination.

Thanks to all who came!

Sagebrush Forbs, continued from p. 1



Figure 2: Two sagebrush study sites in Wyoming with different amounts of perennial grasses (and other graminoids). On the left, *Poa secunda*, *P. fendleriana*, and *Carex filifolia* add a bright-green background to the mountain big sagebrush at this cool, wet site east of Atlantic City. On the right, *P. secunda*, *Hesperostipa comata*, *Achnatherum hymenoides*, and *Elymus elymoides* provide sparse punctuation to open spaces between shrubs in this warmer, drier Wyoming big sagebrush site west of Green River.

In grasslands, grasses tend to compete with forbs, and factors that increase grass abundance tend to decrease forb abundance (Collins et al., 1998; Milchunas et al., 1989). In shrublands, shrubs may provide favorable microsites under their canopies, protecting forbs from harsh conditions and large herbivores (Lortie et al., 2021). In ecosystems that

support a mix of shrubs and grasses—such as big sagebrush ecosystems—the net effect of dominant plants on forbs remains an open question.

Last summer, I began a project to answer this question and explore how perennial forbs fit into big sagebrush plant communities. I visited 30 relatively undisturbed sites across Wyoming and the West (Figure 2). At each site, I estimated the distribution of

gaps that could serve as potential forb microsites by measuring the distances to the nearest perennial grass and shrub at 150 points located along three 25-m transects. I also recorded if the point was located under a shrub (canopy) or in an opening between shrubs (interspace). Then, I identified 5 to 10 individuals from each of 3 to 8 perennial forb species (depending on the total number of forb species at the site) and measured the distance to each forb's nearest shrub and grass neighbor. I recorded the size of the forb and its shrub canopy condition. After the field season, I estimated average soil water dynamics using an ecosystem water balance simulation model (Schlaepfer and Murphy, 2023) with site-specific soil and vegetation data.

Preliminary results from the data I collected in 2023 suggest that perennial forbs tend to grow in shrub canopy microsites where conditions favor shrubs (more deep soil water resources) and in interspace microsites when conditions favor grasses (more shallow soil water resources). Perennial forb size, preferred microsite, and distances to nearest dominant plants were most often related to shallow (but not deep) soil water variables, suggesting that like grasses, this functional type may rely more on shallow soils for moisture.

Although perennial forb microsites generally reflected the average potential microsites available at a given plot, individual species exhibited preferences for different sizes of gaps and shrub canopy conditions. The relative size of individual forbs increased with relative distance from a perennial grass. This effect was most pronounced for forbs under shrubs at dry sites and least pronounced for forbs in interspaces at dry sites (Figure 3). Together, these results suggest that interactions between perennial forbs and grasses are often competitive in big sagebrush ecosystems—particularly under conditions where both are facilitated by shrubs (dry, shrub-dominated sites).

Support from the Wyoming Native Plant Society allowed me to include six sites from Wyoming in this project, where the climate tends to be cooler and with a larger proportion of summer precipitation than in many other parts of the big sagebrush region. The preliminary results from this project are promising, and this summer (2024), I visited additional sites. I look forward to continuing the data analysis in the fall. This research will contribute to the second chapter of

my dissertation and eventually to a publication in a peer-reviewed journal. (*Editor's note: Rachel Renne is a 2023 WYNPS Scholarship recipient.*)

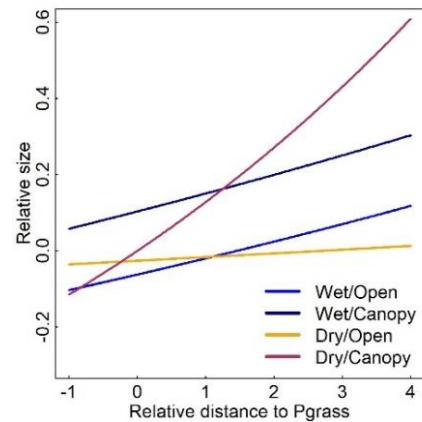


Figure 3: The relative size of perennial forbs was positively related to the relative distance from perennial grasses, and the relationship depended on water availability (wet versus dry sites) and microsite (under shrubs or in open interspaces).

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- Continued, p. 7*

Additions to the Flora – Spikerushes!

Greg Pappas, Botanist, US Forest Service

I am constantly attracted to, and distracted by, sedges. Perhaps this is why I recently discovered two native spikerush species in the Sedge Family that represent new additions to the Wyoming flora or confirm a questionable presence in the state. While surveying an isolated parcel on the Laramie Peak unit of the Medicine Bow National Forest (MBNF) in 2021, I found and collected a spikerush (*Pappas 2 RM*) that I originally thought was the Forest Service Sensitive Species *Eleocharis elliptica*, as I knew of a collection of it from the area (see iNaturalist posting -

<https://www.inaturalist.org/observations/100470156>)

However, after further investigation, I determined my specimen was *E. compressa* (flat-stem spikerush), which was previously not known to occur in Wyoming. An ensuing examination of Rocky Mountain Herbarium (RM) specimens led Ben Legler (RM) and me to conclude that **both** *Eleocharis* species occur in Wyoming! *E. elliptica* resides in the northwest (Yellowstone National Park) and *E. compressa* in the east (Black Hills and northern Laramie Range). The newly annotated *E. compressa* specimens from eastern Wyoming represent two separate varieties: var. *acutisquamata* and var. *compressa*.

Compared to *E. elliptica*, *E. compressa* has more deeply notched floral scales and grows in relatively drier habitats. The *Flora of North America* notes *E. elliptica* is adapted to microhabitats where the surface soil is permanently saturated by groundwater discharge, while *E. compressa* is adapted to microhabitats such as depressions in prairies that are dry in summer. Indeed, all my *E. compressa* specimens, including two more collected from the northern Laramie Range in 2023, came from ephemeral stream beds. (Ben annotated *E. elliptica* specimens from the Black Hills and determined them to be the type variety.)

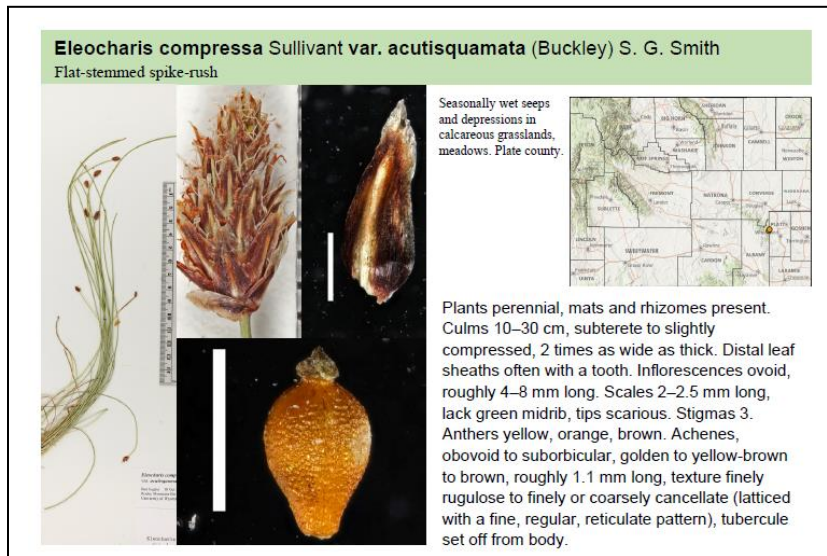


Figure 1. A Wyoming Spikerush Key was released by the Rocky Mountain Herbarium on the heels of new spikerush discoveries. Until recently, only one species in Wyoming was known to have a golden achene. We're up to four golden taxa now!

In 2022, I collected another interesting spikerush, *Eleocharis bolanderi* (Bolander's spikerush), from a streamside moist meadow in the Sierra Madre Range of the MBNF (*Pappas 18 RM*; <https://www.inaturalist.org/observations/147055673>). One distinguishing feature is its entire (not notched) floral scales that are dark brown to blackish. Although not included in Robert Dorn's *Vascular Plants of Wyoming*, *E. bolanderi* is on RM's Wyoming Flora checklist, citing Erwin Evert's 1988 collection from Yellowstone National Park, which is the only documented record of the plant from Wyoming. Intrigued, I perused specimen images on the RM online database looking for potential misidentifications of *E. bolanderi*. Sure enough, four records of *E. acicularis* turned out to be *E. bolanderi*, which were then verified and annotated by Ben at RM. All these occurrences are located within 12 miles of the southern border of Wyoming; thus, collectively they confirm its presence and represent a major expansion of the species' known range in the state. *Special thanks to Ben Legler for reviewing specimens!*

The 2023 Annual Report of the Rocky Mountain Herbarium (RM) announced a new *Eleocharis* key for Wyoming, by Joshua Mattson, undergraduate researcher. *Why Eleocharis?* Wyoming's flora is not static. New species continue to be found in the state, and taxonomic research introduces name changes to familiar species. Both scenarios have recently occurred for *Eleocharis* in Wyoming. The identification guide includes a technical key to *Eleocharis* covering all species now known from the state, and species profile pages with species descriptions, distribution maps, habitat info, and photographs. The photographs include extreme close-ups of inflorescence scales and achenes, captured by Josh using RM's recently acquired microscope imaging equipment and focus-stacking software. The completed identification guide will be made available through RM's in-development Flora of Wyoming website as a PDF document or by request.

2024 Wyoming Plant Species of Concern

Bonnie Heidel

Wyoming Natural Diversity Database

The 2024 update to the Wyoming Plant Species of Concern List (SOC) is posted at:

<https://wyndd-reports.s3.us-west-2.amazonaws.com/24hei02.pdf>. Species that are additions to the SOC are bold-faced – check out the *Botrychium* and *Eleocharis* genera! It is accompanied by three appendix items: Guidelines, Species of Potential Concern, and Species removed since the 2018 update.

The SOC List can be downloaded from the WYNDD Data Explorer in a spreadsheet format (<https://wyndd.org/portal/login>; then “View by List”) with the same information content. It is also a search option in any WYNDD Data Explorer spatial searches (same link; then “View by Map”. It cross-references plant species having a federal agency designation (threatened, endangered, sensitive). Note: WYNDD strives to keep up with U.S. Forest Service designations (USFS is in the process of replacing Sensitive Species by the two regions with Species of Conservation Concern designation by the eight national forests).

Yes, it’s a long list, but Wyoming has a diverse, well-documented flora. Here’s an abridged list of 54 species if you want just those SOC that are also the most globally rare and Wyoming-centered:

Globally Rare Wyoming Plant SOC with High or Very High Contribution Rank

<u>Scientific Name</u>	<u>Common Name</u>
• <i>Abronia ammophila</i>	Yellowstone sand verbena
• <i>Agrostis rossiae</i>	Ross' bentgrass
• <i>Antennaria arcuata</i>	Box pussytoes
• <i>Aquilegia laramiensis</i>	Laramie columbine
• <i>Artemisia biennis</i> var. <i>diffusa</i>	Mystery wormwood
• <i>Artemisia porteri</i>	Porter's sagebrush
• <i>Artemisia simplex</i>	Laramie chickensage
• <i>Astragalus diversifolius</i>	Meadow milkvetch
• <i>Astragalus gilviflorus</i> var. <i>purpureus</i>	Dubois plain milkvetch
• <i>Astragalus hyalinus</i> var. <i>glabratus</i>	Smooth summer milkvetch
• <i>Astragalus jejunus</i> var. <i>articulatus</i>	Hyattville starveling milkvetch
• <i>Astragalus paysonii</i>	Payson's milkvetch
• <i>Astragalus proimanthus</i>	Precocious milkvetch

- *Astragalus racemosus* var. *treleasei* Trelease's milkvetch
- *Boechea pusilla* Small rockcress
- *Cirsium pulcherrimum* var. *aridum* Cedar Rim thistle
- *Cymopterus evertii* Evert's springparsley
- *Cymopterus williamsii* Williams' springparsley
- *Descurainia torulosa* Wyoming tansymustard
- *Draba paysonii* Payson's draba
- *Draba pectinipila* Comb-hair draba
- *Ericameria winwardii* Winward's goldenweed
- *Eriogonum exilifolium* Dropleaf buckwheat
- *Eriogonum umbellatum* var. *cladophorum* Yellowstone sulphur buckwheat
- *Ipomopsis spicata* var. *robruthiorum* Kirkpatrick's ipomopsis
- *Lepidium integrifolium* Thicket leaf pepperweed
- *Leymus simplex* var. *luxurians* Long-awned alkali wildrye
- *Lomatium andrusianum* Andrus' desert-parsley
- *Oenothera coloradensis* Colorado butterfly plant
- *Oreocarya subcapitata* Owl Creek cryptantha
- *Penstemon absarokensis* Absaroka beardtongue
- *Penstemon acaulis* Stemless beardtongue
- *Penstemon gibbensii* Gibbens' beardtongue
- *Penstemon haydenii* Blowout beardtongue
- *Peritoma multicaulis* Slender spiderflower
- *Phacelia glandulosa* var. *deserta* Desert glandular phacelia
- *Phlox pungens* Prickly phlox
- *Physaria didymocarpa* var. *lanata* Woolly twinpod
- *Physaria dornii* Dorn's twinpod
- *Physaria fremontii* Fremont's bladderpod
- *Physaria macrocarpa* Large-fruited bladderpod
- *Physaria pachyphylla* Thicket leaf bladderpod
- *Physaria prostrata* Prostrate bladderpod
- *Physaria subumbellata* Parasol bladderpod
- *Shoshonea pulvinata* Shoshonea
- *Spiranthes diluvialis* Ute ladies' tresses
- *Stephanomeria fluminea* Teton wirelettuce
- *Thelesperma caespitosum* Low greenthread
- *Thelesperma pubescens* Hairy greenthread
- *Townsendia microcephala* Smallheaded Townsend daisy
- *Trifolium barnebyi* Barneby's clover
- *Trifolium dasyphyllum* var. *anemophilum* Laramie clover
- *Xanthisma coloradoense* Colorado tansyaster
- *Yermo xanthocephalus* Desert yellowhead

The bryophyte and lichen flora and their G- and S-ranks can also be queried on the WYNDD homepage, but SOC lists have yet to be prepared for nonvascular species.

Ethnobotany - Part 11.

Gooseberry, Red Currant, Golden Currant and Black Currant (*Ribes* species)

By Meredith Taylor, Certified Wyoming Naturalist

Ribes is a large and diverse genus of 150-200 distinct species of gooseberries and currants. The gooseberries have thorny stems while currants have smooth stems. The deciduous bushes are native to northern temperate climates throughout the world; there are 65 species in North America and 10 in Wyoming. *Ribes* is the only member of the Grossulariaceae family.

Ribes carries White Pine Blister Rust, a non-native fungus that causes serious disease of limber pine, whitebark pine and other white pines. To control the disease, efforts were made throughout the 20th century to eradicate *Ribes*, but they have since been abandoned as ineffective, expensive and unsuccessful.

This ubiquitous shrub grows quickly to 1.5 m. The leaves are waxy or hairy and palmately lobed, measuring 30-40 mm. Inflorescence of white to pink or yellow bell-shaped flowers bloom May to June that bear berries in July and August.

Ribes is an important food source for many cultures as well as birds, bears and browsers. Since *Ribes* is so abundant here, it is a staple food source. The tart berries are high in vitamins A, B, C and E.

This author gathers the berries when ripe to make delicious jams and to sweeten pancakes or native grain porridge; the berries were also dried to make pemmican as part of the Paleo diet. This author has many fans of her wild berry jams including Dr. David Love, who enjoyed the gooseberry jam as a child in Central Wyoming. So,

Sagebrush Forb references (cont. from p. 4)

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- Continued, p. 8*



every summer the jam was shared with Dr. Love and now his son Dr. David Love Jr. who also leads geology trips for the Dubois Museum.

Ribes species are used medicinally as an immune stimulant and to reduce the risk of diabetes and heart disease, as an anti-inflammatory and a blood cleanser.

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This article is for educational purposes and does not condone collecting of plants that readers can't identify with certainty. The ethics of wild plant collecting is to tread softly through the plant's habitat and only pick the occasional leaf or flower to protect plant sustainability. *Check directly with the agency about their policy if you want to harvest native plants on public land.*

Sagebrush Forb references (cont. from p. 7)

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