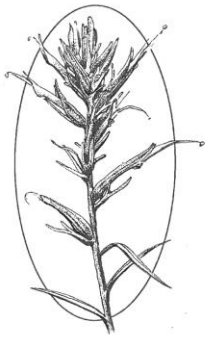

Castilleja linariifolia

Castilleja

Publication of the Wyoming Native Plant Society

December 2018, Volume 37(4)

Posted at www.wynps.org

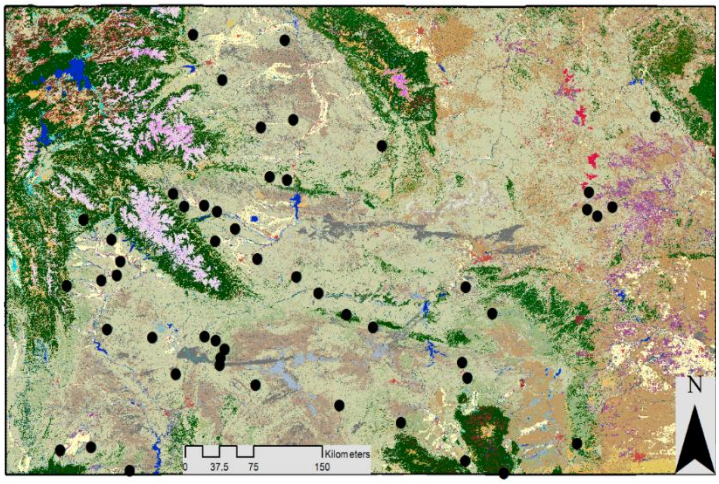

Figure 1. Map of study sites (black dots) across Wyoming

Soil Water Shapes Plant Diversity in Big Sagebrush Communities

By Sam Jordan, Arizona State University

What environmental conditions have greatest influence on plant diversity in big sagebrush communities in Wyoming? How many species of plants can you expect in an area dominated by Wyoming big sagebrush or mountain big sagebrush? These are questions I set out to answer when I started my Master's degree at the University of Wyoming. While I don't have all the answers, I'd love to share what we found. I say "we" because it was only through the patient guidance from my collaborators and staff at the Rocky Mountain Herbarium and the Wyoming Natural Diversity Database that I was able to conduct this research successfully.

We sampled 50 Wyoming sites in 2016 (Figure 1), spending 37 days in the field, after 425 gallons of fuel and over 8,500 miles of driving. Each site was dominated by big sagebrush, and selected for relatively ungrazed, undisturbed conditions with an intact understory of native species. We captured a wide range of environmental conditions in our sampling: from hot and dry to cool and wet, and found many species and large variability between sites.

To make the data we collected as useful as possible, we used a nested sampling design and recorded plant species at seven spatial scales. That is, we counted the number of plants contained in an area half the size of the page you are reading up to 1000 m^2, or twice the size of a basketball court (Peet et al. 1998). Using this method, we are able to compare what we found in big sagebrush to any number of other plant communities. A useful tool in plant ecology is the species-area curve: how many species do you detect as you increase your sample area? This has been an important tool used in many important biogeographical and ecological studies, and in Figure 2, you can see what we found for big sagebrush communities.

The areas we sampled varied greatly: some sites had more species in a 1 m^2 sample area than others did in 1000 m^2. On average, we found 34 species in 1000 m^2, with some sites having as many as 54 and as few as 16 species at that spatial scale. We divided plants into broad categories: forbs, grasses, and shrubs; and found an average of 22, 7, and 4 species in 1000 m^2 sample areas, respectively. Across all of our sites, we found 310 unique vascular plant species, and of those taxa, 209 species occurred in two or fewer locations. In other words, most of the plant species we found were rare forbs. (Continued, p. 9)

In this issue

WYNPS News

Renew and VOTE: HELP US RING IN THE NEW YEAR!! The calendar year is the WYNPS membership year. Enclosed is your renewal form, a 2019 ballot and introductions to a great slate of candidates. Renewals can also be done online through PayPal, and voting can be done through the Society homepage: www.wynps.org. Votes need to be received by 31 January – thank you.

Call for scholarship and grant applications: The call for student scholarship and small grant applications is also in this issue. They are being accepted now through 15 February, by mail or the WYNPS email address. *Please post and circulate this announcement.*

WYNPS Board – 2018:
President: Charmaine Delmatier, Washington (delmatier@wyoming.com)
Vice-President: Katy Duffy, Jackson (owlpals@wyellowstone.com)
Sec.-Treasurer: Dorothy Tuthill, Laramie (dtuthill@uwyo.edu)
Board-at-large:
Brenda Schladweiler, Gillette ('17-'18) (BSchladweiler@bksenvironmental.com)
Lynn Stewart, Dubois ('18-'19) (lstewart@dteworld.com)

2019 Annual Meeting: Please mark your calendars for the weekend of June 15-16, for the 2019 annual meeting. Look for an agenda and registration information online and in the next newsletter.

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Special announcement: A memorial for Dr. Ronald Hartman will be held on 8 February 2019 at the University of Wyoming - Berry Biodiversity Conservation Center @ 5;30 pm. You are invited. Botany Department arrangements are pending.

Treasurer's Report: Balance as of 6 Dec 2018: Scholarship = $606; General = $7,803; Total = $8,409.

Other Contacts:
Editor: Bonnie Heidel (bheidel@uwyo.edu)
Webmaster: Dorothy Tuthill (dtuthill@uwyo.edu)
Sublette Chapter: Julie Kraft, President (jakraft80@gmail.com)
Teton Plants: Amy Taylor, Treasurer; (tetonplants@gmail.com). …Check the chapter homepage for an exciting slate of talks, from September through May!

This Issue: Three articles by graduate student researchers are featured in this issue – *HURRAY*! Articles by Bob Dorn are *always* reasons to celebrate.

2019 Annual Meeting: Please mark your calendars for the weekend of June 15-16, for the 2019 annual meeting. Look for an agenda and registration information online and in the next newsletter.

Contributors to this Issue: Robert Dorn, Bonnie Heidel, Sam Jordan, Julie Kraft, Jason Mercer, Dorothy Tuthill, Rebecca Upjohn.

Reminder: We have a Facebook page and LOVE to be liked! –It's a great place to post your favorite plant photos.

Next Issue: Please send articles, ideas and announcements for the next issue by 15 February.

Wyoming Native Plant Society
P.O. Box 2449
Laramie, WY 82073
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Botanistis' Bookshelf

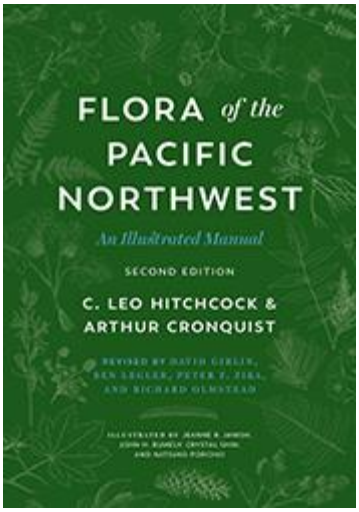
A classic is back, better than ever

(Information from the Publisher)

Hitchcock, C. Leo and Arthur Cronquist; ed. by David E. Giblin, Ben S. Legler, Peter F. Zika and Richard G. Olmstead. ***Flora of the Pacific Northwest, An Illustrated Manual***. 2018. Ill. by Jeanne R. Janish, John H. Rumeley, Crystal Shin, Natsuko Procino. Univ. of. Washington Press. $75.00 hardcover. (ISBN 9780295742885). 936 pp., 7,505 ill., 2 maps, 7 x 10 in.

The revised *Flora of the Pacific Northwest* (abridged) is now available, a mainstay of botanists across the northwestern United States and adjoining provinces. There is a 30% discount off the list price available through Sept 2019! You can buy it online at http://www.washington.edu/uwpress/search/books/HITFL2.html using discount code WST30**.**

Flora of the Pacific Northwest, first published in 1973, became an instant classic for its innovative style of providing species descriptions in the identification keys and for its comprehensive illustrations of nearly all treated taxa (species, subspecies, and varieties). Students rely on it as an essential primer, while veteran botanists and natural resource managers use it as the definitive reference for the region's flora.



This completely revised and updated 2018 edition captures the advances in vascular plant systematics over the decades since publication of the first edition. These advances, together with significant changes in plant nomenclature, the description of taxa new to science from the region, and the recent documentation of new native and nonnative species in the Pacific Northwest required a thorough revision of this authoritative work.

Flora of the Pacific Northwest covers all of Washington, the northern half of Oregon, Idaho north of the Snake River Plains, western Montana, and a portion of southern British Columbia. [Note: It is a valuable resource in the Greater Yellowstone Region of Wyoming!] It addresses wild-growing native and introduced vascular plants within these boundaries.

Treatment of 5,545 taxa (more than 1,000 taxa added from the first edition). Illustrations for 4,716 taxa (1,382 more than the first edition). Nomenclature changes for more than 40 percent of the taxa included in the first edition

These enhancements make this new edition the most comprehensive reference on Pacific Northwest vascular plants for professional and amateur botanists, ecologists, rare plant biologists, plant taxonomy instructors, land managers, nursery professionals, and gardeners.

Botanists' Tech Trends

Alter-ego of technical floras

By Julie Kraft

Wyoming Wildflower App, by Steven K. Sullivan. Go to GooglePlay. Free. Background information is posted at: https://wildflowersearch.org/search?page=Apps .

The Wyoming Wildflowers App can be used on both Apple and Android supported devices. It is free, very easy to use and has many special features to help you identify plants and keep a plant list. It addresses over 2,300 species known to grow in Wyoming. The app asks questions about the plant to be identified as a filter to narrow your search. The filters include flower color, number of petals, leaf arrangement, habitat, elevation, month of flower and location. You can record a latitude and longitude by selecting the time and place button and turning on your devices GPS. By just turning on your GPS feature or selecting your general area on the map, you may decrease the potential number of plants from 1000s to under a 100.

Answering as many questions as possible will reduce the number of possible species. The more information that you provide, the easier it is to identify your plant. You can then select several links to find more information and descriptions, maps of distribution, and verify your identification. You can also add the plant to your plant list by date. This allows you to keep a cumulative plant database of species identified that you can then reference and export a list via a USB or email to yourself.

I have been impressed with the number of plant species covered; several rare species are included. While this is a great resource, not every Wyoming plant is included, but many are, and you can typically get to the right genera. The app includes not only wildlflowers but also grasses, lichen, moss, cacti, trees and ferns. It is a great digital tool that I highly recommend you download and enjoy.

Groundwater Dependent Plants That Don't Use Groundwater? Understanding Plant Source Water Dynamics in Mountain Fens

By Jason Mercer[1,2], David Millar[3], Kathleen Dwire[4], and David Williams[1]
[1] Dept. of Botany, University of Wyoming, [2] Interdisciplinary Water Resources PhD Program, University of Wyoming, [3] United States Geological Survey, [4] United States Forest Service

Water availability is a key control of plant biodiversity in wetlands (Mitsch and Gosselink, 2007). In mountain fens (a kind of wetland known for high biodiversity) water availability is largely controlled by aquifer dynamics, making groundwater a key control of biodiversity in ecosystems (*sensu*, Kløve *et al.*, 2014). Snowpack, however, is the ultimate source of recharge to many temperate groundwater systems (Hood and Hayashi, 2015; Williams *et al.*, 2016), making changes to snowpack, like those being experienced in the western United States (Mote *et al.*, 2018), particularly worrisome in the context preserving biodiversity under shifting climate conditions.

However, the connection between mountain fen biodiversity and groundwater is predicated on the assumption that plants will use the most abundant water source available to them. This assumption may not be reasonable, as indicated by a growing number of studies in both upland (e.g., Brooks *et al.*, 2010) and wetland (e.g., Saha *et al.*, 2015) ecosystems. That is, there is some suggestion that wetland plants may be more flexible in the water sources they use, (e.g., direct precipitation vs groundwater), suggesting a level of resilience that is not yet well understood.

Stable water isotopes are a useful tool for understanding which sources of water are being used by plants. This is because the isotopic signal of xylem water will generally look similar to the water (e.g., groundwater, rain, snowmelt) taken up at the root-water interface (**Figure 1**). Thus my research uses stable water isotopes to understand source water (i.e., groundwater, surface water, soil water) usage by different plant lifeforms (i.e., graminoid, shrub) in a mountain fen located in the Snowy Range, Wyoming.

Using non-parametric, multivariate tests of central tendency (Hand and Taylor, 1987; McArdle and Anderson, 2001) it was found that both graminoid and shrub waters were different from groundwater, surface water, and soil water ($p < 0.05$; **Figure 2**). (Continued, next page)

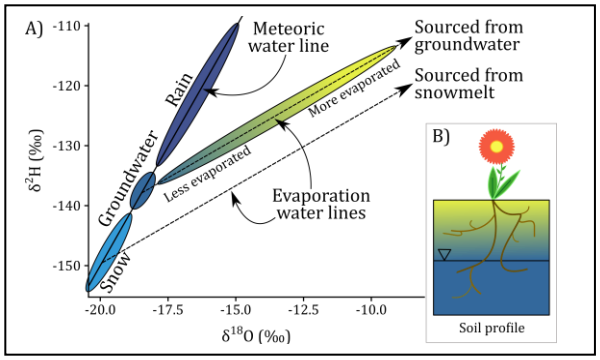


Figure 3. A) A conceptual overview of how to interpret different source waters used by plants, relative to their isotopic values for both oxygen and hydrogen, specific to the study fen. The distributions of snow, groundwater (and surface water), and rain will in reality overlap, but have been simplified here. Groundwater is generally a volume-weighted mix of snow and rain, which is why groundwater lays somewhere between the two precipitation types. B) A hypothetical soil profile indicating the distribution of groundwater (blue), transitioning to more evaporated water associated with drier soils (yellow). Because of these differences in isotopic signal, it is possible to distinguish if wetland plants are using groundwater or soil water. Current understanding indicates that fen plants are using groundwater directly.

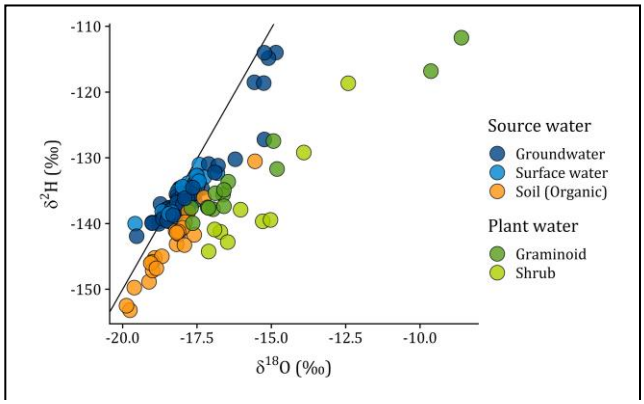


Figure 2. The isotopic values observed for the different source and plant waters. Graminoids include sedge, while common shrubs sampled were willows. These data suggest graminoids and shrubs are not using groundwater directly. Instead, much of the water being used by plants at the study fen appears to be of some yet unknown source, which is largely evaporated.

Graminoid and shrub waters were also significantly different from one another ($p < 0.01$).

These results suggest that fen plants are, generally, not using groundwater directly. Instead, the xylem waters are expressing a degree of evaporation more associated with shallow soil waters (**Figure 1B**). This, then, implies that fen plants may be more flexible in the source waters they are using than is currently appreciated. However, because the actual source water associated with the evaporated isotopic signal was not directly sampled, further work is needed to more adequately sample source waters at the study fen.

The observed isotopic patterns also suggest that while the ultimate source of water for graminoids may be groundwater (which has been evaporated), the same may not be true for all shrubs at SLF. That is, visual back-propagation of the evaporation line for the shrubs is more suggestive of a soil water source. This is curious, because as indicated in **Figure 1**, there is visual overlap between the isotopic values of snow and the observed soil. This may mean that *in situ* snowmelt at the study fen is a more important source of recharge to the soil than groundwater. This kind of hydrological niche partitioning of different plant life forms has not been observed in mountain fens before, and is not well represented in the literature more generally. However, this could mean that shrubs and graminoids may compete more in the future as snowpack volumes reduce with increased temperatures. Thus, future studies focused on understanding the mechanisms generating these patterns could be very valuable in improving our understanding of how mountain plant biodiversity will respond to changes in climate.

(Jason Mercer is a PhD candidate and 2016 recipient of the WYNPS Markow Scholarship.)

Species-Specific Nutrient Limitation Influences Response to Altered Nutrient Availability

By Rebecca Upjohn
Dept. of Ecosystem Science and Management, University of Wyoming

Russian olive (*Elaeagnus angustifolia* L.) is currently listed as a noxious weed in five western states (Wyoming, Washington, Colorado, Montana, and New Mexico), and Connecticut and Wisconsin restrict its transport, sale, distribution, and cultivation. Because Russian olive invasions can substantially increase soil nitrogen (N) availability, the soils within invasion sites may eventually transition to soils that constrain native plant growth because of increasingly limited soil available phosphorus (P) relative to available N. Altered native species performance can result in changes to plant species composition and gradual loss of biodiversity. Consequently, Russian olive invasions in western North America are targets of widespread management and restoration efforts. The removal process typically requires severe site disturbance that can increase erosion and promote secondary exotic invasions, which can make restoration difficult. Unfortunately, restoration of native riparian plants (e.g. *Salix* and *Populus* spp.) may be difficult in places where large-scale flood regimes have been altered. Complete eradication of Russian olive from systems where the plant is the dominant woody species may actually reduce the overall habitat value for wildlife, necessitating the use of native shrubs in any restoration plan.

My field site in the Bighorn basin of northern Wyoming is a perfect storm of these conditions, with altered hydrology, soil nutrient availability, and a high number of secondary invasive species. Given such drastic changes to the ecology of the site, restoration species selection is a complex process, with much of the necessary physiological data missing. The goal of my research is to fill in part of the knowledge gap related to how native shrub species respond to the altered nutrient availability of invaded soils. Despite the tendency of researchers to look at the nutrient limitation at the site level, data from my greenhouse experiment shows that nutrient limitation is ultimately species-specific and even small differences in growth response among species may determine which native species persist, decline, or disappear entirely during Russian olive invasion.

(Continued, next page)

The greenhouse experiment primarily tested the response of several functional traits to varying levels of N and P using three native shrub species: Golden currant (*Ribes aureum*), Silver buffaloberry (*Shepherdia argentea*), and Skunkbush sumac (*Rhus trilobata*). Specifically, I determined nutrient limitation for each species by measuring total biomass, a trait nearly impossible to measure in nature. Among the shrub species tested, N only limited the total biomass of Golden currant ($p < 0.0001$) and Silver buffaloberry ($p < 0.0001$). Therefore, these species should respond well to N enrichment by Russian olive; however, these two species are not nearly as abundant at our invaded field site relative to adjacent areas in the Bighorn basin.

Skunkbush sumac is the dominant shrub species present across the site, invaded and uninvaded areas alike. Interestingly, the experiment revealed that the total biomass of sumac didn't respond the same way due to an interaction between N and P ($p = 0.0204$; Fig.1), potentially indicating co-limitation. When available N was low, total biomass didn't change with increasing P ($p = 0.5588$). But, when available N was high, total biomass increased with higher availability of P ($p = 0.0060$). This suggests that the sumac present at our field site may only be able to utilize the excess N if available P in the soil is sufficiently abundant, meaning the ratio of N:P is more important for understanding how this species responds to altered nutrient availability than concentration of N alone as traditionally expected. Given this result, sumac populations may remain relatively stable and unaffected by nitrogen-fixing invasives, and as such, should be preserved as much as possible during the removal process of Russian olive.

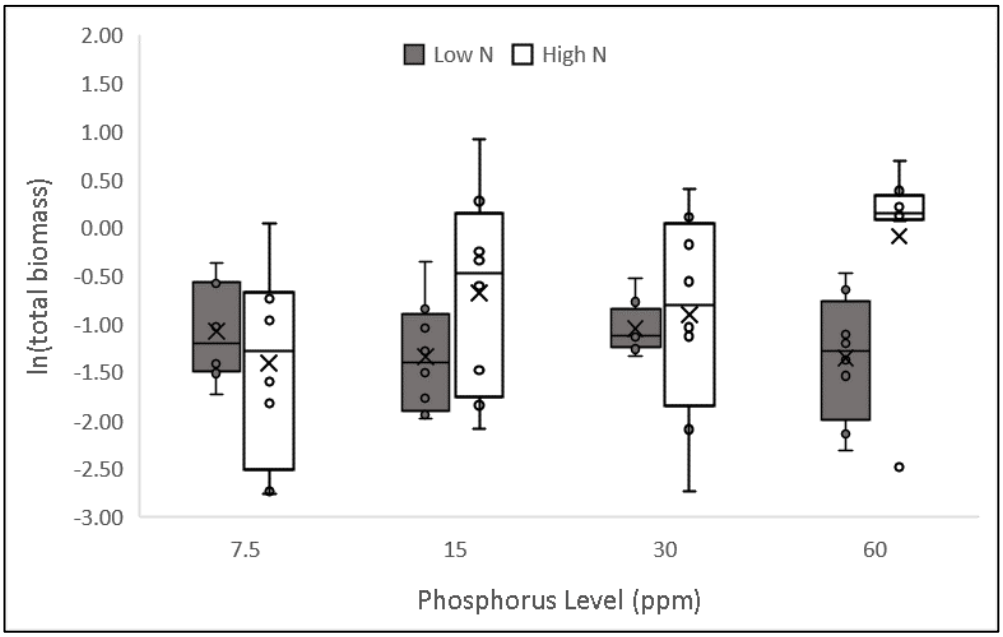


Fig. 1: Response of total biomass for *Rhus trilobata* across four P levels at low and high N availability. Though total biomass generally increased at higher levels of P, only at the highest P treatment does the total biomass differ between N treatments ($p = 0.0011$).

While nutrient limitation alone doesn't fully explain the patterns of abundance observed in the field, it does shed a little light on how changing environmental factors may interact with management practices to force changes in the plant community during the invasion process. For example, one possible explanation for the general absence of Golden currant is that the increased soil available N may have increased the N content of currant leaves, thereby increasing the palatability so, as cow/calf pairs were rotated through the property, the population experienced higher herbivory damage, effectively reducing the population over time. By determining the response of the native shrub species to nutrient gradients, I was able to take a big step forward in knowing how to even approach restoration of such a dramatically-altered field site where the conditions no longer support historical riparian communities. Researching the species-specific differences in nutrient limitation and carefully incorporating ecological tools, such as plant functional traits, will ultimately help restoration ecologists better predict native plant performance under changing conditions and improve the selection of restoration species.

(Rebecca Upjohn is a PhD candidate and 2017 recipient of the WYNPS Markow Scholarship.)

Growing Native Plants

Part 30. Forbs for Moist Sites

By Robert Dorn

Hymenoxys hoopesii, Orange Sneezeweed, is a perennial to 3 feet tall and 2 feet wide. The leaves are narrow, to 12 inches long and 2 inches wide. The flowers are yellow to orange-yellow with the ray flowers reflexed. The flower heads are to 2 inches across with 1 to several at the stem tips. They appear mostly in July and August. The plants occur naturally in moist meadows and open woods in the mountains. They prefer full sun to partial shade and moist, loamy, well drained soils. They are poisonous to livestock. They can be grown from seed sown in fall or spring. Seed is commercially available.

Hymenoxys hoopesii, Gunnison County, CO

Liatris ligulistylis, Meadow Blazingstar, is a perennial to 3 feet tall and 2 feet wide. The leaves are narrow and to 10 inches long. The flowers are purplish-pink. The flower heads are to 3/4 inch long with several scattered along the upper part of the stem. They appear from July to September. The plants occur naturally in moist meadows, open woods, and on slopes in the plains and lower mountains. They prefer full sun to part shade and moist to slightly dry, well drained loamy soils. They can be grown from seed sown outdoors in fall or cold stratify for 60 days for spring sowing. Barely cover with soil. It is in the nursery trade.

Liatris ligulistylis, Pennington County, SD

Penstemon secundiflorus, Sidebells Penstemon, is a perennial to 18 inches tall. The leaves are lanceolate to ovate and to about 3 inches long. The flowers are pink, lavender, or blue, to 1 inch long, and borne on one side of the stem. They appear from May to July. The plants occur naturally on rocky or gravelly sites on the plains and in the lower mountains. They prefer full sun and well drained gravelly soils. They can be grown from seed sown outdoors in fall or cold stratify for 90 days or more for spring planting. Don't expect high germination.

Penstemon secundiflorus, Albany County

Thermopsis montana, Mountain Yellowpea, is a perennial to 3 feet tall and half as wide. It produces rhizomes often forming large patches. The leaves are palmately compound with 3 leaflets and a pair of large stipules that resemble leaflets at the base of each leaf. The leaflets are to 4 inches long. The flowers are yellow, to 1 inch long, and scattered along the upper stem in a narrow spike-like inflorescence above the leaves. They appear from May to August depending on elevation. The plants occur naturally in moist, open to partly shaded areas of the basins and mountains. They prefer full sun to partial shade and moist loamy soils. The plants can be grown from seed that should be scarified before planting. They can also be grown from rootstock divisions. It is in the nursery trade.

Thermopsis montana, Lemhi County, Idaho

Triteleia grandiflora, Largeflower Triteleia, is a perennial from a globose corm and grows to 2 feet tall with one stem per plant. The leaves are strap-like and basal with only 1 or 2 leaves per plant which are to 18 inches long. The flowers are shades of blue with a dark blue nerve running the length of each tepal. They are to 1/2 inch long with 10 or more in a nodding umbel at the tip of the stem. They appear from May to July. The plants occur naturally in moist meadows, open woods, and amongst sagebrush in the valleys and mountains. They prefer full sun to partial shade and cool, moist, loamy soils. They can be grown from the corm but do not dig them from the wild. They should be purchased from a reputable dealer.

Triteleia grandiflora, Gallatin County, MT

To see the plant photographs in color, go to the newsletter on the Society website.

A Century Ago

…What would you call someone who taught botany, zoology, physiology, hygiene, geography, and calisthenics at UW in 1887? A jack-of-all-trades? A renaissance man? The latter seems an apt description, because the man who was one of UW's first five faculty members had expected to teach literature and English. To top it off, a mere century ago, Aven Nelson assumed the position of University of Wyoming President (1918-1922).

From: Judy Knight. Albany County Historical Society blog. https://www.wyoachs.com/new-blog/2018/1/9/a-professor-for-all-seasons-aven-nelson [Downloaded 11 Dec 2018]

Continued from p. 1

To answer our questions about environmental conditions and species richness, we turned to supercomputing. My collaborators developed an ecosystem water balance model for drylands, SOILWAT2, a simulation tool that allows us to estimate how each drop of water moves through an ecosystem (Schlaepfer et al. 2012; Bradford et al. 2014). We use climate averages and site-specific inputs (like soil texture) to calculate where and for how long water moves through our sites. Why is this useful to know? As a water-limited ecosystem, the temporal and spatial distribution of water in the soil profile is the most important component of the water cycle for big sagebrush plant communities. Simulating how wet or dry are the soil profile layers allows us to understand more about a site than just looking at rainfall maps alone. Two sites may receive the same precipitation, but because of soil conditions, one site may be more suitable for retaining moisture and supporting greater plant diversity than another. Those nuanced differences are what we set out to understand with this study, and our findings offer insight to other temperate dry plant communities.

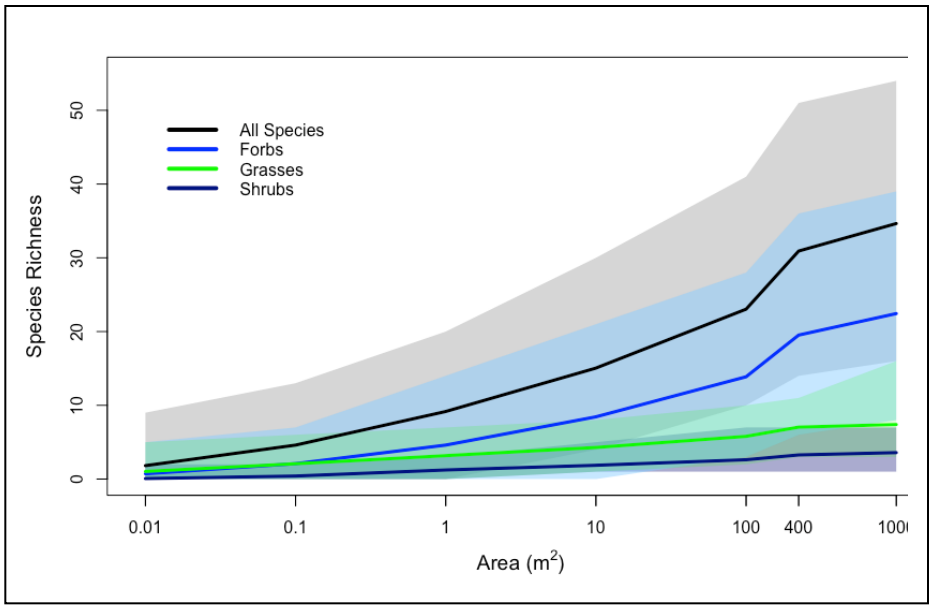


Figure 4. Species richness at each spatial scale (0.01 to 1000 m2). Mean species and functional type richness are presented as a solid lines. Minimum and maximum richness at each spatial scale across all plots are shown as shaded polygons.

With our simulations complete, we were able to see just how closely related soil water conditions were to our field measurements of the plant community. We found that, indeed, understanding soil water offered much more explanatory power than simple precipitation values. Specifically, we found that the number of grass and forb species were closely related to water in shallow soil layers (<30 cm). However, the number of grass species related to shallow moisture during the growing season and the number of forbs related to shallow moisture during the dormant season. Shrubs were more closely related to water availability in deeper soil layers. Between soil water variables and mean annual temperature, we were able to explain about half of the variability in the plant communities that we measured, more than the ~30% of variability we could explain with mean annual precipitation alone. The variability we could not explain could be any number of other influences on those sites: propagule availability, disturbance history, and other site-specific influences that could promote or inhibit the presence of plant species.

What does this all mean for native plant communities in Wyoming? A few things have emerged from this work. For anyone who has spent time in big sagebrush communities during the summer, you might have observed that forbs represent the largest diversity of plants. With our work, we were able to quantify just how numerous and how variable the forb component is at 50 sites in Wyoming. During August in particular, you likely noticed that it can be a severely dry place where only hardy species of plants are able to persist- this study helped connect plant community composition to the water balance at each site. By understanding composition and drivers of plant communities, we can help research efforts to monitor and preserve plant diversity in big sagebrush systems (Davies et al. 2012; Pennington et al. 2016).

(Sam Jordan started his thesis at University of Wyoming, completed it at Yale University after relocating with his advisor, Dr. William Lauenroth, and is currently a PhD candidate at Arizona State University.)

Reference list – see next page

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Wyoming Native Plant Society is a non-profit organization established in 1981 to encourage the appreciation and conservation of the native plants and plant communities of Wyoming. The Society promotes education and research through its newsletter, field trips, annual student scholarship and small grants awards. Membership is open to individuals, families, or organizations. To join or renew, please return this form to:

Wyoming Native Plant Society
P.O. Box 2449
Laramie, WY 82073

Name: _____

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Check one: [ ] New member [ ] Renewing member

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Membership

[ ] WYNPS annual membership: $10.00

[ ] WYNPS annual membership + scholarship support: $20.00 ($10.00 for membership and $10.00 for Scholarship fund)

[ ] WYNPS Lifetime membership: $300 ($150 for membership and $150 for Scholarship fund)

[ ] Sublette Chapter annual membership: $5.00

[ ] Teton Chapter annual membership: $5.00

Total enclosed: _____ THANK YOU!

Wyoming Native Plant Society – Renewal and Ballot

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2019 WYNPS RENEWAL

Name: _____

Address: _____

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Check one: [ ] New member [ ] Renewing member
[ ] Check here if this is an address change.
[ ] Check here if you prefer to receive the newsletter electronically.

Payment:
[ ] WYNPS annual membership: $10; or
[ ] WYNPS annual membership with scholarship support: $20 ($10 for membership and $10 for Scholarship fund)
[ ] WYNPS Lifetime membership: $300 ($150 for membership and $150 for Scholarship fund)

In addition to the statewide organization, we have two chapters. Membership in chapters is optional; chapter members must also be members of the statewide organization.

2019 WYNPS BALLOT – Please mail for arrival **by January 31** or email wynps@wynps.org

Please vote for one person for each Officer position, and for the At-Large positions:

President ____ Katy Duffy (Jackson) Secretary/Treas. ____ Dorothy Tuthill (Laramie)
Vice President ____ Lynn Stewart (Dubois) At-Large (2-year term) ____ Katie Haynes (Laramie)
At-Large (1-year vacancy) ____ Paige Wolken (Cheyenne)

Write-in candidate and office: _____

[We are filling BOTH At-Large positions this year. **Thank you** to Katy Duffy, Lynn Stewart and Dorothy Tuthill for running again! We appreciate all the time and effort.]

Candidate Biographies

Katie Haynes is Botanist for the USDA Forest Service on the Medicine Bow – Routt National Forests and Thunder Basin National Grassland in Laramie, WY, involved with the ongoing effort to conserve rare plants and their habitats. Her passion for native plants dates back to age 13 and a summer spent inventorying the flora of a county open space in her hometown, forever sealing her fate as a lover of plants and the natural world. She obtained her MS at Colorado State University. Katie and family are dog-people. She is also a greenhouse gardener, and roller skater extraordinaire, and honored to have the opportunity to expand her role in Wyoming Native Plant Society.

Paige Wolken is the State Botanist in Bureau of Land Management Wyoming Office leading Plant Conservation and Restoration. Her career in plant ecology and botany spans the Great Plains and Rocky Mountain West, most recently working for the U.S. Army Corps of Engineers in Cheyenne, and earlier for the National Park Service, U.S. Fish and Wildlife Service, U.S. Forest Service and for an environmental consulting company. She obtained her MS at the University of Wyoming. Paige and family live in Cheyenne along with their cat, *Calamovilfa.*

Katy Duffy worked as resources education ranger in Grand Teton and Yellowstone National Parks, was an early champion of the Teton Plants Chapter, and most recently held an At-Large position before running for President.

Lynn Stewart has a degree in Outdoor Recreation and Wildlife Biology. He helped organize our successful annual meeting in Dubois, and held an At-Large position before running for Vice-President.

Wyoming Native Plant Society

2019 MARKOW SCHOLARSHIP/SMALL GRANT

Applications are due February 15, 2019. Awards will be made in April, 2019.

Electronic copies of this application are also posted on the WYNPS homepage at: www.wynps.org

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The Wyoming Native Plant Society promotes appreciation, understanding and conservation of native plants and plant communities through its annual scholarship/small grants program. For scholarships, thesis research may address any aspect of botany including floristics, taxonomy, ecology, genetics, plant geography, range science, paleontology, pollination biology, physiology, and mycology. For small grants, projects such as botany curriculum development, public native plant gardens, and other forms of outreach will be considered. **This competition is open to all grad students who conduct research in Wyoming, residents of Wyoming or members of WYNPS.**

Proposals must pertain to native plants/vegetation of Wyoming. Preference will be given to proposals expected to generate research data or promote public understanding. Up to $1,000 may be covered for a scholarship proposal, and up to $500 for a small grant proposal. *Awards defray direct project costs, excluding labor or conferences*. Eligible expenses include:

1. Direct costs of travel, meals, and lodging for research or education projects.
2. Supply and service expenses used for the sole purpose of the project (e.g., consumable supplies such as laboratory chemicals, soil and nursery stock, and services such as phone and computer time).

The deadline for proposals is February 15. Awards will be announced in April. The proposal should be no longer than three pages and include the following:

- Name, mailing address, telephone number (land &/or cell as appropriate) and email address of the applicant.
- Name, mailing address, contact person's name & phone number for any organization that will be directly involved with the applicant when executing the proposal.
- Short abstract of the study or project (2-5 sentences).
- Description of the study or project: objectives, methods, description of final product, and short description of past similar work (if applicable). Garden proposals should include plant lists, an educational component, and explicitly address long-term maintenance plans.
- Description of how the study or project will benefit native plants or plant conservation in Wyoming.
- Overall budget showing amount requested from WYNPS ($1,000 or less), the intended purpose of the funding, and other funding sources.
- Timeline for completion of the major components of the study or project.
- Brief statement of applicant's qualifications or biography.
- Name, address, email address or phone number of two people as references.

Successful scholarship or grant recipients will be required to submit a final report (due no later than February 15, 2020) documenting the study or project accomplishments to WYNPS, written for a broad audience and suitable for publication in our *Castilleja* newsletter. **Please send completed applications to:** Wyoming Native Plant Society, P.O. Box 2449, Laramie, WY 82073; or wynps@wynps.org .