Castilleja

A Publication of the Wyoming Native Plant Society

www.uwyo.edu/wyndd/wnps/wnps_home.htm

March 2003

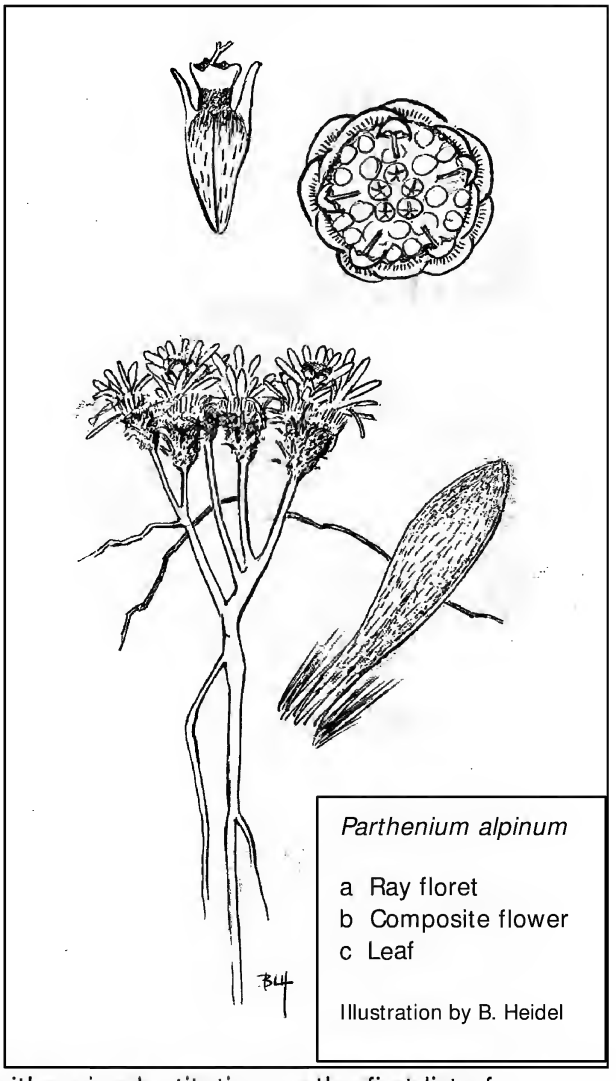
Volume 22 No. 1

In this issue:

Botanists Seek to Understand Megadroughts

The past holds keys to the future and the clues are in the records marked by annual tree rings. University of Wyoming botanists Stephen Gray, Stephen Jackson and colleagues are publishing results of 750-year-long tree-ring chronologies examined from a network of study sites in the central and southern Rockies for multi-decade variability in precipitation (Gray et al. 2003). The study suggests that the Great Plains, the Rockies, and the Southwest are stricken by 'megadroughts' when the tropical Pacific turns cold at the same time that the North Atlantic warms. Multi-year persistence of these ocean conditions can result in multi-year severe droughts in the western interior of North America. (cont. p. 4)

Wyoming Harbinger of Spring



Parthenium alpinum

a Ray floret
b Composite flower
c Leaf

Illustration by B. Heidel

Wyoming feverfew (*Parthenium alpinum* Nutt.; also called alpine feverfew) is a stemless, mat-forming perennial forb of the Aster family (Asteraceae). It arises from a deep, woody caudex and each branch of the caudex is crowned by rosettes of leaves. The flowers are whitish or greenish and composed of male disk florets and five inconspicuous female ray florets. Wyoming feverfew was proposed as Threatened by the Smithsonian Institution on the first list of potentially endangered and threatened plants of the United States (Ayensu et al. 1978) but found to be more common and taken off the list in 1985. Currently, there are at least 44 populations known on the high plains of Wyoming, 4 in Colorado, and 4 in New Mexico. It flowers without fanfare at the end of April and early May, a harbinger of spring, even though an inconspicuous one. JH

WNPS NEWS

Summer 2003 WNPS Annual Meeting:
The WNPS annual meeting/field trip is scheduled for the weekend of May 31-June 1, 2003 in the Jack Morrow Hills. We will visit Bush Rim, home to the largest population of the Large-fruited bladderpod (*Lesquerella macrocarpa*), a state endemic, as well as the Killpecker Dunes. Look for more details in the May newsletter.

Treasurer's Report: Balance as of 28 February 2003: General Fund $477.13: 2003 Student Scholarship Fund: $566.50; Total funds: $1043.63.

Election Time is Near: It is time once again to fill incoming vacancies on the WNPS Board. If you are interested, please contact Jennifer Whipple, other Board members, or drop a line mailed to the WNPS mailing address (below). A ballot will appear with the annual renewal notice in the upcoming May issue.

Wyoming Native Plant Society
PO Box 3452, Laramie, WY 82071

President: Jennifer Whipple (Mammoth) - 344-7988
Vice President: Jean Daly (Sheridan) - 674-9728
Sec.-Treasurer: Drew Arnold (Laramie) - 742-7079
Board Members: Claire Leon (Story) - 683-2302
Jim Glennon (Rock Springs) - 352-0336

* *

Newsletter Editor: Bonnie Heidel (Laramie; 742-9523, email: bheidel@uwyo.edu)
Teton Chapter: PO Box 82, Wilson, WY 83014, Joan Lucas, Treasurer
Bighorn Native Plant Society: PO Box 21, Big Horn, WY 82833, Jean Daly, Treasurer

New Members: Please welcome the following new member of WNPS: Heidi Anderson (Gardiner, MT).

MEETINGS

Black Hills Botany and Ecology Workshop

Hosted by Black Hills National Forest
Date: **March 11, 2003**, 9:30 am to 3:30 pm
At Northern Great Plains Interagency Fire Center (old terminal building at the Rapid City airport), Training Room in Rapid City, SD.
A workshop is offered on the botany, plant ecology, forest ecology, and vegetation monitoring being conducted in the Black Hills area, as a forum for researchers and managers to meet others doing similar work, share ideas, network, and coordinate. Attendees are invited to take a few minutes to talk to the group about their program or projects that they are working on. Please RSVP and indicate if you're interested in giving a short presentation.
For more information, contact: Cody Wienk, Fire Ecologist at 605-745-1172 or Cody_Wienk@nps.gov .

Improvement and Management of Sagebrush Communities in Wyoming

Hosted by Wyoming Chapter of Wildlife Society
Date: **June 16-20, 2003**
At Sweetwater County Events Center, Rock Springs
A workshop is offered on the current state of knowledge on the ecology, management and improvement of sagebrush communities in Wyoming. The final session will review the guidelines to manage sage grouse populations and their habitats, and the Wyoming guidelines for managing sagebrush communities with emphasis on fire management.
Registration is $200 before 16 May, and $275 after that time. For more information, contact Steve Kilpatrick at 307-733-2321 or Steve.Kilpatrick@wgf.state.wy.us.

Monitoring Whitebark Pine for Blister Rust: A Methods Workshop

Held in conjunction with the Whitebark Pine Ecosystem Foundation's 2003 Annual Meeting
Date: **September 8-10, 2003**
At Holiday Inn, West Yellowstone, Montana
What: This workshop is offered for land managers, scientists, field technicians, and professionals interested in learning blister rust monitoring techniques and the latest whitebark pine research and management activities.
Registration is $150 per person. For information and registration contact: Debbie Graham, Continuing education, University of Montana (406-243-2047), email:debbra.graham@mso.umt.edu.

Contributors to this issue: Beth Burkhardt, Jean Daly, Robert Dorn, Walter Fertig, Joy Handley, Bonnie Heidel, Elizabeth Lack, Claire Leon, and Carl Linneaus.

Redrawing the Phlox Family Tree

by Robert Dorn

(Editor's note: The Polemoniaceae [Phlox Family] is among the revised families in the current state flora; see "Changing Times, Changing Floras," Castilleja 20(4). The 13 genera in Dorn (1992) are joined by two "new" genera and new genus circumscriptions in Dorn (2001). Look for more taxonomic counseling services in future issues.)

Several of our families have been noted for the difficulty of circumscribing the included genera because of the close morphological similarities of the species. The most notable are the Apiaceae, Carrot family, the Brassicaceae, Mustard family, and the Polemoniaceae, Phlox family. In the latter family, this is most easily appreciated by the fact that of our 15 genera, only *Phlox* and *Polemonium* have historically not had any of their members originally described as or transferred to the *Gilia* genus.

J. Mark Porter and Leigh Johnson have recently proposed a new phylogenetic classification for the family Polemoniaceae based primarily on molecular studies. The resulting rearrangements can be a bit confusing. All of our species formerly included in *Leptodactylon* are now treated in *Linanthus* and all of our species that were formerly in *Linanthus* are treated in *Leptosiphon*. This arrangement was suggested in 1961 by Edgar Wherry based on morphology, but he did not formally propose the changes.

The earlier segregation of *Ipomopsis* from *Gilia* by Verne Grant in 1956 is supported by molecular data as well as the earlier known difference in base chromosome number, although, as Porter and Johnson point out, "the morphological traits that distinguish these genera are surprisingly cryptic." Porter and Johnson removed several more species from *Gilia. Gilia tenerrima* went to the monotypic genus *Lathrocasis*, which is separated from *Gilia* by a combination of characteristics, although the mostly entire leaves will easily separate it from our remaining two species of *Gilia.* Three of our former *Gilia* species were placed in the genus *Aliciella* based on DNA sequence data, chromosome numbers, and seed morphology.

Although the genera of Polemoniceae can be difficult to differentiate on a worldwide basis, our species are reasonably distinct, so that determining the genus is relatively easy. We can expect similar generic upheavals in the future in our other families that have morphologically similar species such as the Apiaceae and Brassicaceae mentioned above. It would be nice to have all species and genera clearly distinct from one another, but in many cases the morphology seems to be slower to change than the underlying genetics. We can only hope that this is the exception rather than the rule.

Reference

Porter, J. M. & L. A. Johnson. 2000. A phylogenetic classification of Polemoniaceae. Aliso 19(I): 55-91.

Wyoming Conservation Directory

For a current listing of research/ education organizations, government agencies, commodity groups, community assistance programs and environmental advocacy groups in the state, see the posting:

http://www.uwyo.edu/enr/ienr/ ConservationDirectory.

Last but not least on the list is Wyoming Native Plant Society, a research and education organization like no other.

This list is maintained by the UW Institute of Environment and Natural Resources.

National Website on Imperiled Plants

The Center for Plant Conservation launched a new website on the country's native, imperiled plant. Among the 600+ species featured are 12 Wyoming species, posted electronically at: http://www.centerforplantconservation.org.

Botanists seek to understand megadroughts – cont.

The researchers found that the tree-ring records exhibit significant oscillations in precipitation that last between 40 and 70 years. In general, multi-decade oscillations in the tree-ring record are not cyclical and are not always in phase across the Rockies, suggesting complex linkages between seasonal precipitation and ocean temperatures. "Occasionally, these oscillations can synchronize across the Rockies, particularly in times of 'megadroughts' that affect large regions of the country for a decade or more, such as occurred in the late 1500s and the 1950s," said Stephen Gray of the University of Wyoming's Department of Botany, and one of the paper's authors. The 1950s drought was associated with a persistently cold tropical Pacific and warm North Atlantic, and similar conditions have been in place since 1998, when once again the Rockies, Great Plains and Southwest have been stricken by drought. Because no comparable 750-year-long-proxy records exist of sea surface temperatures in the Tropical Pacific and North Atlantic, the demonstrated link between ocean temperatures and precipitation in the Rockies is limited to the last century.

The authors hypothesize that the current conditions could be playing a major role in resetting plant demographic clocks across the Rockies through wildfires, insect outbreaks, and tree mortality from physiological stress. Given the longer growing season associated with global warming, the species dominant in the region now might be replaced by other native and non-native species, producing long-term vegetation changes.

NOAA scientists recognize the same climate conditions that were present in the 1950s drought in a large-scale, ongoing sea-surface temperature pattern that has persisted since 1998, with record warmth in the western Pacific and cool waters in the eastern Pacific. Could the 1950's drought or the outcome of the current drought be predicted? NOAA scientists are gleaning lessons from current conditions to identify precursor states in oceanic climate, similar to the way the more cyclic El Niño or La Niña are predicted. What we hope to be able to do eventually," said Steve Jackson of the University of Wyoming Department of Botany, "is use the information on the relationship between ocean temperature regimes and North American climate to guide us in more effective long-term water management and to anticipate climatic effects on ecosystems."

From year-to-year, it is not unusual for some area of the country to be in drought at some point," said Douglas LeComte, drought specialist with the NOAA Climate Prediction Center. "However, the extent of last summer's serious drought conditions measured by the Palmer Drought Indices has not been seen since the mini-dust bowl drought of the mid-1950s." Even now, over one-fifth of the nation is in severe drought. As of this writing, the Wyoming Water Resources Data System shows that there are five areas in the country where 2001-2002 annual precipitation levels are the lowest on record, including Wyoming (http://www.wrds.uwyo.edu/wrds/wsc/dtf/divprerank.pdf) and the NOAA drought index data show that southern and central areas of Wyoming make up the largest drought-afflicted area (http://www.drought.unl.edu/dm/monitor.html).

State climatologist Jan Curtis cited climate research and botany research when he told Casper audiences recently that Wyoming is looking at eight years of drought, minimum, and likely a decade (Casper Star Tribune 14 February 2003). The climate story as told in tree rings is not available for quick reference and casual reading, but in its place, Wyomingites may want to keep an eye on the state and federal drought information sources in this article, as well as stream flow data (http://wy.water.usgs.gov/projects/drought/index.html) and fire data (http://www.nifc.gov/). BH

References cited

Gray, S., J. Betancourt, C. Fastie, and S. Jackson, in press. Patterns and sources of multidecadal oscillations in drought-sensitive tree-ring records from the central and southern Rocky Mountains. Geophysical Research Letters, in press, doi:10.1029/2002GL016154, 2003.

(*This article was extracted from a University of Wyoming press release, NOAA information on the internet, and the Casper Star Tribune.*)

Big Horn Native Plant Society Report

Despite the dry season in the Big Horn Mountains, 2002 was a great year for wildflowers. It was a very successful year for our Bighorn Native Plant Society field trips as well. The first trip of the year was on May 18, in meadows above Big Horn along the Red Grade Road. As always, the flowers were abundant in the meadows and on the limestone outcrop, a spot where some of the earlier species bloom. This is a location where we can always find early spring flowers. The trip was led by Dick Birkholz.

The second trip, on June 8, was a windy, cold, blustery day, and as a result only two members showed up. These two still had a very good time learning the families. This session was held in Story, in fields next to Our Lady of the Pines Catholic Church.

Trip number three took place on a fine day in late June. Several stops were made along Highway 16 above Buffalo on our way to Elgin Park, which was a riot of color, dominated by spectacular fields of Lupine. Between fifteen and twenty people joined us on this trip, most of whom brought picnic lunches, which were enjoyed at the edge of the forest.

The final trip, on July 6th, began in the Burgess Junction area, in an open, mostly wet site of diverse vegetation, including three *Agoseris*--*A. lackschewtiizii, A. aurantiaca*, and *A. glauca*. We continued on to Hunt Mountain, which is a fine alpine location. Among species observed were *Primula parryi, Dryas octopetala, Eritrichum nanum, Silene acaulis, Hymenoxys grandiflora, Zigadenus elegans* and *Phlox multiflora*.

We had a wonderful year, and look forward to another in 2003. Come and join us!

Jean Daly and Claire Leon

Working in Wyoming's Wetlands

By Elizabeth Lack

(*The author is currently conducting an inventory of wetland plants in Wyoming for her Master's thesis at the University of Wyoming and she is grateful to be a past recipient of Wyoming Native Plant Society scholarship.*)

In my job as an environmental consultant, I've had the opportunity to work in wetlands around Wyoming and in other western states. Most of my work in wetlands involves mapping wetlands, or in industry jargon "delineating" wetlands. The mandate for this work rests in the Clean Water Act. Section 404 of the Act authorizes the Army Corps of Engineers to issue permits for the discharge of dredged or fill material into the waters of the United States, which includes wetlands. This, of course, begs the question, what is a wetland? In 1987, the Army Corps of Engineers published a manual of guidelines and methods to determine whether an area is a wetland. In this manual, three criteria are used to determine a wetland: hydrology, soils, and vegetation.

The vegetation component is what sparked my interest in wetland plants. For the most part, when you are looking for wetlands, you are looking for wetland plants. Sometimes it's very easy. A patch of cattails (*Typha spp.*) is usually a good clue that you've found a wetland. Other times, it's a matter of looking for the right color. If you gaze across a grassland or meadow and see the distinctive dark green color of baltic rush (*Juncus balticus*) in a low spot, you may (or may not) have a wetland. Baltic rush is one of those plants that give wetland delineators fits, especially in July or August. The hydrology component may not be obvious at that time of year, so you have to look carefully at the soils to determine whether the baltic rush is telling you whether you have a wetland or not. Willows (*Salix spp.*) can also be problematic. I've seen willows growing in some pretty dry conditions, and despite the presence of willows, the soils and hydrology do not always indicate wetland conditions.

Other areas can be more fun (and challenging) for wetland delineators. In Wyoming, moist meadows, seeps, springs, oxbows, and backwaters are some of my favorite types of wetlands. I've seen numerous moist meadows with a wide array of colorful and diverse species. Such spots can offer hours of interesting botanizing – of course a variety of sedges and grasses are likely to be found along with colorful forbs such as buttercups, gentians, bistort, monkey flowers, iris, marsh marigold, lousewort, orchids ...and the list goes on. Moist meadows, however, often have a curious mix of wetland and upland species that can make delineating the boundary of wetland quite a challenge. Seeps also provide fascinating opportunities to botanize. The usually small area under the influence of seepage typically has dramatically different vegetation from the adjacent upland. The boundary between wetland and upland is often abrupt. When water is added via a seep or spring to an otherwise arid setting you'll find a smack of green – sedges, spike rushes, watercress – often made more colorful by dragonflies and other insect life.

Wetlands are more frequent in Wyoming than you might think. In the big scheme of things they are a small, but important part of our landscape. They are a big part of our flora. A surprising number of plant species occur Wyoming's wetlands, approximately 1,100 species according to the *National List of Vascular Plants that Occur in Wetlands.* In addition, two of our federally-listed threatened species, Ute ladies' tresses orchid (*Spiranthes diluvialis*) and Colorado butterfly plant (*Gaura neomexicana ssp. coloradensis*) are found in wetlands. The Wyoming Natural Diversity Database lists nearly 200 plant species of special concern that occur in our wetlands. I encourage everyone to get out and enjoy the wonders of our wetlands.

A Passion for *Parthenium alpinum*
(Test your asteraceous IQ)

1) A species of the genus *Parthenium* found in Texas and Mexico is used to produce

A) an alcoholic beverage
B) rubber
C) perfume
D) salsa

2) *Parthenium alpinum* is in the section *Bolophytum*, which in Greek means

A) wolf plant
B) bullfighter
C) clump plant
D) light bulb

3) The specific epithet "*alpinum*" is a misnomer. Wyoming feverfew actually grows

A) at sea level
B) in the Black Hills
C) in riparian areas
D) on the high plains

4) A distinguishing feature of the genus *Parthenium* is

A) fused florets
B) great big, nasty teeth
C) yellow disk flowers
D) plaid ray flowers

5) The location of the type collection is in

A) Wyoming
B) Idaho
C) Canada

Answers to *Parthenium alpinum* quiz

1: B) Guayule (*Parthenium argentatum* Gray) is cultivated as a source of natural rubber. It was widely used by the United States during World War II and Reed Rollins was deployed to study it (Rollins 1950). Crosses between guayule and Wyoming feverfew, the most cold-tolerant species in the genus, could increase the northern range of guayule cultivation (West and Waines 1988).

2: C) "Bolo" is Greek for lump or clod and "phyton" is Greek for plant.

3: D) Wyoming feverfew is found on the high plains of central and southeastern Wyoming, northeastern Colorado, and northern New Mexico. It occurs on sparsely vegetated slopes and outcrops, typically in wind swept habitats.

4: A) *Parthenium* is differentiated from other genera in Asteraceae by the fusion of the basal portion of the two subjacent sterile flowers, the basal portion of the achene and its subtending phyllary (Rollins 1950). This fusion causes the phyllary and two flowers to remain attached to the achene when it is shed.

5: A) Nuttall (1840) described the type location as "in the Rocky Mountains, towards the sources of the Platte, in about lat. 42 degrees, on shelving rocks at the summit of a lofty hill, near a place called the "Three Buttes" by the Canadians, 7000 feet above the level of the sea." Goodman (1943) examined information on the 1834 Wyeth Expedition, of which Nuttall was a member, and deduced that "the source of the Platte" referred to the Sweetwater River in central Wyoming. Goodman called it "the long-lost *Parthenium*" and thought that the elevation was probably an overestimation. It was not seen for over 100 years after Nuttall discovered it in 1837. It was collected again in 1947, near Alcova, by H. D. Ripley and R. C. Barneby as told in previous Wyoming NPS newsletter articles by Jim Locklear (1989, 1990). JH

References

Ayensu, E.S. and R.A. DeFilipps. 1978. Endangered and Threatened Plants of the United States. Smithsonian Institution and World Wildlife Fund, Washington, DC.

Goodman, G.J. 1943. The story of *Parthenium alpinum*. Madroño 7:115-118.

Locklear, J. 1989. Lost Plant of the Wyeth Expedition, Part I. Castilleja Oct 89:2-4.

Locklear, J. 1990. Lost Plant of the Wyeth Expedition, Part II. Castilleja Feb 90:1

Nuttall, T. 1840. Descriptions of new species and genera of plants. Trans. Am. Phil. Soc. n.s. 7:347-348.

Rollins, R.C. 1950. The guayule rubber plant and its relatives. Contributions Gray Herbarium 172: 1-73.

West, J. and J.G. Waines. 1988. Hybridization between guayule, *Parthenium argentatum* and *Parthenium alpinum* (Asteraceae). Bulletin Torrey Botanical Club 115(4): 290-296.

A New Sensitive Plant Species List for the USDA Forest Service in the Rocky Mountain Region (Region 2)

By Beth Burkhart, USDA Forest Service Botanist
Custer, South Dakota

The National Forest Management Act (NFMA) requires the Forest Service to maintain "viable populations of existing native and non-native [vertebrate] species in the planning area" (planning area = all Forest Service lands) by providing habitat "to support, at least, a minimum number of reproductive individuals, and that habitat must be well distributed so that those individuals can interact with others in the planning area" (36 CFR 219.19). U.S. Department of Agricultural Regulation 9500-004 extends this obviously discriminatory concern for viability to cover plants and invertebrates when it states: "habitats for all existing native and non-native plants, fish and wildlife species will be managed to maintain at least viable populations of such species." It's quite a tall order to assure maintenance of ALL species occurring on National Forest system lands (both on national forests and national grasslands), but that's what the Forest Service in Region 2 (R2) is required to do in Wyoming, Colorado, South Dakota, Nebraska, and Kansas!

How does the Forest Service make this a manageable requirement? By considering all plant species somewhere on the spectrum from widespread, flourishing, and abundant to uncommon, declining, and sparse – and focusing attention on those that are on the uncommon, declining, and sparse end. The Forest Service's Sensitive Species program is designed to address the mandate by working to prevent a trend toward listing species under the Endangered Species Act of 1973. Sensitive species are defined in the Forest Service Manual, FSM2670.5, as "those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: a. significant current or predicted downward trends in population numbers or density, or b. significant current or predicted trend in habitat capability that would reduce a species' existing distribution."

Why would a plant species ever hope to be designated sensitive? Given that a species fits the description of uncommon, declining, and sparse, sensitive status should help to protect and maintain the species and its habitat. Agency policy requires the Forest Service to avoid or minimize impacts to sensitive species. One of the main tools to implement the policy is a biological evaluation - an investigation and determination of the potential effects of individual programs, projects, and activities on a species and its habitat that must be done for every project that goes through a National Environmental Policy Act (NEPA) process. Decisions to proceed with projects must not result in a loss of viability or cause a trend toward listing under the Endangered Species Act of 1973.

In R2, the Forest Service has been working with a Sensitive Species List developed in 1994. That list was comprised of 87 animals (including mammals, birds, fishes, amphibians, reptiles, and invertebrates) and 79 plants for a total of 166 sensitive species. Information has changed greatly from 1994 to 2000, so the Regional Forester decided it was time to develop a new list. In January 2001, the process and criteria used for determining sensitive status were approved and steps toward a new sensitive species list begun.

The process includes: 1) pre-screening of all known flora and fauna in the region, 2) application of evaluation criteria to each species, 3) determination of status, 4) peer review of the evaluation and determination steps, 5) publication of the draft final sensitive species list in the Federal Register for public comment, and 6) finalization of the final sensitive species list as a Rocky Mountain Region supplement to the Forest Service Manual. The list will be open to change by submission of petitions for change from the Forest Supervisors in R2 (exact process not yet defined). It's hoped the list will not go for another ten years without update, but stay more current with information that becomes available on species every year.

Right now, the Forest Service is in step 4 of the process above – peer review of the evaluation and determination steps, with a draft sensitive species list completed.

Step 1: Pre-screening. Pre-screening factors for plant species included:

- The Nature Conservancy (TNC)/State Heritage Program designation of G or T or N 1-3 (Globally critically imperiled, imperiled, or vulnerable OR Nationally critically imperiled, imperiled, or vulnerable)
- Candidate for federal listing
- IUCN (World Conservation Union) = Critically Endangered, Endangered, or Vulnerable
- Bureau of Land Management (BLM) sensitive species
- De-listed from federal listing within the past five years
- State Threatened, Endangered, Species of Concern, Species of Special Concern, or Sensitive
- TNC/State Heritage Program S1-2 (State critically imperiled or imperiled)

The agencies involved here have screened thousands of potentially imperiled species. Their lists are deemed highly credible and have undergone a high degree of scientific rigor and scrutiny over a sustained period of time. Species that met one of the pre-screening factors was considered a priority for evaluation for the R2 sensitive species list. (cont. p. 6)

Step 2: Apply evaluation criteria. Roughly 600 plant species were identified by the pre-screening factors. Each species was evaluated by a combination of Forest Service and non-Forest Service botanists and biologists using the following evaluation criteria:

? Geographic distribution within the Rocky Mountain Region
? Geographic distribution outside the Rocky Mountain Region
? Capability of the species to disperse
? Abundance of the species in the Rocky Mountain Region
? Population trend in the Rocky Mountain Region
? Habitat trend in the Rocky Mountain Region
? Vulnerability of habitats in the Rocky Mountain Region to modification as a result of land management activities currently implemented or proposed for implementation
? Life history and demographic characteristics of the species

Each criterion was assigned an A, B, C, or D rank of concern (A= High concern, B= Some concern, C= No concern, D= Insufficient information to assign a rank).

Step 3: Determination of status. The final determination for each species was based on a synthesis, review, and discussion of all the criteria by a team of Forest Service botanists and biologists. Rationale for each determination was documented and will be available to the public when the list is published for public comment.

It's important to know that the final determination for each species involved assigning it to one of four categories:

1) R2 Sensitive Species
2) Not R2 Sensitive Species but Should Be Considered for Other Emphasis Lists (there are species that don't have a viability concern in R2 but which are appropriate to track at other levels – examples of Emphasis Lists at the Forest level include Species of Local Concern and Management Indicator Species)
3) Not R2 Sensitive Species and Not of Concern
4) Insufficient Information to Make a Determination (there are some species that are so poorly known (inventory-wise as well as biology-wise) that there is not enough information available to make a educated determination whether it warrants sensitive status or not)

Step 4: Peer review. The evaluations, determinations, and rationales for each species were peer reviewed by Forest Service botanists, biologists, and managers (from Districts, Forests, and the Regional Office) as well as non-Forest Service botanists, biologists, and managers from other federal and state agencies (including the US Fish and Wildlife Service, BLM, and State Heritage Programs).

This is the step where the process is as of this writing. There has been an active review process by all participants and several confounding factors to the process running as smoothly it might in the ideal world. The time factor has been an issue – putting a timeline on the process that didn't always mesh with evaluators' schedules (both inside outside the Forest Service), or allow for expert data/information management.

The schedule now is that the Regional Forester will sign the final R2 sensitive species list at the end of February 2003. There will likely be some shifting of numbers, but a rough synopsis of the expected end result is that the sensitive plant list will change from 79 species to approximately 130. The sensitive animal list will change from 87 species to approximately 85. With the animal list, even though the final number stays fairly constant, the composition of the new list will likely be about 60% different from the 1994 list. It's important to remember that species were not "taken off" the list – all species were evaluated the same way to determine those species warranting sensitive species status, whether they were on the old list or not.

So stay tuned to your local Forest Service contact person for the final R2 sensitive species list. The approach used in developing the sensitive species list in 2003 seems to be producing a result that moves plant species toward an equal footing with animal species – i.e. a more appropriate proportion of sensitive species to total number of species present. It's also been an eye-opener to many people throughout the Forest Service regarding how little is known about many plant species, and that the information that's missing is essential to developing conservation strategies for species the Forest Service is committed to protecting!

What does all this mean to a devoted member of Wyoming Native Plant Society? It means it's likely that a larger share of the wonderful state and regional endemic plant species that call Wyoming home will have a greater protective status on Forest Service lands. It also means that attention will be drawing around both those species designated sensitive as well as those species labeled "Insufficient Information to Make a Determination." This, in turn, means that any survey, inventory, population trend or habitat trend data (just to name a few areas) that many of you readers gather and publish or roll up into Wyoming Natural Diversity Database (WYNDD) information will continue to be extremely valuable in helping the Forest Service carry out its mandate to conserve the flora and fauna on its lands (which are your lands) and keeping Wyoming the wild and wonderful place it is.

(*The list had not been released at the time this newsletter went to press. Watch for an overview of list or policy changes in future issues.*)

Confessions of a Moonwort Stalker

By Mr. X*

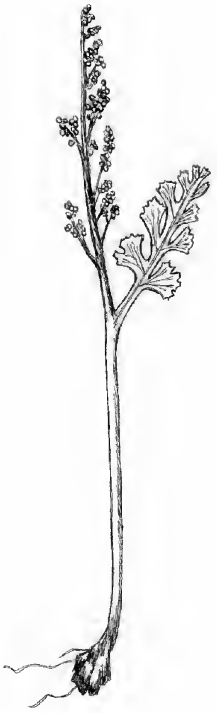
*(*Due to the sensitive nature of this topic, Walter Fertig asked that his name not be included with this article. It is reprinted from the Bighorn Native Plant Society newsletter of June*

2002).

Looking back now, it seemed so innocent at first. George Jones and I were hiking along Cub Creek, a mile or so above its confluence with Pumpkin Creek in the northeastern Bighorn Range on a hot August afternoon in 1996. Our progress was slow as we hacked our way over the steep terrain of broken limestone rubble and dense, streamside vegetation. We were here as part of a week-long study to map the vegetation and document the flora of the Mann Creek drainage, a large chunk of wild countryside being considered for designation as a Research Natural Area by Bighorn National Forest. At that very moment, however, I was thinking less about research and more about taking a short breather from the hard day's work.

I spotted a small spring high up on the steep, north-facing slope above Cub Creek and decided this shady spot would serve quite nicely for a short break. As I climbed up the wet, moss-covered boulders I mentally took note of the plants - mostly Ciliate bluebells and Brook saxifrage under deep shade of Engelmann spruce and Subalpine fir. One little plant happened to catch my eye, however - a tiny, limey-green splash of color against the deep gray-green of the moss. In hindsight, I wish I had turned away, or stopped for a break somewhere else along the stream, or looked right instead of left. But I guess it was fate that I happened to catch a glimpse of my first Mingan moonwort (*Botrychium minganense*), starting an obsession with these diminutive ferns that has not ceased to this day.

To the uninitiated, my fascination with moonworts may seem peculiar at best. Moonworts are mostly small, primitive vascular plants of the genus *Botrychium* that are related to the true ferns (but placed in their own family, the Ophioglossaceae). Like ferns, club mosses, and horsetails, moonworts reproduce solely by spores, rather than seeds as do flowering plants and gymnosperms. The spores of moonworts are borne in small round spheres called sporangia that are usually clustered along the margins of a specialized leaf and may superficially resemble a cluster of grapes (grapefern is another common name for *Botrychium*). Spores are microscopic packets of germ plasm which, like many seeds, are dispersed widely from the parent plant via wind or water. On finding a suitably moist spot of soil, the spore germinates into a fleshy, brownish, subterranean string-like plant called a gametophyte which bears no resemblance to its parent. Gametophytes are unusual in that they possess only one half the complement of chromosomes as their parent and cannot produce their own food by photosynthesis - instead relying on symbiotic fungi (mycorrhizae). Gametophytes produce eggs and sperm in specialized structures called antheridia and archegonia. When fertilized, the egg will grow out of the archegonium into an adult plant with the typical moonwort morphology called a sporophyte (literally "spore plant"). Moonworts, like other lower vascular plants, exhibit a life cycle that alternates between sporophyte and gametophyte forms with each generation.



Right: Upward-lobe moonwort (*Botrychium ascendens*). Illustration by W. Fertig from *Wyoming Rare Plant Field Guide* (1994).

Mature sporophytic moonworts can be recognized by their single, green, fleshy leaf that is divided into two separate fronds. The larger portion is called the vegetative frond because it does not produce spores or sporangia, and is usually once to twice pinnately divided into rounded or toothed leaflets. The size and shape of the leaflets are often useful for identifying different species. The name moonwort is derived from the leaflet shape of many *Botrychium* species which resemble half-moons. Attached to the vegetative leaf is the smaller fertile frond which bears the grape-like sporangia. Fertile fronds may be similar in appearance to the vegetative segment, or more typically are smaller and more deeply divided. The shape, size, and point of attachment of the fertile frond (also called the sporophore) are diagnostic features for identification.

Most moonworts are very low in stature (often being only a few inches tall) and are often obscured by surrounding vegetation. Many of the species are also quite rare and often restricted to unusual or challenging habitats, ranging from alpine talus slopes to dense willow thickets and mosquito-infested swamps. This can make moonwort hunting a tremendous challenge. For some of us, the hunt can lead to a life-long obsession.

There are eight species of moonworts known from Wyoming, and unverified reports of three (cont. p. 10) others. Seven of these species are known or reported from the Bighorn Range. The most common moonwort in the Bighorns and Wyoming as a whole is, appropriately enough, the Common moonwort (*Botrychium lunaria*). This species can be recognized by its overlapping, fleshy, broadly fan-shaped leaflets and bead-like fertile leaf segment attached near the middle of the leaf. In the Bighorns, *B. lunaria* can be found in moist meadows, swampy forests, and alpine meadows and rocky slopes in

Bighorn, Johnson, and Sheridan counties.

The Common moonwort is closely related to the Mingan moonwort, and in the past taxonomists have treated the two as the same species (*B. minganense* is sometimes called *B. lunaria* var. *onondagense*). Mingan moonwort can be distinguished by its more oblong leaf segments that do not overlap. *B. minganense* is uncommon in Wyoming, being known from less than 5 extant populations in the Absaroka and Bighorn mountains.

Prior to 1996, only the Common and Mingan moonworts were known from the Bighorn Range. On the same fateful day that we found *B. minganense*, George Jones and I also discovered the first population of Rattlesnake fern (*Botrychium virginianum*) reported from the Bighorns. Our population (actually a single individual that we carefully photographed to document its presence) was located just downstream of the *B. minganense* site on Cub Creek at the base of another moss-covered limestone spring. Rattlesnake fern is the largest of the moonwort species in the state and can be recognized by its broadly triangular, twice to thrice-compound, 2-10 inch long leaf blades borne on elongate leafstalks up to 12 inches long. This is one of the most widespread *Botrychium* species in North America, but is fairly rare in the mountains of Wyoming. It is mostly found in moist, shaded valley bottoms on lime-rich soils within dense spruce forests.

Four years ago, I discovered the first reported population of Lance-leaved moonwort (*Botrychium lanceolatum*) in the Bighorn Range while conducting a study of the rare Northern blackberry (*Rubus acaulis*) along Sourdough Creek (Johnson County). As part of my study, I was setting up a transect to count the number and density of blackberry stems in a dense thicket of willow in a hummocky swampland. Just as I went to pound in the corner stake for the plot, I noticed a yellowish-green leaf poking through the tall sedges and reedgrass - a new moonwort! Sacrificing scientific accuracy (I moved the corner post over a few centimeters to spare the moonwort), I spent the next hour engaged in a HAK (hands and knees) survey of the deer fly-riddled swamp but found only 3 more of the elusive ferns. *B. lanceolatum* can be identified by its once or twice compound triangular sterile leaf blade that is attached directly to the main leafstalk (sessile). Besides the Bighorn population, this species is known from only two other sites in Wyoming in the Wind River and Medicine Bow mountains.

In July 2001, I took a break from fieldwork pursuing the still elusive Hall's fescue on Bighorn National Forest to visit the French Creek Swamp in pursuit of moonworts. French Creek had come to my attention a few years earlier when Faye Streier of the NRCS in western South Dakota reported finding the Crenulate moonwort (*Botrychium crenulatum*) there. Crenulate moonwort had previously been reported for Wyoming by the late Dr. Warren Wagner in the fern volume of *The Flora of North America*, but when I asked Wagner about the report a few years later he confessed that he had never actually seen any evidence of the species in the state, but presumed it should be here since it occurs in adjacent states. Faye provided a detailed report of her discovery, but unfortunately had no voucher specimen or photo for confirmation. Accompanied by my trusty, canine field companion, Max, we hiked into the swamp (located just 3 miles NW of Hunter Work Camp) to see if we couldn't resolve the mystery.

Right: Rattlesnake fern (*Botrychium virginianum*) by Jane Dorn

French Creek Swamp is an extensive rocky-hummocky wetland with thick, saturated deposits of organic soil and litter - just the sort of place a rare plant and moonwort hunter dreams about on warm summer afternoons. After 10 minutes of HAK survey I was rewarded with the day's first moonworts - tiny little plants just starting to unfurl their sterile and fertile fronds after a delayed Spring. These ferns were quite unusual in that the sterile frond was attached at the very base of the plant, rather than midway up the leafstalk. Running it through the plant key, I realized I had stumbled upon the Least moonwort (*Botrychium simplex*), one of the smallest of Wyoming's moonworts and the second most common after *B. lunaria*. This find, however, did represent a new distribution record for the Bighorns and Johnson County.

Knowing that multiple species of moonworts can be found in the same habitat, I pressed on in search of *B. crenulatum*. A few wet hummocks later, I found my quarry - 10 small ferns with sharp-tipped, shallowly-lobed sterile leaflets attached on a short stalk above the middle of the common leafstalk. Additional survey uncovered another 25-50 individuals, each with sharp-toothed leaflets. This started to trouble me, since *crenulatum* is supposed to have rounded teeth. Again consulting my dog-eared copy of Dorn's *Vascular Plants of Wyoming*, I discovered that my new plants were probably not Crenulate moonwort, but its close cousin, the Upward-lobe moonwort (*B. ascendens*), another new species for the Bighorns and listed as Sensitive by the US Forest Service. Previously, *B. ascendens* was known only from the southern Absarokas in Wyoming, and relatively few other locations across western North America (it is considered quite rare globally by The Nature Conservancy). I collected a small specimen and took numerous pictures of the new plant and later had Dorn confirm its identity.

Unfortunately, I overspent my time at French Creek Swamp and had to depart without finding *B. crenulatum*. Perhaps Faye had mistaken *B. ascendens* for *crenulatum* (they are very similar). But perhaps *B. crenulatum* is still out there - waiting for another crazed moonwort stalker to renew the hunt.

Ask Linnaeus!

Questions about Wyoming native plants

Dear Linnaeus,
I was very disappointed to learn that there are no native apples growing in Wyoming. It just seems wrong since it is well known that Johnny Appleseed planted as far west as Wisconsin, so they should be here. This issue and four cups of coffee keep me awake every night, and I am going crazy!

Frantic in Farson

Dear Fran,
You have hit on a perplexing situation that has troubled botanists, foresters, pastry chefs, and scrap metal dealers for years. In fact, this strange condition inspired the movie *Absence of Malus*, and no satisfactory hypothesis has since been proposed beyond the statement "Because!" L.

Dear Linnaeus,
Last summer when I was in Yellowstone, I saw some white flowers growing in a wetland near Canyon City. What were those flowers? And what were the other ones in the forest?

Bogged down in Baggs

Dear Bogged,
From your description, it sounds like the white flowers belong to a plant that grows in that area. The ones in the forest were probably something else. L.

Dear Linnaeus,
This question has bothered me for a long time! What would you say is the best way to recognize a dogwood?

Perturbed in Pinedale

Dear Piney,
By its bark. L.

Dear Linnaeus,
How would you explain floristic endemism along the Great Basin Divide as influenced by substrate specificity and post-Laramide regional geomorphology?

Professor Werner von Schlectenhoffen,
BS, MS, PhD, LAPD, NADPH

Dear Prof.
I'm sorry, we only take questions about plants. L.

Dear Linnaeus,
I know that western wheatgrass (*Elymus smithii*) is common in our flora, and I was wondering if there is an eastern equivalent. Is there?

Curious in Casper

Dear Curious,
Indeed there is! We found a relic population of eastern wheatgrass over near Torrington. Due to the high cost of publishing, it was never formally described and, therefore, has not been included in the floral manuals. However, we expect the description to come out next month in the *National Enquirer*, and the species will be called *Elymus jonesii.* L.

Statewide Color Infrared Orthophotos

Color infrared aerial photography of the entire state of Wyoming was collected by the U.S. Geological Survey during the summers of 2001 and 2002. Many are available for download through the Wyoming Digital Orthophoto Browser at http://www.wygisc.uwyo.edu/doqq/, at 1 meter resolution, in MrSid format, but are not yet georeferenced.

Black-and-white digital orthophotos are already available and the entire set of color infrared imagery should be georefenced by early 2004 and made available for download incrementally throughout 2003-2004.

Note: The deadline for contributions to the May issue of *Castilleja* is 22 April. If you have announcements, questions for Linneaus, or book reviews, send them to WNPS, P.O. Box 3452, Laramie, WY 82071.

Summer Botany Courses in Laramie

Two field botany/plant taxonomy courses are being offered this summer in Laramie. "Flora of the Rocky Mountains" is a University course (3 credits) that "acquaints students with the flora of the surrounding region. Emphasizes field identification and collection from plant communities encompassing a wide range of environments, such as grasslands, forests and alpine tundra." The emphases of the course are plant taxonomy and field identification skills. General Biology is a prerequisite. Less rigorous is "Beginning Field Botany," offered through the University's Community Enrichment Program. This is a four-week course consisting of one evening session and one half-day weekend field trip each week. It will cover the basics of plant identification, introduce participants to the excellent botany resources available in Laramie, and include some discussion of plant ecology, plant geography and rare plant conservation.

"Flora of the Rockies" runs June 18 - August 8. "Beginning Field Botany" is tentatively scheduled June 19 - July 12. For costs and more details, see UW's Summer Session Bulletin (now available), and the Community Enrichment Program's summer catalog (available in April). Both courses are taught by Hollis Marriott, who received her MS in Botany from UW in 1985. She has worked as a field botanist in Wyoming and South Dakota, with an emphasis on public lands management.

The Wyoming Native Plant Society, established in 1981, is a non-profit 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 $7.50 annually.

To join or renew, return this form to:

Wyoming Native Plant Society
PO Box 3452
Laramie, WY 82071

Name: _____

Address: _____

_____

___ $7.50 Regular Membership
___ $15.00 Scholarship Supporting Member
($7.50 goes to the annual scholarship fund)

Wyoming Native Plant Society
PO Box 3452
Laramie, WY 82071