Castilleja linariifolia

Castilleja

Publication of the Wyoming Native Plant Society

May 2013, Volume 32(2)

Posted at www.wynps.org

In this issue:

All Plants Great and Small

By Bonnie Heidel

The dwarf stature of alpine plants shows classic economy-of-size in the Plant Kingdom, an efficient use of energy over a short growing season under harsh conditions (Bliss 1956). Many alpine plants have a "savings plan" that sequesters the bulk of biomass out-of-sight, e.g., with 47-75% of living biomass belowground in alpine plants of the Medicine Bow Range, WY (Scott and Billings 1964). Strangest of all is the life of the alpine annual, Koenigia (*Koenigia islandica*; in the Buckwheat Family) which has no other savings than its seed, and rushes from germination to seed production in a fast-paced growing season.

Koenigia is distributed from arctic latitudes to alpine summits and was first described in 1753 from Iceland by Linnaeus, named in honor of one of his students. The species' epithet (islandica) refers to Iceland. It has circumboreal distribution and far-flung outliers in Tierra del Fuego, Argentina. In 1913, a mere century ago, the first collection of Koenigia from the American Rocky Mountains was made in central Colorado by the International Phytogeographical Excursion. It was promptly pickled in alcohol, sent off to Copenhagen, and not recognized as a North American range extension until decades later by which time it had been re-discovered in Colorado (Weber and Wittmann 2012). The first Wyoming collection was made in 1959 in the Beartooth Mountains (Johnson 1962), and its distribution expanded many times since, as recently as last year (Elliott 2012). It is now known from 40 discrete places in 15 sections of the Beartooths in Wyoming, though some sites are smaller than a desk. Elsewhere, in northern British Columbia, it was known from a handful of northern alpine collections until concerted studies over the past decade (Hebda and Marr 2012). The authors hypothesize that Koenigia and its frequent associate, Icegrass (*Phippsia algida*), may be indicators of high elevation late-Pleistocene refugia of western North America (Marr et al. 2012).

In the Beartooth Mountains, Koenigia grows on saturated sands, moss mats and organic soil fed by snowmelt (Johnson 1962). These settings are in alpine bogs, lake margins, and wet gravelly soil along alpine rivulets (Evert 2010). The Beartooths hardly seem like a safe-haven for long-term survival during glaciation, but not all alpine elevations were once buried in year-long snow and ice. (Cont. on p. 11)

Oeder's lousewort *(Pedicularis oederi*) is a bright beacon of the Beartooth Plateau, at its southernmost extent on the continent. By B. Heidel. Read more about it in "Only in the Beartooths" – p. 6.

WYNPS News

THE BEARTOOTHS BECKON: The 33rd annual meeting of Wyoming Native Plant is July 26-28 in the Beartooth Mountains. Please register for your preference of Beartooth hikes and dinner menu options – complete hiking and camping information is in this issue, and has been posted on-line. Bring your friends and family – the event is open to the public. Three of the hike destinations have checklists, a Beartooth geology map is available, and this set of information is posted at the WYNPS homepage for you. An excellent dinner menu and evening program at Hunter Peak Ranch cap off the main day of hikes on Saturday, July 27. Lodging is still available at the Hunter Peak Ranch if you are not camping [(307) 587-3711 or http://www.hunterpeakranch.com/)]. Please return the enclosed reservation form by **24 June** – thanks!!

Chapter News: Chapters are doing what chapters do best - look for an exciting slate of state plant hikes coming to you in a separate mailing and posting.

Wyoming Native Plant Society
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WYNPS Board – 2013

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Treasurer's Report: Balance as of 24 April 2013: Scholarship = $985.50; General = $5,105.68; Total = $6,091.18.

Contributors to this Issue: Ann Boelter, Cathy Cripps, Robert Dorn, Bonnie Heidel, Yelena Kosovich, Dorothy Tuthill.

New Members: Please welcome the following new members to WYNPS: Firewise Landscapes, Inc., Jackson; Jane Gallie, Kelly; Sarah Sturges, Moose; Dana Tully, Pinedale.

Message from the President

I imagine everyone reading this is as eager as I am to begin the new plant appreciation season, and would like to see some warmer weather. Yes, the moisture is needed, but it would be OK with me if it came as rain rather snow at this time of year. However, I have seen my first wildflowers (a buttercup), and gotten my first tick—so spring must be on the way!

Congratulations to the 2013 Markow Scholarship/Small Grant award winners—Olivia Nater and Yelena Kosovich. The Society received a number of excellent proposals this year, ranging from wildflower gardens to educational kits to ecological and phylogenic research, and it was no easy task to choose the "best." Olivia, a graduate student in the University of Wyoming Department of Zoology and Physiology, will be examining the effect of climate change on the intimate relationship between native plants and their pollinators. Specifically, she will be addressing the questions "Does warming create plant-pollinator mismatch?" and "Do native plants suffer from pollinator limitation?" Yelena is a free-lance bryologist, who will be developing a bryophyte inventory for the Medicine Bow National Forest, including rare species. We wish them well, and look forward to hearing more about their projects.

Best wishes, as well, for the projects that we were unable to fund. Several were worthy, but our funds are limited. Please consider making a donation to the Scholarship Fund, so that we can continue to offer—and expand—awards to support research and education about Wyoming's native plants.

Last and certainly not least, please register soon for the 2013 annual meeting! Details can be found in this newsletter. You won't want to miss it!!

Dorothy

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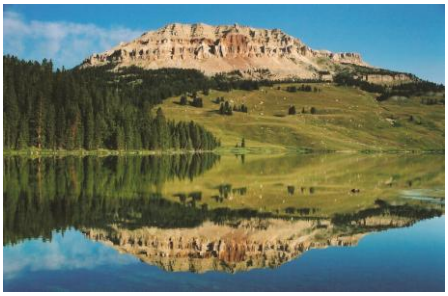
Webmaster: Melanie Arnett (arnett@uwyo.edu)
Sublette Chapter: Karen Clause, President; Julie Kraft, Treasurer
Teton Chapter: Amy Taylor, Treasurer
Bighorn Native Plant Society: P.O. Box 21, Big Horn, WY 82833 (Jean Daly, Treasurer)

2013 WYNPS ANNUAL MEETING SCHEDULE



Right:
Beartooth Butte,
Beartooth Lake

Friday July 26th –LILY LAKE CAMPGROUND HIKE AND CAMPFIRE

7 pm – 8 pm. Lily Lake hike. Walk to the lake and a nearby fen. Bring boots.
8 pm or so – Campfire!

Saturday July 27th – TWO HALF-DAY FIELDTRIPS or ONE-DAY FIELDTRIP SERIES

9 am – 5 pm
(Bring your lunch, bug spray, bear spray, water, rain gear and rubber boots or waterproof footwear)
Half-day hikes – meet @ 9 am at parking lot on top of Clay Butte (Clay Butte Lookout)
BEARTOOTH BUTTE half-day hike – Visit the potential Beartooth Butte Research Natural Area in a stunning alpine setting, and Whitlowwort Wonder of Wyoming. Leader: Walt Fertig.
SWAMP LAKE half-day hike – Visit the highest concentration of rare wetland plants in Wyoming, including red manzanita, a plant of the far north found nowhere else in the conterminous United States except at Swamp Lake Special Botanical Area. Leader: Walt Fertig.
Full-day hike series – meet at 9 am at Top of the World Store (located on the Beartooth Hwy between Bear Lake and Island Lake Campgrounds)
ALPINE EXPLORATION IN LINE CREEK AREA - one-day field trip as a series of hikes – Examine all-things-alpine, from mosses and fungi, to permafrost and rock polygons among a blaze of flowering plants, including those that reach Wyoming only in the Beartooths. Leaders: Phil Robertson (S. Illinois University, ret.), Cathy Cripps (Montana State University), Elena Kosovich (independent researcher), Bonnie Heidel (WYNDD), Jennifer Lyman (Rocky Mountain College).

Saturday evening – HUNTER PEAK RANCH

5:30 pm Social Hour
6:30-7:30 Dinner
7:30-8:30 Evening Program
- Geology of the Beartooths, by Ken Pierce (USGS, ret.)
-Plants and Volcanoes of Yellowstone – It's a Blast!, by Jennifer Whipple (NPS, ret.)

Sunday morning July 28th – HUNTER PEAK RANCH

8:00 am WYNPS annual meeting – the coffee's on!

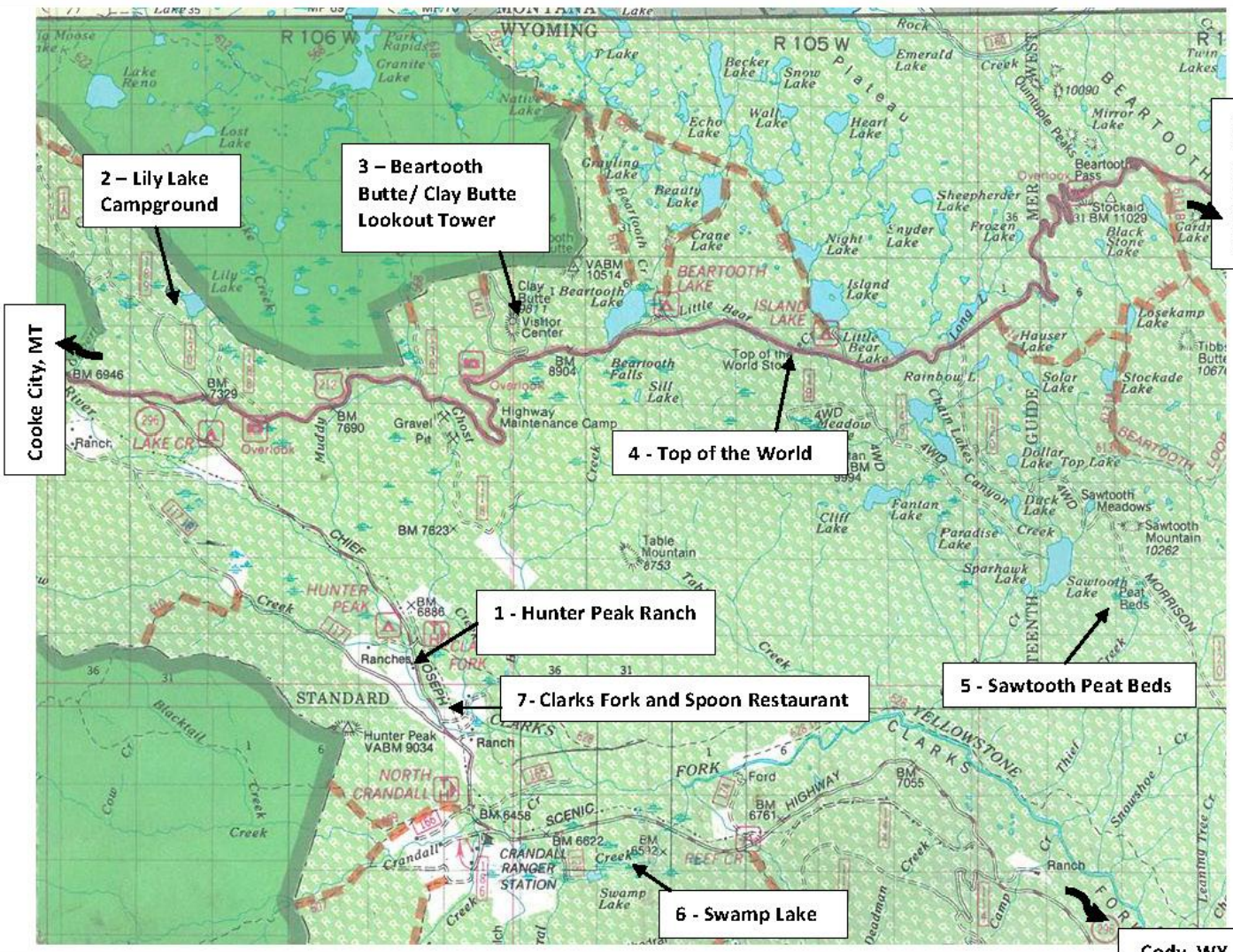
Sunday - ONE HALF-DAY or a WHOLE DAY FIELDTRIP

9 am – 12 pm ALPINE HIKE IN LINE CREEK AREA – morning hike; Leader: Walt Fertig
9 am – 5 pm SAWTOOTH PEAT BEDS – 7 miles (roundtrip) strenuous hike to see the Sawtooth Peat Beds, a potential Geological Interest Area, the only palsa fen in the conterminous United States. Leader: Kent Houston (USFS)

LODGING and CAMPING
Hunter Peak Ranch has accommodations for multiple groups of 2-6 people – great for families or friends, offering private rooms and kitchenettes. Reservations fill up fast – the Ranch recommends making reservations early: (307) 587-3711 or http://www.hunterpeakranch.com/

Lily Lake Campground is free – but it is first come, first serve. If you'd like a campsite at Lily Lake, please indicate so on the reservation form. We will have volunteers claim sites Friday morning as best we can but we can't promise anything for sure. Room for two cars/site. Hunter Peak Campground is the only local FS campground that takes reservations (1-877-444-7777, Monday-Saturday or online at www.recreation.gov). It is right next to the Hunter Peak Ranch and there is room for RVs but no hookups. There are also Fox Creek, Crazy Creek, Lake Creek, Beartooth Lake and Island Lake campgrounds within 15 miles. RVs are OK but no hookups. Are all available on a first come, first serve basis.

2013 Wyoming Native Plant Society Annual Meeting in the Beartooth Mountains



1 - Hunter Peak Ranch
Coming from the south on Chief Joseph Hwy (WY Hwy 296), go 1 mile north of the Bridge over the Clarks Fork of the Yellowstone River. Look for the Hunter Peak Ranch sign on the left side of the highway (west side). *You have arrived*!
Coming from the north on Chief Joseph Hwy (WY Hwy 296), go ~5 miles south of the junction with the Beartooth Highway (US Hwy 212). Look for the Hunter Peak Ranch sign on the right side of the highway (west side), right after passing by the Hunter Peak Campground (USFS).

2 - Lily Lake Campground
From the junction of Chief Joseph Hwy (WY Hwy 296) and the Beartooth Highway (US Hwy 212), go east almost 1 mile. Look for the Lily Lake Campground turn on the left (north side). Follow the gravel road to a T-intersection. Turn right (east) to drop down to the lakeside campground.

3 - Beartooth Butte/ Clay Butte Lookout Tower and Visitor Center – proposed Botanical Area
From the junction of Chief Joseph Hwy (WY Hwy 296) and the Beartooth Highway (US Hwy 212), go east about 6 miles. Look for the Clay Butte Lookout Tower turn-off. Go to the parking lot on top. (Early-birds take note: There is a gate across the road that will not be open until shortly before the Saturday meeting time.)

4 - Top of the World public parking area (south side; store is on the north side) – for alpine hikes in designated Line Creek Research Natural Area, making 3 stops
From the junction of Chief Joseph Hwy (WY Hwy 296) and the Beartooth Highway (US Hwy 212), go east about 10 miles. Look for the Top of the World Store on the left (north side). Meet in the large public parking pull-off on the right (south) side.

5 - Sawtooth Peat Beds – proposed Geological Area
From the Top of the World Store, go less than 1 mile east on the Beartooth Highway (US Hwy 212). Turn right to Morrison Jeep Trail parking lot. (The turn is across from Long Lake).

6 – Swamp Lake – designated Botanical Area
From the Bridge over the Clarks Fork of the Yellowstone River on the Chief Joseph Hwy (WY Hwy 296), meet at the Swamp Lake pull-off about 3.5 miles south-and-east. The pull-off is on the right (south) with the lake and cliffs in view.

Gas and supplies are limited to the Top of the World Store, and the
Clarks Fork and Spoon Restaurant and Gas Station (near Hunter Peak Ranch). Nearest town is Cooke City.

2013 WYNPS Annual Meeting Registration Form

All hike events are free, and every event is open to the public. Please return this form by **June 24, 2013** for dinner reservations and to help us prepare. If you plan to attend the annual meeting or any of the hikes, but don't need dinner or a spot saved at Lily Lake, please return this form anyway as we'd still like to know you are coming! No dogs, please, on any of the hikes.

Name _____

Address _____City_____State____ Zip _____

Phone_____ Email _____

Number in party _____ I (we) plan to participate on: _____Friday _____Saturday _____Sunday

_____Yes, I would like a Lily Lake campsite reserved for me, if possible

Saturday hike preference:
_____Alpine full-day fieldtrip
_____Beartooth Butte and Swamp Lake half-day fieldtrips

Sunday hike preference:
_____ Alpine half-day fieldtrip
_____Sawtooth palsa fen full-day fieldtrip (strenuous fieldtrip)

Saturday evening dinner at Hunter Peak Ranch. Price is $22 per person ($1 per year of age for children 12 and under) and includes light appetizers, dinner, homemade bread, dessert, iced tea or lemonade. No alcohol is sold but you may bring your own. Please indicate your dinner choice and number of people if you are registering for others:

Snow paintbrush (*Castilleja nivea*) is a regional endemic of southcentral Montana and northwestern Wyoming, discovered in the Beartooths during "driving squalls of snow" by F.W. Pennell. It might be finished blooming by the time we arrive in late July, but we can still hope (for flowers, not snow). By: J. Janish, from Vascular Plants of the Pacific Northwest.

Steak _____ Fish _____ Vegetarian _____

Also please indicate if you have any special dietary restrictions or needs:_____

_____

Number of adults _____ X $22.00 per adult = _____

Children's ages _____ X $1 per year of age = _____

Total enclosed = _____

Please enclose check or money order made out to Wyoming Native Plant Society. Sorry, we cannot accept credit cards. Please mail this registration form and payment to WYNPS, P.O. Box 2449, Laramie, WY 82073**.** If you have questions, please contact Ann Boelter (amb749@yahoo.com), Bonnie Heidel (bheidel@uwyo.edu) or Kent Houston (khouston@bresnan.net).

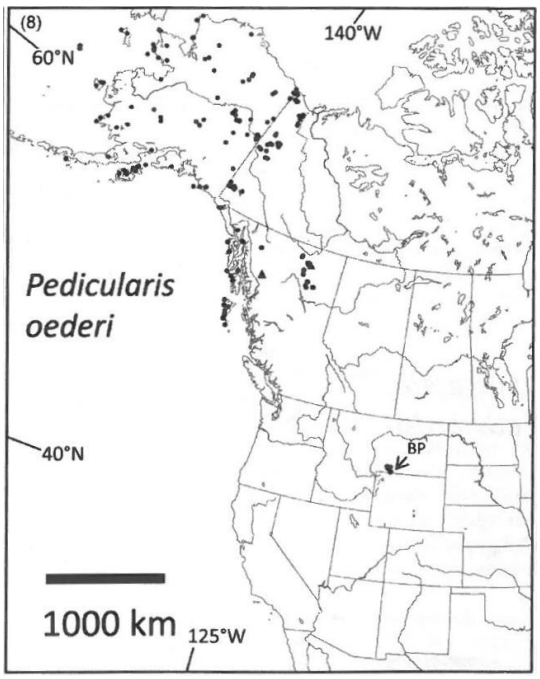
Checklists of plants we'll see on Saturday hikes are posted at the WYNPS homepage along with a Beartooth geology map that you can bring. If you don't have internet access, there'll be some extra copies at the hike.

Only in the Beartooths

(Editor's Note: The following is extracted from: Evert, Erwin. 1984. Notes on some plants occurring in the Beartooths I. *Castilleja* 3(2): 2-3. His article offered a sneak preview of plants for attendees at the 1984 annual meeting, and now for those at the 2013 annual meeting.)

The Beartooth Plateau in Park County, Wyoming is certainly one of the most well collected alpine areas in the state. A relatively steady stream of collectors has worked the Beartooth Plateau since the opening of the Red Lodge-Cooke City Highway (Beartooth Hwy.) in the 1930's. The Beartooth Plateau and environs harbor a number of rare, seldom collected, and otherwise interesting plant species that are found only here or in some cases, a few other alpine areas in the state.

Rare species that have been found in the state only on the Beartooth Plateau are Icegrass (*Phippsia algida*), Rock whitlow-grass (*Draba glabella*), Garden sorrel (*Rumex acetosa*), and Oeder's lousewort (*Pedicularis oederi*. The first three species were found in the Colorado Rockies. The Beartooth Plateau apparently represents the most southerly station in North America of *Pedicularis oederi* and perhaps of *Rumex acetosa*. ...It is interesting to note that the *Draba* and the *Rumex* are known only from the original collections and along with *Phippsia*, represent three of Wyoming's rarest plants. On the other hand, *Pedicularis oederi* is not uncommon on the plateau.



Pedicularis oederi distribution in North America. From. Marr et al. 2012 .(BP=Beartooth Plateau)

The complete Castilleja article is posted in the newsletter archive at the WYNPS homepage, and a companion article on other amazing Beartooth plants appeared in: Part II by Evert, E. 1984. Castilleja 3(3): 1-4.

Beartooth Alpine Diversity

(*Editor's Note: The following is extracted from: Anderson, B. 1994. Beartooth Country: Montana's Absaroka and Beartooth Mountains. Montana Geographic Series, No. 7, rev. ed.*)

The alpine flora of the Beartooth Mountains appears to be richer than that of any other North American mountain range. Why is the Beartooth flora so rich? Many explanations have been offered.

- The Rocky Mountain ranges with the richest floras are the high ones that trend east and west and intersect the principal north-south ranges…
- The richness of the Beartooth flora may be an indirect result of the height of the range. ...Because of its height, the Beartooth range was not entirely glaciated. The high peaks remained ice-free, as did a few other "refugia."…
- The copiousness of the Beartooth flora may also have been influenced by the expansiveness of the alpine terrain. Other states, notably Colorado, have higher elevations, but perhaps no other U.S. mountain range south of Alaska has as much land above treeline. The several hundred thousand acres of alpine Beartooth plateau and its plethora of north-facing cirques and alpine bogs and meadows constitute a nonpareil environment for botanical diversity…"

The Beartooth Grand Slam

Each of the four signature landscapes of the Beartooth Mountains has a designated or proposed natural area within them, so our annual meeting offers the "Beartooth Grand Slam" to see these benchmark places. A fifth additional destination also offers a signature landscape back in time, a *Pleistocene* glimpse of the Beartooth Mountains. All are represented on the field trip map (this issue) so that you have the option of visiting each on your own, before or after the organized hikes, no matter which hike options you take. A geology map is posted with a compilation of three checklists (www.wynps.org) for you to print one or all to take along.

Line Creek Research Natural Area –
The Line Creek area spans much of the largest alpine plateau in the Beartooth Mountains, with extensive alpine tundra. It straddles the Montana -Wyoming state line and encompasses the Twin Lakes area of Wyoming, an area with a prepared plant checklist. Hike options: all day Saturday, or else half-day Sunday morning.

Proposed Beartooth Butte Research Natural Area –
Beartooth Butte rises like a white island of sedimentary rock above its surroundings, a geological relict and alpine biological island with a flora that is represented in a plant checklist. Hike options: Saturday morning.

Swamp Lake Botanical Area – Swamp Lake is one of the largest peatlands in the state, and the largest wetland on alluvium deposits in the rugged valley where the Beartooth Mountains meet the Absaroka Mountains. It is site of many "first-for-Wyoming" plant discoveries, and has the highest concentration of rare wetland plants in the state, in a flora that is represented by a plant checklist. Hike options: Saturday afternoon.

Proposed Lake Creek Research Natural Area –
Lake Creek lies at the heart of some of the oldest rock outcrops in Wyoming, fractured metamorphic rock so resistant to erosion that this waterway has a Jekyll-and-Hyde hydrology with segments of raging creek torrent and placid lake-like calm. It has some of the most acidic wetlands in the Beartooth Mountains, and lies within designated wilderness. Hike options: We will camp and walk *just outside* of its borders at Lily Lake on Friday night. Additional information available upon request.

Proposed Sawtooth Peat Beds Geological Area –
Not all of the Beartooth Mountains were covered by snow and ice when glaciers were prevalent. The Sawtooth Peat Beds site has an elevated mound of peat formed over permafrost, vestige of climate conditions that are today present only in subarctic latitudes. Hike options: all day Sunday (7 miles roundtrip; strenuous difficulty).

Announcing:
Pocket Guide to Sagebrush. 2012. By L. Shultz. 84 pp. (3 ½" x 4 ¾") A publication of Point Reyes Observatory, NRCS and many collaborators. Posted on-line at: http://www.sagestep.org/pubs/brushguide.html .

This guide is written for anyone interested in sagebrush species and habitats, giving characteristics and range maps for all 18 woody species of *Artemisia* and their subspecies in the country. Wyoming has nine species not counting all the subspecies, so this guide is a must for members in sage country and many biologists in the state.

Included are general descriptions, detailed descriptions of both vegetative and flowering stem leaves, inflorescences, and flowering heads, and information on phenology, distribution and ecology. It is by the Flora of North America author and illustrator, this definitive treatment condensed and augmented by high-quality photos of each species and its habitat. It can readily be downloaded (full page format). A limited number of copies will be available at the WYNPS annual meeting, or can also be ordered through: Dorothy Tuthill (DTuthill@uwyo.edu), Biodiversity Institute, University of Wyoming, 1000 E. University Ave., Laramie, WY 82071.

Growing Native Plants

Part 8. Tall Perennial Forbs

By Robert Dorn

Tall perennial forbs are used mostly for a background in a flower bed that is alongside a fence or building. For a bed in the open, the tall forbs are usually placed in the middle of the bed. Tall forbs usually require more moisture than shorter forbs. In general, forbs with a branched rootstock can usually be grown from rootstock divisions. Those with rhizomes can be easily grown from rhizome cuttings. The rest should be grown from seed or obtained from a nursery. To see the plants in color, go to the Society website.

Aconitum columbianum, Monks-hood, can grow to 6 feet tall. It has deeply lobed leaves to 8 inches long and wide. The flowers are deep blue to purple, to 1 inch long, each with a hood-like upper sepal, and borne along the upper half of the stem.

Aconitum columbianum, Carbon County

They bloom from June to August, the earlier date at lower elevations and the later date at higher elevations. The plants occur naturally in moist to wet woods and along stream banks in the mountains. They prefer moist, rich soil in shade but will grow in full sun if they have adequate moisture. All parts of the plant are poisonous to humans and livestock. The plants can be grown from seed planted in the fall about .25 inch deep or less or cold stratify for 60 days and surface sow in spring. Bulblets from the leaf axils can be planted in the fall. Plants can be divided but transplanting is difficult. Seed is commercially available.

Chamerion angustifolium, Fireweed, is an aggressive rhizomatous forb that can reach 6 feet tall. The leaves are willow-like giving it an alternate common name of Great Willowherb. The flowers are pink to pink-purple, up to 1.25 inches across, and borne abundantly along the upper third of the stem. The plants are long blooming, mostly from July to September. The plants occur naturally in open, moist areas of the mountains. They prefer full sun to light shade and moist, well drained, loamy soil. They can be grown from rhizome cuttings or from seed sown in the fall or spring. Cold stratification of 60 days usually helps germination if spring sown. It is also in the nursery trade.

Chamerion angustifolium,
Rio Blanco County, Colorado

Helianthus nuttallii, Nuttall Sunflower, is a rhizomatous perennial that can grow to 8 feet tall. The leaves are lance-shaped and up to 7 inches long. The flowers are the typical "sunflower" with both ray and disk flowers that are golden-yellow, the disk flowers slightly darker. The flower heads are up to 3 inches across with one to several near the tip of the stem. The plants are best grown as a cluster to get enough flowers for a striking effect. Blooming is from July to September. It occurs naturally in moist to wet meadows and along stream banks in the plains, valleys, and basins. It prefers full sun and moist, well drained, loamy soil. It is easily grown from rhizome cuttings. Seed can be sown outdoors in fall in place or in pots for later transplanting. It is also in the nursery trade.

Helianthus nuttallii, Albany County

Heracleum sphondylium, Cowparsnip, is a coarse perennial upto 6 feet, rarely 9 feet, tall with thick hollow stems. The leaves are compound with 3 or more lobed and toothed leaflets, the entire leaf up to 2 feet long. The flowers are white and tiny but densely clustered in large compound umbels at the tip of the stem, each inflorescence up to 8 inches across. It flowers mostly in June and July. The plants occur naturally on stream banks and in wet meadows in the higher basins and valleys and in the mountains.

Heracleum sphondylium, Carbon County

They prefer full sun or partial shade and moist to wet, loamy soil. The plants may be poisonous to livestock and contact may cause a skin rash in some people. It can be grown from seed sown outdoors in fall. It is also in the nursery trade.

Iliamna rivularis, Wild Hollyhock, is a perennial to 6 feet tall. The leaves are lobed and up to 6 inches long and wide. The flowers are pale pink to lavender, up to 1.5 inches across, and scattered along the upper two-thirds of the stem. Flowering is from June to September. The plants occur naturally in open, moist areas of the mountains. They prefer full sun and moist, loamy, well drained soil. They can be grown from seed sown outdoors in fall. Seed is commercially available.

Iliamna rivularis, Carbon County

Announcing:
Forb Seedling Idenification Guide for the Inland Northwest. 2013. By P. Pavek, B. Erhardt, T. Heekin and R. Old. 150 pp. (full page) Posted online at: http://www.plant-materials.nrcs.usda.gov/pubs/wapmcpu11331.pdf

Gardeners and restoration ecologists alike will benefit by a new Natural Resource Conservation Service (NRCS) publication featuring the seedlings of native, introduced, invasive and noxious species of the Inland Northwest. It presents over 140 species, including high-quality photographs of both seedling and flowering stages, augmented by descriptions and other information such as look-alikes, and control priority (for invasives). Most of the species featured, both native and non-native ones, are found in Wyoming.

Alpine Mushrooms of the Beartooth Plateau

By Cathy Cripps, Montana State University

Figure 1. *Amanita groenlandica* forma *alpina* in the Beartooth Plateau, by Cathy Cripps.

Figure 2: Stems of *Amanita groenlandica* continue to grow even when the cap is frozen to the ground, creating a "pagoda-like" growth form. By Cathy Cripps.

The cold wind-swept alpine tundra hardly seems like a place to look for mushrooms. But a variety of cold-adapted fungi do live above treeline and the Beartooth Plateau is a premier area for Arctic-alpine mushrooms. Most are tiny and go unnoticed by the untrained eye, but can be found nestled under willows, in mats of *Dryas*, on wet mosses, protruding from grass clumps, and even in rings on open ground. Their close associations with plants as decomposers, mycorrhizal mutualists, and pathogens make them important in alpine ecosystems. Mycorrhizal fungi occur on roots of grasses and forbs (AM fungi), on ericaceous plants (ericoid fungi) and on *Salix, Betula* and *Dryas* (ECM fungi), but only the latter produce mushrooms.

Amanita groenlandica forma *alpina* is one of the more spectacular ECM fungi found on the Beartooth Plateau (Fig. 1). Sometimes it fruits in great numbers, standing tall and shining near its willow host. The species was first described from Arctic Greenland, but the alpine form has only been found on the Beartooth Plateau. Like all Amanitas, the stem arises from a 'death' cup at the base. The creamsicle-colored cap can open to the size of an out-stretched hand. When temperatures dip, young mushroom caps freeze to the soil surface, while stems continue to push up from the warm soil below, creating 'pagoda-like' structures (Fig. 2).

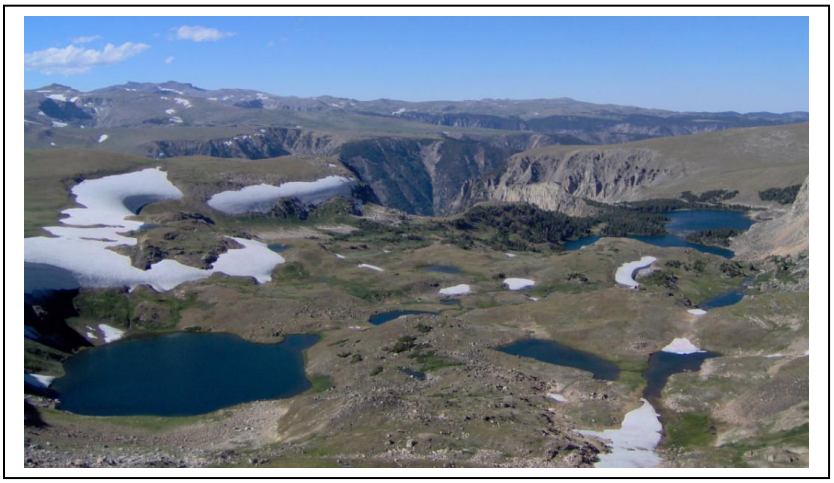
Amanita groenlandica was discovered for the first time in alpine habitats of the Rocky Mountains as part of an alpine fungi survey by Dr. Cathy Cripps, a mycologist at Montana State University (Cripps and Horak 2010). Now, almost 200 species of Arctic-alpine macofungi are recorded from the Rocky Mountain alpine zone all the way into southern Colorado. In 2008, the International Arctic-Alpine Mycology Symposium was held on the Beartooth Plateau and information on this and the fungi can be found at:
http://www.pnwfungi.org/articles_volume_5_ISAM.htm

References

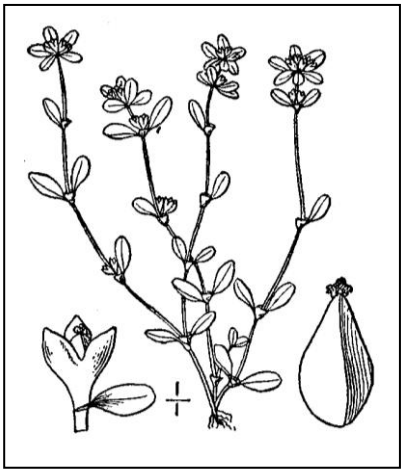
Cripps, C.L. and E. Horak. 2010. *Amanita* in the Rocky Mountain alpine zone, USA: New records for *A. nivalis* and *A. groenlandica*. North American Fungi 5(4): 9-21.

All Plants Great and Small (cont. from p. 1)

Alpine climates, unlike arctic ones, have higher average daytime air temperatures, more direct solar and thermal radiation, and much greater diurnal variability; conferring harsher, more unpredictable conditions (Bliss 1956, Billings 1973). Perhaps the intense red color of the entire Koenigia plant can absorb this intense light. Johnson (1962) observed that "[Koenigia] plants exposed to direct sunlight develop more anthocyanin pigment than plants growing in partial shade." While the species often grows no taller than the diameter of a penny, its red coloration may be as conspicuous as one. A more complete review of general plant adaptations to the alpine environment is presented by Knight (1994).



Above: The Beartooth Mountains include expanses of plateau with Koenigia habitat. The largest and most accessible alpine plateau area is in Wyoming. Photo by Yelena Kosovich, reprinted from: Kosovich-Anderson, Y.I. and M.S. Ignatov. 2010. Three interesting Brachytheciaceae mosses from the Beartooth Plateau (Rocky Mountains, Wyoming, U.S.A.). Arctoa 19: 183-190.



Koenigia islandica. From: Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols.* Charles Scribner's Sons, New York. Vol. 1: 647.

Koenigia is a glabrous, reddish-stemmed annual herb less than 5 cm tall. The leaves are oblanceolate to obovate and blunt, sessile, and opposite to whorled. Flowers are 1 to few in axillary or terminal clusters. The miniscule perianth has 3 greenish-white calyx lobes (Packer and Freeman 2005, Scott 1997). Most other species of the small genus are in the Himalayas (Packer and Freeman 2005). Koenigia has the same morphological traits and gangbuster life cycle throughout its global distribution. A major genetic divergence found between arctic and alpine populations of Koenigia is in seed germination (Wagner and Simons 2009).

Here is a precautionary word for Beartooth alpine tour-goers. Don't be alarmed to see folks falling to their knees on alpine hikes. It is the best position to take in the wonder of Koenigia.

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Wyoming Rezoned

Gardeners, know your comfort zone! Hardiness zone maps for planting represent average annual low temperatures that constrain survival. In 1990, much of Wyoming fell within Hardiness Zone 4 (av. winter low in the range of -20° to -30° F). The Arbor Day Foundation has posted a Hardiness Zone Map reflecting updated 2006 conditions to help the public determine which woody plants are now suitable. The revised map reflects that many areas have become warmer since 1990 when the last USDA hardiness zone map was published. Almost half of Wyoming is now in Hardiness Zone 5 (av. winter low in the range of -10° to -20° F). In theory, that means more planting options.

An animated on-line view of the difference between 1990-2006 is presented at: http://www.arborday.org/media/mapchanges.cfm.

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