



Castilleja

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Native Plant Society
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Indian Paintbrush State Flower of Wyoming

by Walter Fertig

Indian paintbrushes (genus *Castilleja*) are among the most familiar and showiest of the many wildflower species found native in Wyoming. Fifteen species and two varieties occur across the state in habitats ranging from basin sagebrush grasslands to montane meadows and alpine peaks. Our species come in a wide variety of colors, including rose-purple, red, orange, yellow, and even grayish-white. Unfortunately, flower color is not always a reliable feature for identifying different species, as many colors may occur within one species or intermediate hues may be the result of hybridization. Paintbrushes have acquired a reputation as being taxonomically difficult, in part because hybridization can occur between closely related species and partly because the floral features used in keys are often difficult to observe.

The true flower of the Indian paintbrush is actually quite inconspicuous, being mostly hidden by the colorful floral bracts that make up the inflorescence. These bracts are modified leaves that have assumed the function of attracting visually-oriented pollinators to the drab, greenish flowers. The bracts surround a four-lobed calyx and a green, two-lipped corolla. The upper lip of the tube, called the galea, is a large, hood-like structure that encloses the anther-bearing stamens. The smaller lip may occur just below the galea, or about halfway down the tube, depending on the species.

One of the most unusual traits of the paintbrushes is their ability to supplement their food supply by tapping into the roots of other plants. Like several other genera in the figwort family (Scrophulariaceae), *Castilleja* species are partially parasitic (hemiparasitic). Paintbrush roots form specialized parasitic sidebranches called haustoria that can penetrate the roots of neighboring plants in order to obtain water, sugar compounds, and

important minerals from the host plant.

Paintbrushes tend to lose more water through their leaves via transpiration than many other plants and thus may depend on their host plants for increased water uptake. In addition, this water loss creates a suction-like force that actually helps power the uptake of food-rich sap and water from the host's roots into the roots of the paintbrush plant.

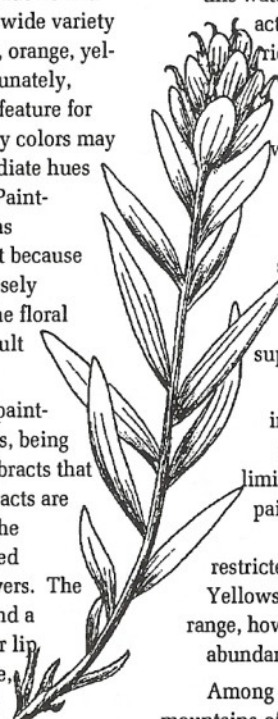
Paintbrushes are capable of growing without hosts in greenhouse situations and occasionally in home gardens. Studies have shown that under these conditions *Castilleja* plants are often shorter, less branched, and later-flowering than plants with hosts. Success in the garden may be dependent on supplying adequate water and nutrients.

Many of the paintbrush species in Wyoming and the west have narrow geographical ranges, sometimes being limited to a single mountain range. Snow paintbrush (*Castilleja nivea*) and Cock's-comb paintbrush (*C. crista-galli*) are restricted to the Absaroka Mountains and the Yellowstone National Park area. Within their range, however, most species are at least locally abundant and few are in danger of extinction.

Among the more widespread species in the mountains of the state are the Sulphur paintbrush (*C. sulphurea*), Scarlet paintbrush (*C. miniata*), and Rosy paintbrush (*C. rhexifolia*), each of which is named for its primary floral color. These three species differ from most paintbrushes of lower elevations in having entire or only slightly lobed or toothed leaves. In basin regions, Nelson's paintbrush (*C. chromosa* or *C. angustifolia*) is one of the showiest and most common species. It is easily

Continued on p. 6.

Above: The yellow-flowered Sulphur paintbrush (*Castilleja sulphurea*) is one of the more abundant and easily recognized species of mountain meadows, woods, and slopes in Wyoming. Ill. by W. Fertig



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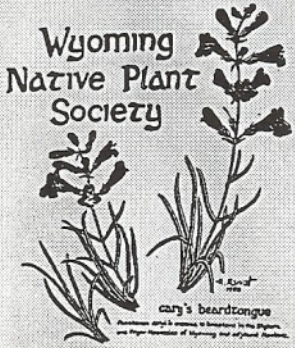
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Wyoming Native Plant Society

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Contributors to this issue: John Baxter, Walter Fertig (WF), and Andy Kratz.



WNPS NEWS

Annual Meeting: The WNPS annual meeting was held at Grand Teton National Park on the weekend of July 9-10, 1994. Twenty-eight members and guests were in attendance the first day, and over 30 plant lovers enjoyed activities on the second (a record turn-out for an annual get-together). The Society was pleased to have a botany class from Western Wyoming College accompany us on our field trips.

Out-going President Phil White conducted an unusually formal (but entertaining) business meeting. An important issue brought up during the general discussion was the need for the Society to become more active in promoting native plants in seed mixes used for reclamation work, especially along state highways. A committee was drafted to investigate what steps the Society can take. Barbara Amidon also raised concerns about the status of wildflowers in Southwest Wyoming now that a new energy boom is developing there. She encouraged members to take a more active interest in local events and to express their concerns about wildflowers and rare plants to federal and state agencies.

Walter Fertig announced the results of the 1994 elections and the "Name the Newsletter" contest. Elected as officers of the Society for 1994/95 were: President: Barbara Amidon; Vice President: Mary Neighbours; Secretary-Treasurer: Walter Fertig; 2-year Board member: Diana Osuna. Jennifer Whipple will continue as the carry-over Board Member. The amendments to the By-Laws regarding membership dues, annual meeting dates, and voting by proxy at Board meetings, were approved by the required 3/4 majority. Finally, *Castilleja* was selected as the winning entry in the Name the Newsletter Contest (narrowly beating out *Artemisia*) and is the new mascot plant of the Society. Congratulations to Mary Neighbours and Jill Walford of Laramie for suggesting this entry and for each winning a free one-year membership.

Several sites were suggested for the 1995 annual meeting, including the Red Desert, Beartooth Plateau, Swamp Lake, and Snowy Range. After discussion of the merits of each, the Red Desert was selected by vote of the attendees and the four Board members present. Look for more information on the itinerary and date of next year's meeting in an upcoming newsletter.

Once the meeting was completed (with Jennifer Whipple maintaining her streak of annually seconding the motion to adjourn), attendees enjoyed a sunny day of relaxed botanizing on the shores of Two Ocean Lake. Following lunch (filled with discussions of deep botanical and philosophical significance), the group divided, with many participants choosing to enjoy the scenery near Jackson Lake while others went searching for unusual sedges with Erwin Evert. The latter group was rewarded with the finding of Buxbaum's sedge (*Carex buxbaumii*) one of the rarer boreal sedges of northwestern Wyoming.

On Sunday, a large group took the tram up Rendezvous Mountain to observe the alpine tundra flora. Among the many showy wildflowers in full bloom were the rare Payson's bladderpod (*Lesquerella paysonii*) and Shultz's milkvetch (*Astragalus shultziorum*). To the disappointment of Phil White, no new state records were encountered on this trip. We hope for better luck next year in the Red Desert! WF

Teton Chapter News: Learn about and comment on the developing interagency noxious weed suppression program for Northwest Wyoming at 7:30 PM, Tuesday, 11 October, 1994 at the Moose Visitor Center, Grand Teton NP. Discussion to be lead by Deborah DesLaurier, Vegetation Ecologist for Bridger-Teton National Forest.

Membership Renewal Time: If a "94" is present on your mailing label, your annual dues for 1995 are due. A membership form is included on the last page of this issue. Please note the new address for the Society in sending in renewals or other correspondence.

New Members: Please welcome the following new members of WNPS: Joan Bennet (Buffalo), Janet Britt (Riverton), Juli Crane (Hyde Park, UT), Bonnie Heidel (Helena, MT), Connie Isdahl (Powell), Bennie Johnson (Green River), John Joy (Whitehall, MT), Elise Prayzich (Jackson), and Tovi Santiago (Jackson).

Treasurer's Report: Balance as of 28 September, 1994: General Fund \$560.06; 1994-95 Scholarship Fund \$ 184.00. Total Funds: \$744.06. WF

Attention WNPS Members: Your articles about Wyoming native plants or art work are welcome in the newsletter! Deadline for the December issue is 30 November 1994.



What's in a Name?

Besseya

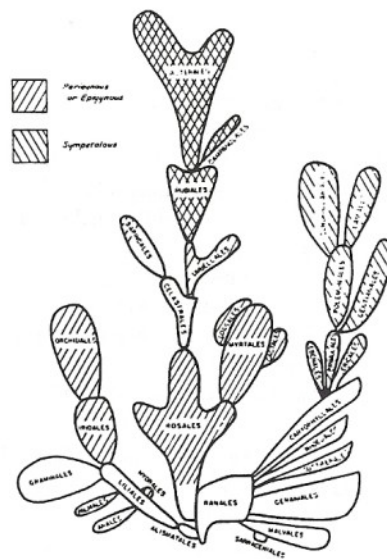
The genus *Besseya* in the Scrophulariaceae (figwort family) contains 7-9 species restricted to North America. Commonly referred to as kittentails, members of this genus are recognized by their heart-shaped basal leaves and dense spike-like inflorescences of white, pinkish, or purple flowers with 2-4 calyx lobes and 2 exerted stamens.

Three species of *Besseya* occur in Wyoming. The most abundant is the aptly named *B. wyomingensis* (Wyoming kittentails), which is found throughout the state on open slopes and meadows from the foothills to above timberline. Wyoming kittentails is unusual in that its flowers lack petals. Nonetheless, the species produces a showy pinkish-purple inflorescence due to the bright colors of the slender filaments of the stamens. Once the stamens have wilted, however, Wyoming kittentails assumes a drab, grayish-green color and can be difficult to spot.

Wyoming's other two species of kittentails have very limited distributions in the state. Alpine kittentails (*B. alpina*) is restricted to moist alpine meadows in the Snowy Range of Albany and Carbon Counties. This purple-flowered species superficially resembles Wyoming kittentails but its flower color is the result of a two-lipped corolla, rather than bright stamen filaments. White River kittentails (*B. plantaginea*) is the rarest of all in Wyoming, being known from a single collection in the southern Laramie Range, last seen in 1916. It resembles *B. alpina* but has white or pinkish petals, longer leaves, and occurs on wooded slopes in the foothills zone.

Per Axel Rydberg named the genus *Besseya* in honor of his colleague, Professor Charles E. Bessey (1845-1915) of the University of Nebraska. Bessey was an outstanding teacher and influenced a generation of talented students, including Frederick Clements, one of the most influential plant ecologists of the early 20th Century. However, Bessey is best remembered for his contributions to the development of a phylogenetic system of plant classification. Bessey contended that the order "Ranales" (including the Ranunculaceae, Paeoniaceae, Magnoliaceae, and other similar families) were the most primitive of the flowering plants due to their possession of a number of morphological features considered similar to their gymnosperm ancestors. Orders that differed from this basal group in one or more features were considered more advanced, and thus more recently derived. Bessey illustrated his concept of angiosperm relation-

ships in a famous chart that became known as "Bessey's cactus" (or *Opuntia besseyi*) due to its loose resemblance to a beavertail cactus. Although many of Bessey's conclusions are no longer accepted, his basic concepts have become a cornerstone of systematic and cladistic methodology and his cactus-like charts live on in the works of Arthur Cronquist and other recent taxonomists. WF



Above: Bessey's cactus ("Opuntia Besseyi"), an early scheme of organizing orders of flowering plants along phylogenetic or evolutionary-based lines. From "Plant Classification, second edition" by Lyman Benson, DC Heath and Co., 1979.



Revegetation and Native Plants in the Rocky Mountain Region of the Forest Service

By Andy Kratz
Regional Botanist, USFS Region 2
(Rocky Mountain Region)

Many people have concluded that under ecosystem management and the National Forest Management Act mandate to maintain diversity, the US Forest Service (USFS) should be using native plants for revegetating skid trails and roadcuts, fire rehab seeding, wildlife habitat and range improvements, and restoration of riparian or other systems. Continued use of exotic plants seems to run counter to our focus on maintaining biological diversity and healthy ecosystems, especially when the species we use become invasive in the surrounding landscape, but also if they persist for decades and prevent the reestablishment of natural vegetation.

But switching to the use of native plants presents many challenges. The most obvious concerns are over availability and cost of native materials, though the counter argument is that suppliers would rush to fill the demand if the use of natives was required, and the cost would then drop with increased volume of trade. Other concerns include species information, defining "native", seed transfer guidelines, technology transfer, and the skills which would be needed to make the switch, plus the time-frames for such a change in management. Some hard questions could be asked about finding suitable native plants for reclamation of toxic mining spoils, or the need to find species capable of competing with introduced exotic weeds, and the rationale for requiring the use of only native species on skid trails where the surrounding vegetation already has a large component of exotics.

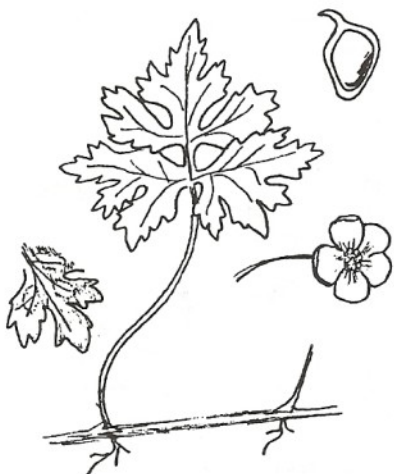
The most vexing concerns, however, involve genetics. Cultivars of native plants have been produced by the Soil Conservation Service and others through standard agricultural practices of plant breeding. Giving preference to "desireable" characteristics among plants from different parts of the species geographic distribution, crosses have been made to produce cultivars with improved tolerance for alkaline soils, better foliage or forage production,



Above: *Draba verna*, a non-native mustard that has become established in Yellowstone National Park. With muddy cars coming to the park from all corners of the nation, Yellowstone has become home to many unwelcome exotic species. Ill. by W. Fertig.

greater seed production, or other factors. These cultivars are still recognized by the same scientific name, but have a trade name too (e.g. "San Luis" slender wheatgrass). If these genetically manipulated species are considered "native" and are planted in relatively natural ecosystems alongside their naturally occurring relatives of the same scientific name, the cultivars may serve as "Trojan horses" for the introduction of new genes from distant parts of the species range into the local population. Without human intervention, these genes might never cross existing physical barriers to gene flow. We have no way to predict the consequences of introducing such genes, and once they enter the local gene pool there is no way to remove them. This could be called "genetic pollution".

Similarly, if plant materials (seeds, cuttings, transplants, etc.) are collected in the wild and are considered to be "native" anywhere within the natural range of the species, planting these natives in ecosystems in a different location from where they were collected may pose risks of genetic pollution. The USFS stopped doing this with native trees many years ago, though the primary concern at the time was that they did not grow as well when moved very far from their original location. The agency developed seed zones and seed transfer guidelines to address the problem. Similar steps will likely need to be taken for other native plants that will be used in revegetation, but the issues of biological diversity (including genetic diversity) make the task more



Above: Creeping buttercup (*Ranunculus repens* var. *repens*), a Eurasian native that has become established in many areas of the US, including Lincoln and Sublette Cos., Wyoming. Ill. by W. Fertig

complicated now. It should not be a problem if collecting seed within a project area and returning it to the site after ground disturbance, but moving from one watershed to another or over a large elevational gradient raises questions.

An intermediate step along the way toward incorporating native species into revegetation efforts (while answers to challenging questions are sought) might be to continue to use exotics, but to make sure that we do not use those which are invasive or persist in natural ecosystems for more than a few years. If we eliminate the use of invasive or persistent species, the native plants from the surrounding landscape should displace the exotic revegetation mix over time. This would avoid the current higher costs of obtaining native plants for revegetation, and avoid concerns over genetic pollution (provided that the exotics used are not so closely related to native species that they might interbreed). Some of the suitable exotics might include annual plants (e.g., cereal rye) which will not persist, and sterile hybrids (e.g., "Regreen" sterile wheat).

One of the first questions to be asked before revegetating an area should be "Do I need to plant anything?" Many times the answer should be "No," but federal agencies have a tendency to automatically seed areas even under circumstances for which past observations have shown that seeding is not effective. This issue is complicated by regulations regarding rehab seeding and how and when the costs can be charged. Sometimes spreading weed-free straw or excelsior matting is an appropriate alternative to

seeding smaller project areas, and will allow native plants to revegetate the site over time.

We may find it helpful to set varying standards for revegetation efforts depending on the land uses involved. For example, the Mount Baker-Snoqualmie National Forest determined that their highest priorities for using native plants are those sites adjacent to Wilderness areas, Research Natural Areas, National Parks, streams, wetlands, and around documented sightings of sensitive plants. They decided that in areas which they wished to keep in permanently disturbed condition (e.g., landing strips, powerline corridors, seed orchards, road shoulders, etc.), the use of native plants would be a long-term goal, but a lower priority.



Above: Shepherd's purse (*Capsella bursa-pastoris*), an exotic species well established throughout the United States. Ill. by W. Fertig

A conceptual problem that the USFS seems to have in revegetation is the tendency to want a revegetated area to return to a late successional condition as soon as possible. When using native plants, we tend to select those from mature natural vegetation, rather than looking to the native weeds (ruderal species) which would begin the successional process on a natural disturbance, such as a landslide, or fire. Perhaps this stems from years of trying to reestablish trees as quickly as possible, rather than mimicking natural succession following a stand replacing event. As our understanding of ecosystem management evolves, perhaps we will borrow more ideas from natural processes and the complex interactions among early seral vegetation, wildlife, and other organisms.

(Excerpted from USFS Region 2 Fishes, Wildlife, Botany, PTES, Ecology, Range Newsletter)



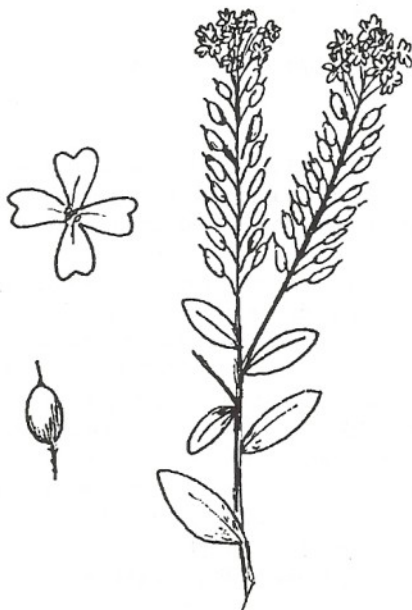
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recognized by its deeply divided gray-hairy leaves and rounded inflorescence of bright red, deeply cleft bracts. This is also one of our earliest blooming paintbrushes, with flowering beginning as early as April.

The most famous of all our paintbrush species is the Wyoming paintbrush (*C. linariifolia*), the plant selected as the official state flower by the Wyoming legislature in 1917. This species is unusual in that its calyx lobes tend to be more brightly colored than the leafy bracts. It tends to be a tall, much-branched plant and is often considered to be much less showy than other *Castilleja* species. Not surprisingly, state documents (including the official 1994 Wyoming highway map) often have illustrations that depict other species of paintbrush as our "state flower".

Aven Nelson, Wyoming's leading botanist of the first half of the 20th Century, was one of the few detractors of the selection of Indian paintbrush as the state symbol. Nelson criticized this choice because he felt the paintbrush did not command "our love and admiration, the sole elements upon which the reign of a floral emblem rests". Despite Nelson's contentions, the paintbrush has earned the admiration and respect of the citizenry of Wyoming because of its beauty and knack for survival.

Below: Hoary alyssum (*Berteroa incana*), an alien mustard often found along disturbed roadsides in western and southern Wyoming. Ill. by W. Fertig



Sample page from Plant Identification Terminology, reprinted with permission of the Publisher.

anthers to the stigma of the same flower or to the stigma of another flower on the same plant.

Semen. A seed. Figure 960.

Semi- (prefix). Half, partly or almost.

Semicarpous. With ovaries of carpels partly fused, the styles and stigmas separate. Figure 961.

Seminiferous. Seed-bearing.

Semitropical. See subtropical.

Semperflorous. Flowering throughout the year.

Sensitive. Responsive to touch.

Sepal. A segment of the calyx. Figure 962.



Figure 960



Figure 961



Figure 962

Sepaloid. Sepallike in color and texture.

Septate. Divided by one or more partitions. Figure 963.

Septentate. With parts in sevens. Figure 964.

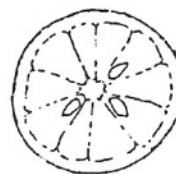


Figure 963



Figure 964

Septicidal. Dehiscing through the septa and between the locules. Figure 965. (compare loculicidal and poricidal)

Septifolious. With seven leaves or seven leaflets. Figure 964.

Septifragal. Separation of the valves from the



Botanist's Bookshelf

Plant Identification Terminology: An Illustrated Glossary by James G. Harris and Melinda Wolf Harris. 1994. Spring Lake Publishing, Box 266, Payson, Utah 84651. \$17.95, 188 pp., ill.

One of the most frustrating experiences for a budding plant enthusiast trying to key out an unknown specimen is encountering a literal "language barrier" when opening up a flora or manual. To the uninitiated (as well as many veteran taxonomists), keys often appear to be written in a foreign tongue. Unfamiliar and somewhat intimidating words like "monochasium", "hirsutulous", "gynobasic", and "fastigiata" crop up all too frequently in keys and can quickly discourage even the most avid botanist.

Most plant keys and manuals come with a glossary to deal with this problem, but more often than not the user must wade through even more confusing terminology in the definitions. Worse yet are glossaries that lack illustrations. Taxonomy is a very visual science, and pictures can be far more instructive than words in creating the proper mental picture needed to translate a key or identify a flower.

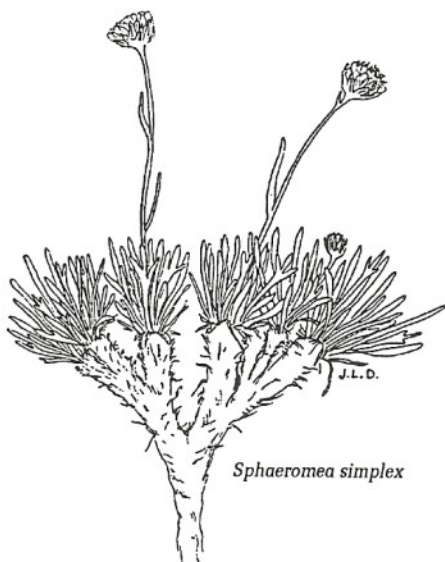
Plant Identification Terminology: An Illustrated Glossary is a new book designed to rescue botanists who are not fluent in technical botanical terminology. The book contains definitions of over 2400 terms commonly (and uncommonly) found in keys and floras. Most of these terms are also illustrated by accurate and clearly labeled figures. The combination of minimally technical definitions with

diagnostic drawings should be sufficient to make even the most difficult term understandable.

The book is divided into two parts. Part one is the main glossary and is organized alphabetically. Part two contains specific terminology organized by major plant structures: roots, stems, leaves, inflorescences, flowers, and fruits. Within these categories, terms describing similar attributes are grouped together. For example, terms describing leaf attachment (such as clasping, decurrent, perfoliate, etc.) are in the same section for ready comparison of similarities and differences. This section of the book is of particular value to students of plant morphology.

This book is also a valuable reference to beginning students in plant taxonomy courses. Although similar to classics such as Harrington and Durrell's "How to Identify Plants", *Plant Identification Terminology* is superior because it covers many more terms and has more illustrations. Amateur and professional botanists will also find this volume to be a useful supplement to their library of technical floras and manuals. WF

Note to WNPS Members: Although the retail price of this book is \$17.95, Spring Lake Publishing is offering a special price to Native Plant Society members of \$15.95, postage paid. To receive this discount, order directly from the publisher and mention that you are a member of WNPS.



Sphaeromea simplex

Presidential Memo Calls for Greener Landscaping

An executive order signed by President Clinton on April 26, 1994 calls for federal agencies to utilize regionally native plants whenever possible in landscaping projects. Clinton's order supports a recent government study which found that native plants provide valuable wildlife habitat and reduce the need for costly fertilizers, pesticides, and irrigation. In addition, agencies are asked to use integrated pest management techniques, recycle green wastes as compost, and implement more water-efficient irrigation practices. Lastly, agencies are asked to create outdoor demonstration gardens using local native species to promote greater public awareness of the beauty and benefits of natives. WF

The Wyoming Native Plant Society, established in 1981, is a nonprofit organization dedicated to encouraging the appreciation and conservation of the native flora and plant communities of Wyoming. The Society promotes education and research on native plants of the state through its newsletter, field trips and annual student scholarship award. Membership is open to individuals, families, or organizations with an interest in Wyoming's flora. Members receive *Castilleja*, the Society's quarterly newsletter, and may take part in all of the Society's programs and projects, including the annual meeting/field trip held each summer. Dues are \$5.00 annually.

To join the Wyoming Native Plant Society, return the membership form below to:

Wyoming Native Plant Society
604 Grand Ave.
Laramie, WY 82070

Wyoming Native Plant Society

Name: _____

Address: _____

- \$5.00 Regular membership
 \$15.00 Scholarship Supporting Member
(\$10.00 goes to annual scholarship fund)

The Botany 130 Song Book

By John "Barney" Baxter

Yet another soon to be classic from the laboratory sections of Botany 130 at the University of Wisconsin-Milwaukee. The tune is an old folk song that may not be familiar to many readers. If you don't recognize it, use the tune to the Talking Heads song "Psycho Killer".

Old Hugo De Vries

(Tune: *Sweet Betsy From Pike*)

*Oh, do you remember old Hugo De Vries?
His reprints piled up till they reached to his knees,
He studied mutations and published like mad,
But got no promotion - oh boy, was he sad.*

*Old Hugo jumped up and he ran to the Dean,
Old Hugo was mad! And he made quite a scene!
But not having tenure, old Hugo was fired,
And he and his primroses quickly expired.*

(Note: O.K., so they were evening primroses. Picky, picky, picky).



WYOMING NATIVE
PLANT SOCIETY
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