*Castilleja linariifolia*


# *Castilleja*

**Publication of the Wyoming Native Plant Society**

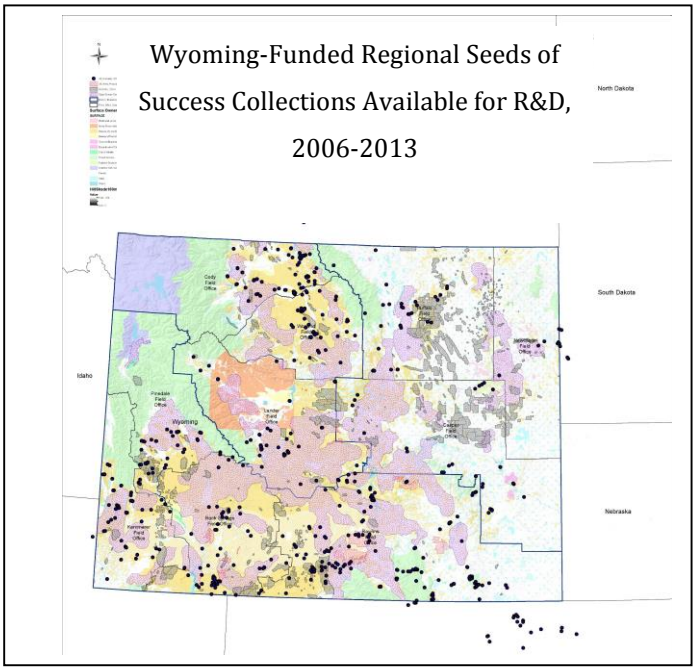
May 2014, Volume 33(2)

Posted at www.wynps.org


## SOS: A Signal of Reclamation Progress

Wyoming Bureau of Land Management has amassed over 350 native plant species in eight years of running the Seeds of Success (SOS) program full throttle (Figure 1). Many of the seeds collected this year will be used in Native Plant Materials Development research projects including evaluation of Greater Sage-Grouse habitat forbs for commercial production, assessment of genetic exchange between cultivars and local genotypes, and comparison of range-wide responses to climate change conditions. Seed will also be put into long-term storage for conservation as well as for use in restoration and reclamation seed trials.

*Buchloe dactyloides* (Buffalograss) is now among SOS collections in Wyoming. From: USDA-NRCS PLANTS Database / Hitchcock, A.S. (rev. A. Chase). 1950. Manual of the grasses of the United States. USDA Miscellaneous Publication No. 200. Washington, DC.




Above: SOS collecting stations among BLM field offices, 2006-2013

Further information on the SOS Program is posted by the BLM (http://seedsofsuccess.smugmug.com/ ; http://www.blm.gov/wy/st/en/programs/pcp.html)

In this issue:



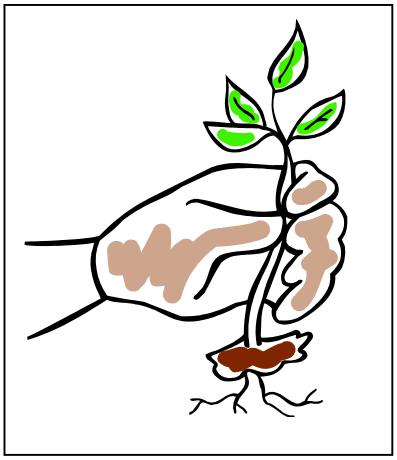
## Weed Invasion Patterns in Southwestern Wyoming: Weeding Fiction From Fact

How do energy developments and related surface-disturbing activities affect weed invasion of natural vegetation? Generalizations abound, though most studies on the spread of non-natives have addressed the matter for no more than one weed species at a time in a limited study area. This spring, a new publication presented a regional perspective across the sagebrush steppe of five southwestern Wyoming counties.

Relationships between the distribution of invasive plants and human activities were teased out, factoring in for distance from such activities, and independent environmental variables (Manier et al. 2014). Sixty paired transects of 1 km length were placed across five southwestern counties relative to seven invasive plant species, and 11 known activities or absence of such (*Continued*, p. 3).

## WYNPS News

2014 Scholarship and Grant Winners: The 2014 Markow award winners are Elizabeth Pansing (University of Colorado, Denver), graduate student, for her project examining the role of microsite type and rodent seed theft in Whitebark Pine regeneration; and the Sage and Snow Garden Club in Pinedale to purchase native plants for their water-wise demonstration garden. They were awarded $600 and $800, respectively. Thanks to everyone who applied…and all who make it possible.



2014 Annual Meeting: Register now for the 2014 Annual Meeting, **June 20-22** in Lander. Join a hike to Popo Agie Falls on Friday eve, longest day of the year; botanize like crazy at Red Canyon Ranch and join the Bioblitz series featuring birds, bats, butterflies, fish, frogs, small mammals and *plants*! An evening catered dinner will be followed by an expert bee biologist talking about wild bees of Wyoming wildflowers. Then on Sunday, explore the new Desert Yellowhead population on the Beaver Rim and flowering cohorts. Register now, by mail, or by credit card using PayPal. - reservations for the Annual Meeting dinner are due by June 7 ($20 per adult; $10 for kids age 12 and younger). OR you can bring your own dinner. All events are open to the public. See the annual meeting insert (this issue) for more details.

More 2014 Field Trips: See this issue for a few new field trips around the state. Also: see the Teton Chapter homepage for hike events! (http://tetonplants.wordpress.com/)

Treasurer's Report: Balance as of 17 April 2014: Scholarship = $773; General = $5,914; Total = $6,687.

The Next Deadline: Please send articles and announcements for the October issue by 18 September. Ideas are welcome any time!

New Members: Please welcome the following new members to WYNPS: Janet Bala, Pocatello, ID; Beverly Halm-Levin, Jackson; Linda Johnson, Salt Lake City, UT; Lillian McMath, Los Gatos, CA; Jayne Peeters, Big Horn; Meredith Taylor, Dubois; Jill Welborn, Wheatland.

---

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

---



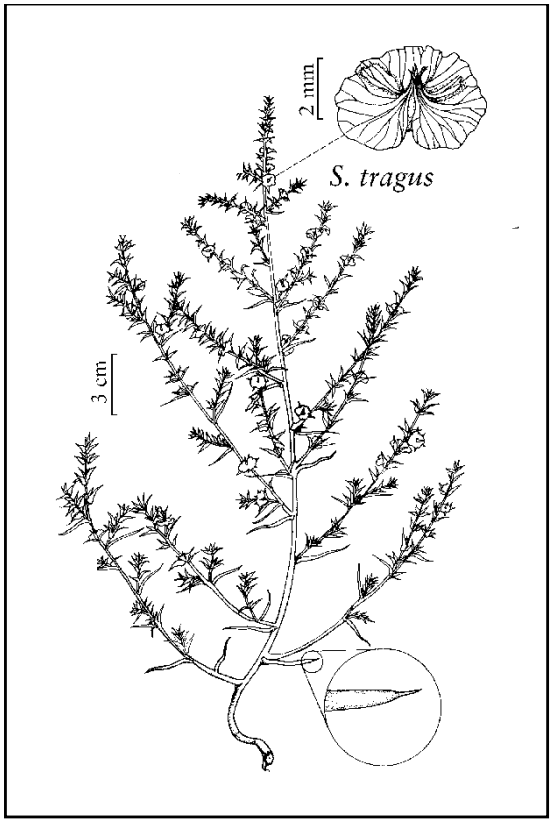
### CHAPTER CORNER

The next Teton Chapter program is: Tuesday, May 27, when nationally acclaimed botanists Drs. Noel and Patricia Holmgren will present their work on the multi-volume, definitive Intermountain Flora. For more information, see: http://tetonplants.wordpress.com/ .

Contributors to this Issue: Ann Boelter, Robert Dorn, Bonnie Heidel, Olivia Nater, and Dorothy Tuthill.

Weeding Out Fiction From Fact (cont. from p. 1)

- Major highway
- Primary road (paved or gravel)
- Secondary road (gravel)
- Tertiary road (gravel)
- Reclaimed tertiary road
- Unofficial road (two-track)
- Railroad
- Oil and gas pipeline (buried)
- Overhead power lines
- Oil and gas well pad
- Reclaimed well pad




Above: Russian thistle (*Salsola tragus*), a widespread non-native plant of sagebrush steppe, from: Mosyakin, S.L. *Salsola*, In: Flora of North America Editorial Committee, eds. 2003. *Flora of North America North of Mexico*. 16+ vols. New York and Oxford. Vol. 4, pp. 398-403.

---

*How was Russian thistle introduced to North America?* It was probably introduced accidentally in flaxseed imported from Russia.

While many strong direct relationships were documented between weed frequency and distance from disturbance, one of the more surprising results reported by the authors was that a subset of weed species have frequencies independent of distance to surface-disturbing activities, including alyssum (*Alyssum desertorum*), halogeton (*Halogeton glomeratum*) and Russian thistle (*Salsola tragus*). Another surprise was the disturbance having highest cumulative numbers of different invasive weeds was not associated with the activity that disturbed the biggest blocks of surface area. Instead, it was associated with the unofficial roads (two-tracks) that might look as though they have little development.

The reader is referred to the original publication, its links to raw data, and discussion of management implications for further information.

Reference

Manier, D.J., C.L. Aldridge, M. O'Donnell, and S.J. Schell. 2014. Human infrastructure and invasive plant occurrence across rangelands of southwestern Wyoming, USA. Rangeland Ecology and Management 67: 160-172.

Plant Hikes in Collaboration with Meteetsee Museums

An exciting weekend of botanical tours are offered by Meteetsee Museums, in collaboration with agencies and Wyoming Botanical Society. The Sub-Alpine Botanical Tour is set for Saturday, June 28, to the Dick Creek Lake area near Meeteetse. It will be led by Michael Kirkpatrick. The High Desert Botanical Tour is set for Sunday, June 29, lead by Earl Jensen to the Bobcat Draw area (between Worland and Meeteetse). In case of bad weather or very poor road conditions, the latter would be held near the Legend Rock area. Both tours will leave the Meeteetse Museums at 9 a.m. and begin on site around 10:30 am. For more information, and to confirm dates, contact: http://meeteetsemuseums.org/calendar.html .

Free and open to the public!

## How will climate change affect native plant-bee mutualisms?

By Olivia Nater

Climate change can differentially shift phenology (the timing of biological events, e.g. flowering and insect emergence) of plants and their pollinators, potentially resulting in "plant-pollinator mismatch" (Memmott et al. 2007). Loss of synchrony between timing of flowering and pollinator activity causes the degradation of plant-pollinator network structure and is a likely cause of recent extirpations of native bee species (Burkle et al. 2013). My study, partly funded by the Wyoming Native Plant Society, aimed to elucidate how local plants and their pollinators respond to temperature rise and how this will affect pollination services. In 1975 and 1976, a UW graduate student conducted a weekly floral census at a site ~25 miles south of Laramie, WY. I repeated this census over three growing seasons (2011-2013), to investigate how flowering phenology (timing of flowering) has responded to local increases in winter temperatures over the last 40 years (Fig. 1).

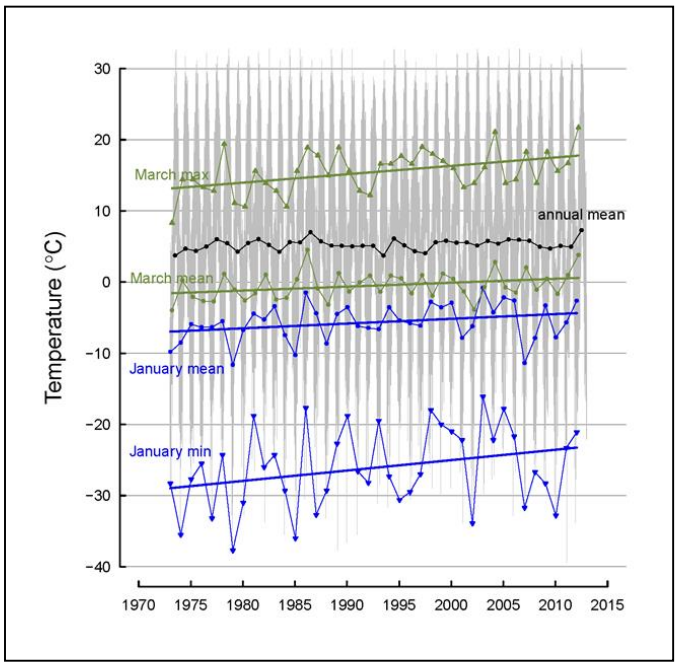



Figure 1 (above). Winter temperatures recorded by the Laramie airport weather station are now 2-6 °C warmer than in 1973. Hourly temperature measurements from 1973 to 2012 are shown in gray in the background, with (unchanged) annual mean (black points and line) and significantly changed monthly temperatures (blue: January, gray-green: March) overlaid. Circles indicate mean temperatures and upward and downward pointing triangles indicate temperature maximums and minimums, respectively.

Figure 2 (right): Counting plants in a heated plot.




Figure 3a (above). Flowering phenology of 14 plant species in heated (red) and control (black) plots. Vertical dashed lines mark the beginning and end of the floral census period. The timing of peak bloom is indicated by triangles.

In 2013, I also exposed plants and bees to experimental warming at the same site to determine the potential for climate-driven plant-pollinator mismatch. In early May 2013, I set up open-top polycarbonate warming chambers at one of my field sites and monitored plant flowering phenologies in both heated and control plots over the course of the growing season (Fig. 2). Additionally, I placed cocoons of two native mason bee species, *Osmia aglaia* and *Osmia californica*, into the same plots and recorded bee emergence daily. I was unable to detect a difference in bee emergence between heated and control plots because bees began emerging in large numbers from both treatments as soon as they were set out, due to the late start of the experiment. Plants, however, responded more slowly, and I observed high response diversity, whereby some species flowered earlier in heated plots, some phenologies were unaffected, and some even appeared to be delayed by warming (Fig. 3a).

I compared my entire plant phenology dataset (2011-2013) to the historical dataset (1975-1976, Tepedino and Stanton 1980) from the same site, and found significant advances in all 14 species under study (Fig. 3b). First bloom occurred on average 12.0

days earlier during 2011-2013 than during 1975-1976; a much greater and more consistent shift than what I found with experimental warming. Artificial warming experiments tend to underpredict actual

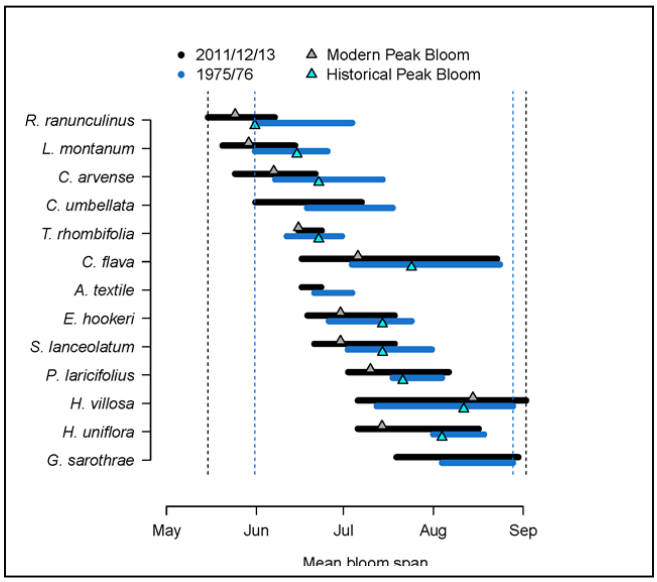



Figure 3b (above). Flowering phenology of 13 plant species from historical (1975 and 1976, blue) and modern (2011, 2012, and 2013, black) censuses. Dashed lines mark the mean beginning and end of the historical (blue) and modern (black) sampling periods and triangles indicate times of peak bloom. All phenologies were significantly advanced in recent relative to earlier censuses.

advances in the timing of flowering (Wolkovich et al. 2012). If I had begun heating plants earlier in the year to match observed increases in winter temperatures over the past 40 years (Fig. 1), I would have likely recorded a stronger phenological response. Based on thermal time models, first emergence of native bees has advanced by an average of 8.0 days (Nater, in prep.), which indicates that bees and plants may be responding differently to climate change. Unlike many insect phenologies, plant phenologies also rely strongly on other cues such as photoperiodicity (King and Heide 2009) and timing of snowmelt (Saavedra et al. 2003, Inouye 2008), which may cause this discrepancy between plant and insect responses to temperature rise.

To examine how pollinator limitation might affect plant reproductive fitness, I excluded pollinators from flowers of three species and compared seed set of open and bagged flowers. Pollinator limitation is harmful to the fitness of green gentian (*Frasera speciosa*), textile onion (*Allium textile*) and prairie thermopsis (*Thermopsis rhombifolia*), as both number and weight of seeds produced from flowers covered with nylon mesh bags were significantly reduced compared to the seed set of open flowers that had access to insects. *F. speciosa* was able to set seed without insect pollinators, but seed number and mean seed weight were much lower in bagged pods. Whereas bagged A. textile and *T. rhombifolia* flowers did produce fruits, these were small and shriveled and did not contain any developed seeds. These plants are therefore unlikely to be able to successfully reproduce without the help of pollinators.

In conclusion, the future viability of bee and plant species under climate change will depend on their degree of specialization and their ability to adapt to changing environments. Strictly codependent species are at much greater risk of extinction than generalist species (Memmott et al. 2007, Burkle et al. 2013). As different native bee species vary in the timing of their activity periods (Bartomeus et al. 2013) and in their phenological and physiological responses to warming (Fründ et al. 2013), high species diversity can ensure plant-pollinator synchrony and will provide pollination services with some protection from environmental change. Therefore, it is of utmost importance to increase efforts to conserve biodiversity of native plants and their pollinators.

References

Bartomeus, I., M. G. Park, J. Gibbs, B. N. Danforth, A. N. Lakso, and R. Winfree. 2013. Biodiversity ensures plant–pollinator phenological synchrony against climate change. Ecology Letters 16:1331–1338.

Burkle, L. A., J. C. Marlin, and T. M. Knight. 2013. Plant-Pollinator Interactions over 120 Years: Loss of Species, Co-Occurrence, and Function. Science 339:1611–1615.

Fründ, J., S. L. Zieger, and T. Tscharntke. 2013. Response diversity of wild bees to overwintering temperatures. Oecologia 173:1639–1648.

Inouye, D. W. 2008. Effects of climate change on phenology, frost damage, and floral abundance of montane wildflowers. Ecology 89:353–362.

King, R., and O. Heide. 2009. Seasonal flowering and evolution: the heritage from Charles Darwin. Functional Plant Biology 36:1027–1036.

Memmott, J., P. G. Craze, N. M. Waser, and M. V. Price. 2007. Global warming and the disruption of plant-pollinator interactions. Ecology Letters 10:710–717.

Saavedra, F., D. W. Inouye, M. V. Price, and J. Harte. 2003. Changes in flowering and abundance of *Delphinium nuttallianum* (Ranunculaceae) in response to a subalpine climate warming experiment. Global Change Biology 9:885–894.

Tepedino, V., and N. Stanton. 1980. Spatiotemporal variation in phenology and abundance of floral resources on shortgrass prairie. Western North American Naturalist 40:197–215.

Wolkovich, E. M., B. I. Cook, J. M. Allen, T. M. Crimmins, J. L. Betancourt, S. E. Travers, S. Pau, J. Regetz, T. J. Davies, N. J. B. Kraft, T. R. Ault, K. Bolmgren, S. J. Mazer, G. J. McCabe, B. J. McGill, C. Parmesan, N. Salamin, M. D. Schwartz, and E. E. Cleland. 2012. Warming experiments underpredict plant phenological responses to climate change. Nature 485:494–497.

Growing Native Plants

**Part 12. Perennial Grasses**

By Robert Dorn

Grasses can be classified as either cool season or warm season. Cool season grasses start growth in early spring and mature in late spring or early summer. Warm season grasses start growth in late spring or early summer and mature in late summer. Grasses are used mostly as specimen plants, accents, or for native lawns. Advantages of native grass lawns are that they need less water and less mowing. A disadvantage is that our best natives are warm season grasses so they do not green up as early in the spring as non-native lawn grasses. The following five examples include three accent grasses and two native lawn grasses. Only one, *Elymus*, is a cool season grass.

*Andropogon gerardii,* Big Bluestem, grows to 6 feet tall and 18 inches wide. The leaves turn reddish or russet in the fall. The inflorescence is a series of 3 to 6 narrow, elongate spikes each to 4 inches long and appearing from July to September. The plants occur on the plains along the eastern edge of Wyoming, especially in moist depressions. They prefer full sun and well drained loamy soils and are drought tolerant. It can be grown from seed and is also in the nursery trade.

*Andropogon gerardii*, Crook County

*Bouteloua gracilis*, Blue Grama, is popular for native grass lawns. It is rhizomatous but often densely tufted also. The flowering stems grow to 1 or rarely 2 feet tall. When not in flower, the plants are generally only 3 or 4 inches tall. The inflorescence is a comb-like spike to 2 inches long, often nodding, 1 to 3 at the tip of each slender stem, appearing from July to September. The plants occur naturally in dry, open areas of the plains, basins, and foothills. They prefer full sun and dry, well drained soils including sandy and alkaline soils. It does best below 7500 feet. It needs about 1 inch per month of moisture. It is drought tolerant becoming dormant and brown until moisture returns. Mow as infrequently as possible to maintain vigor. Seed for several cultivars is available commercially. Cultivar 'Hachita' sometimes recommended for our area was selected from New Mexico. A better choice might be the Bad River ecotype from South Dakota or seed gathered from within or adjacent to Wyoming. Surface sow in mid to late spring. Lightly cover with soil to provide some protection against rodents and birds. For lawns use about 0.5 to 1 pound of pure live seed (PLS) for 1000 square feet for a thick initial stand. Custom harvested seed is usually not pure so more may be needed. Water regularly until well established and control weeds. Plant plugs are also available.

*Bouteloua gracilis*, Goshen County

*Buchloe dactyloides*, Buffalograss, is another popular grass for native grass lawns. It is usually a better choice for lower elevations. It spreads by stolons forming dense mats and grows to 4 or rarely 8 inches tall. The male inflorescence is a short spike to ½ inch long, 2 spikes per stem. The female inflorescence is a bur-like cluster of 2 or 3 flowers mostly hidden by the curly vegetative leaves. The flowers appear from May to July or August. The plants occur naturally in moist areas on the plains. They do not do well above about 6500 feet elevation. They prefer full sun or light shade and moist (about 15 inches moisture annually or more), loamy or clayey

soils. The plants are not salt tolerant and not as drought tolerant as Blue Grama. Mow infrequently. Seed is commercially available as are plant plugs and sometimes sod. Water and control weeds until well established. For lawns, use 1 pound of pure live seed (PLS) per 400 square feet. Cultivars may be mostly female plants. Get seed or plants adapted to our latitude. Research the possibilities on the internet, especially information from Wyoming seed companies.

*Buchloe dactyloides*, Fall River County, SD

*Elymus cinereus*, Basin Wildrye, is a cool season bunchgrass that grows to 6 feet tall and forms large clumps to 3 feet across. The leaves turn tan in winter. The inflorescence is a narrow spike to 8 inches long at the stem tips appearing in June and July. The plants occur naturally in open areas, especially in gullies and other temporary drainageways that receive extra moisture, in the basins, valleys, and plains. They prefer full sun and dry to moist, loamy, well drained soils and are drought tolerant once established. Seed is commercially available. It can also be grown by rootstock division.

*Elymus cinereus*, Carbon County

*Schizachyrium scoparium*, Little Bluestem, is a bunchgrass with short rhizomes and grows to 2 or 3 feet tall. In winter the plants are various shades of reddish-brown, rust, or mahogany (see the Society website for photo in color). The inflorescence is a series of narrow, elongate racemes to 2 inches long on the upper part of the stems appearing from July to September. The plants occur naturally on dry, open hills in the foothills, valleys, basins, and plains, often where gravelly. They prefer full sun and dry, well drained soils and are drought tolerant. It does not tolerate mowing or clipping more than once a year. There are several cultivars in the nursery trade. It can be grown from seed or rootstock division.

*Schizachyrium scoparium*, Goshen County

Announcing:

*Plants With Altitude*, a guide to hardy, water-wise, beautiful and accessible wildflowers and shrubs native to Wyoming or adjoining states was released this spring. It is by Amy A. Fluet, Jennifer S. Thompson, Dorothy E. Tuthill, and Brenna R. Marsicek.

It is a paperback book with color photos and spiral binding, 66 pp., now available for $5 including tax; or $8 with shipping, from: UW Berry Center, Rm 231; University Bookstore; or online at wyomingnativegardens.org. Also available through some conservation districts.

## Wyoming Wildflower App

Smart phone apps are becoming flora-savvy! Flora ID Northwest has recently published a new Android app for Wyoming Wildflowers on the Google Play Store. They are pleased to make this available in a "field friendly format" that is the culmination of nearly 20 years producing interactive plant keys. The app is titled "1850 Wyoming Wildflowers." It is much more comprehensive than the usual wildflower book or app, with many more species, over 5,700 photos, and sophisticated interactive keys with all the functionality of the keys in our PC programs. The app includes 93% of all the native and naturalized, non-grasslike flowering species in Wyoming. Species can be sorted by either common or scientific names, with synonyms listed in descriptions.

For more details, see their web site, www.flora-id-northwest.com or the web page on Google Play Store (https://play.google.com/store/search?q=%22flora%20id%20northwest%22&c=apps ). The Google link will give you access to Wyoming and the other 27 apps available, covering 18 western and central states and 4 Canadian provinces. The apps will run in Android cell phones and 7- or 10-inch tablets with Android versions 3.0 or higher. Kindle Fire users should be able to get the apps from Amazon by late June.

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

**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: _____

Address: _____

_____

Email : _____

Check one: [ ] New member [ ] Renewing member

[ ] Renewing members, check here if this is an address change.

[ ] Check here if you prefer to receive the newsletter electronically

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!