Castilleja

The Newsletter of the Wyoming Native Plant Society

May 2000
Volume 19, No. 2

Special Black Hills Botany Issue

In this issue:

American Trailplant (*Adenocaulon bicolor)* is a white-flowered, perennial member of the sunflower family (Asteraceae). It occurs primarily in the Pacific Northwest, but widely disjunct populations are also found in the Black Hills of Wyoming and South Dakota and in the northern Great Lakes area. Trailplant gets its name from its white-woolly leaf undersides which, when trampled, are exposed to reveal a traveler's path. In the Black Hills, trailplant occurs mostly on north-facing slopes in small, moist drainages dominated by Paper birch, Ironwood, and Aspen forests. Although listed as Sensitive by the Forest Service, many new colonies have been discovered as a result of recent surveys in Wyoming and South Dakota. In Wyoming alone, the total population numbers about 25,000 individuals, suggesting that the species is less threatened than once thought. Illustration by Walter Fertig from the *Wyoming Rare Plant Field Guide.*

WNPS NEWS

Membership Renewal/Elections: Enclosed with this issue is a renewal notice and ballot for new Society officers. Members with a 98, 99, or 00 on their mailing label need to renew to remain in good standing, while those with a 01 are paid through the year. The following individuals have agreed to run for the WNPS board: President – Amy Roderick, Vice-President – Joy Handley, Secretary/Treasurer – Walt Fertig, and 2-year board member- Jim Ozenberger. As always, write-in votes are welcome (although please, no votes for Ross Perot). Please also nominate sites for next years annual meeting/field trip on the ballot.

2000 WNPS Annual Meeting/Field Trip: The Society's annual meeting is scheduled for the weekend of June 17-18 in the Shirley Basin and surrounding mountains of central Wyoming. Plan to meet at the state rest area near the junction of highways 487 and 77 on Saturday morning (June 17) at 8:30 AM for a brief business meeting in the parking area. From here, we will proceed to Chalk Mountain to observe a variety of unusual cushion plant species, including the state endemic *Sphaeromeria simplex* (Laramie false sagebrush) and wildflowers. We also plan to explore the Agate Flats area for spring cushion plants and Shirley Mountain (weather permitting) for Brandegee's polemonium and other showy species. For those who wish to continue on Sunday, we will be camping out Saturday night on Chalk Mountain or Shirley Mountain.

Black Hills Field Trip: In conjunction with the Great Plains Native Plant Society, Hollis Marriott will be leading a field trip to the Black Hills of Wyoming and South Dakota on the weekend of July 21-23 (sorry, but this date does not coincide with the Sturgis motorcycle rally). For more details, see page 11 for the full itinerary and map.

New Mailing Address: Please note that the Society has changed its mailing address to PO Box 3452, Laramie WY, 82071.

We're looking for new members: Do you know someone who would be interested in joining WNPS? Send their name or encourage them to contact the Society for a complimentary newsletter.

Attention Readers: We are always looking for articles and illustrations for the newsletter. Items for the October issue are needed by 25 September 2000.

Treasurer's Report: Balance as of 15 May 2000: General Fund $387.14; 2000-2001 Student Scholarship Fund $40.00; Total funds: $427.14

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

President: Jim Ozenberger (Jackson)
Vice President: Amy Roderick (Laramie)
Secretary-Treasurer: Laura Welp (Laramie)
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Newsletter Editor: Walter Fertig (307) 766-3020 (wk)/e-mail: clyde@uwyo.edu .

Teton Chapter: PO Box 82, Wilson, WY 83014 (Joan Lucas, Treasurer).

Other Regional Plant Societies:

Bighorn Native Plant Society, PO Box 21, Big Horn, WY 82833 (contact Jean Daly for more information)

Great Plains Native Plant Society, PO Box 461, Hot Springs, SD 57747 (contact Cindy Reed for more information)

Contributors to this issue: Walter Fertig (WF), Hollis Marriott, Dave Ode, C.L. Porter.

Special Black Hills Botany Issue

The Black Hills of northeast Wyoming and northwest South Dakota have long attracted attention for their unusual flora – a hodgepodge of species from the Rocky Mountains, boreal forests of Canada, the deciduous forests of the Eastern United States, the Great Plains, and Great Basin. In all, over 1300 vascular plant species have been documented in the Black Hills, including nearly 100 rare species that are at the periphery of their range or widely disjunct. Dozens of rare or unique plant communities are present in the Hills, providing habitat for a host of wildlife species, including several endemics (such as white-winged junco, Black Hills redbelly snake, and Cooper's Rocky Mountain snail). With the growth of human populations in the region and high demand for natural resources (timber, minerals, and space for recreation), the flora of the Black Hills is increasingly threatened. This special issue of *Castilleja* has been prepared to increase awareness and appreciation for the Black Hills and its important botanical values.
WF

The Black Hills Landscape

By Hollis Marriott

The Black Hills are a small isolated mountain range on the Great Plains of western South Dakota and northeastern Wyoming. They were named for the dark covering of Ponderosa pine that contrasts with the surrounding prairie. The Hills are perhaps most widely known for abundant tourist attractions and the annual Sturgis motorcycle rally. But the area offers far more, including scenic beauty, excellent outdoor recreation, and explorations in natural history that are both fascinating and accessible.

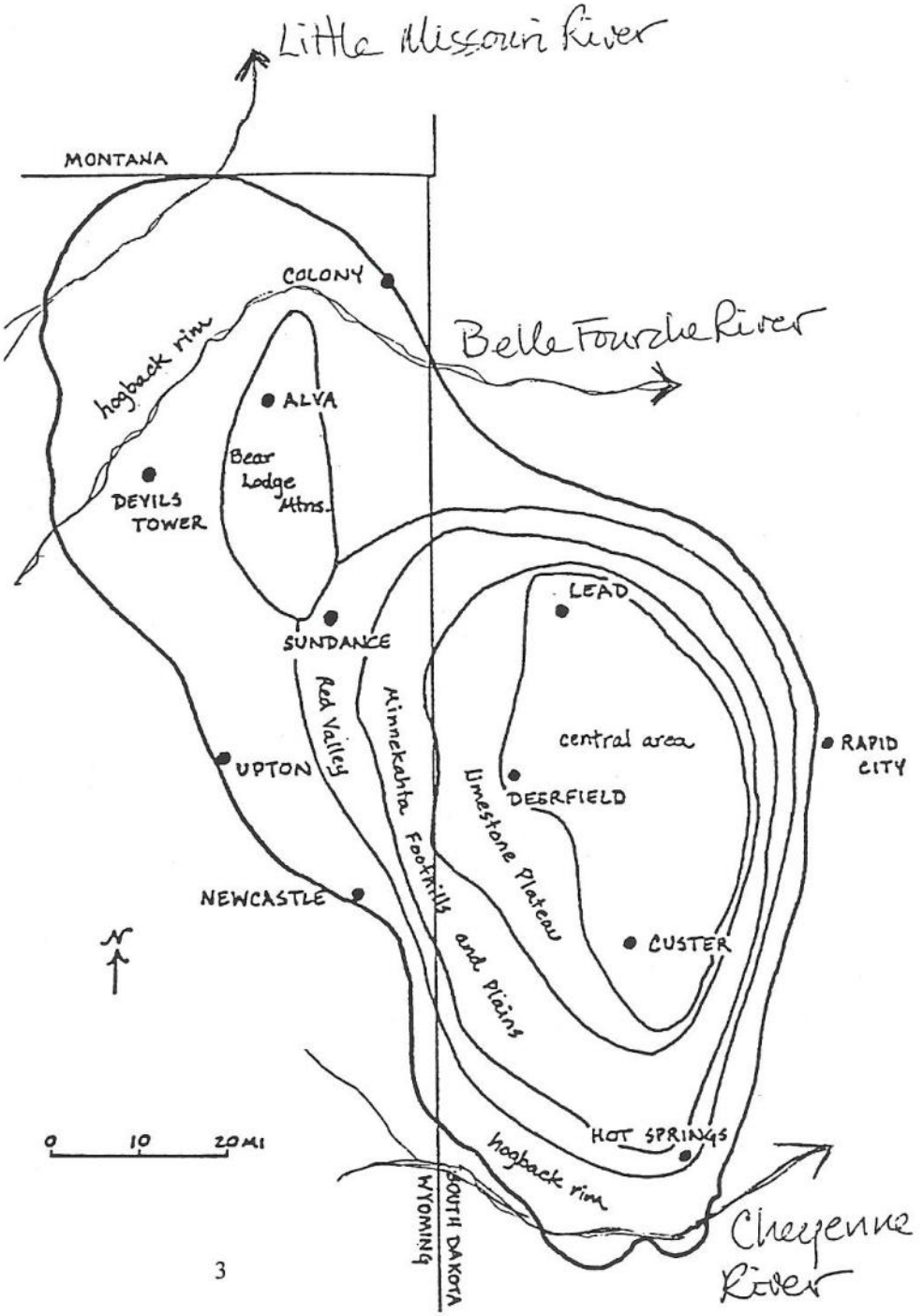
Though located on the Great Plains, the Black Hills are related to the Rocky Mountains, as they were created at the same time and exhibit the same style of uplift. The erosion that followed has produced a rounded mountain range with concentric exposures of progressively younger rocks moving from the center outwards. Five "geomorphic regions" have been recognized within the Black Hills based on these concentric zones of rock and the distinctive landscapes that have developed (see map). These can be easily seen from roads crossing the area.

The Central Core includes the oldest rocks found in the Black Hills - granite, schist and slate more than 1.6 billion years in age. It is a rugged hilly area with numerous rock outcrops, and narrow dark canyons. Elevations are relatively high, and this region includes Harney Peak, the high point of the uplift at 7242 ft. Mount Rushmore and the Black Hills Needles are other famous outcrops. Surrounding the Central Core is the Limestone Plateau. It is best developed on the west side, where the erosion-resistant limestone has produced a broad plateau-like surface with elevations as high as 7000 feet in places. The landscape is less rugged here, with forested hills and mountain meadows in broad drainage bottoms.

Elevations drop from the Central Core and Limestone Plateau through the Minnekahta Foothills (sandstones and limestones) to the Red Valley or Racetrack, which surrounds the high Black Hills. The racetrack is derived from a collection of soft red sandstones and siltstones with gypsum lenses. Because these rocks are so soft, erosion during the millions of years following uplift of the Hills has produced a low-lying area of rolling prairies and eroded red bluffs. The more hospitable nature of the Red Valley made it attractive for town sites. Sundance, Beulah, Spearfish, Sturgis and part of Rapid City all are located within the Red Valley.

The outermost geomorphic region is the Hogback Rim, made of sandstones, siltstones and shales. The more resistant sandstones have been eroded into prominent "hogbacks" or ridges, for example Dinosaur Hill on the west side of Rapid City, and the Elk Mountains south of Newcastle.

A zone of unusual geologic features crosses the northern Black Hills from Hulett east to Sturgis. This was an area of volcanic and subsurface igneous activity late in



the mountain-building episode that produced the Black Hills. The most famous of these are Devils Tower and Bear Butte, but there are many others, such as Sundance Mountain, Inyan Kara Mountain and the gold-mining region of Lead and Deadwood. The Bear Lodge Mountains north of Sundance are a small uplift superimposed on the Black Hills during this period. Technically a part of the Black Hills, the Bear Lodge is sometimes considered distinct from the "Black Hills proper," the two being separated by the Red Valley in the vicinity of Sundance.

The Black Hills Managed Forest

By Dave Ode

In November 1899 the Federal Government held the first ever regulated timber sale, "Case No. 1," in the Black Hills Forest Reserve just south of Nemo, SD. Gifford Pinchot himself negotiated the terms of the sale with the purchaser - Homestake Mining Company. Pinchot became the first Chief of the Bureau of Forestry (what is now the Forest Service).

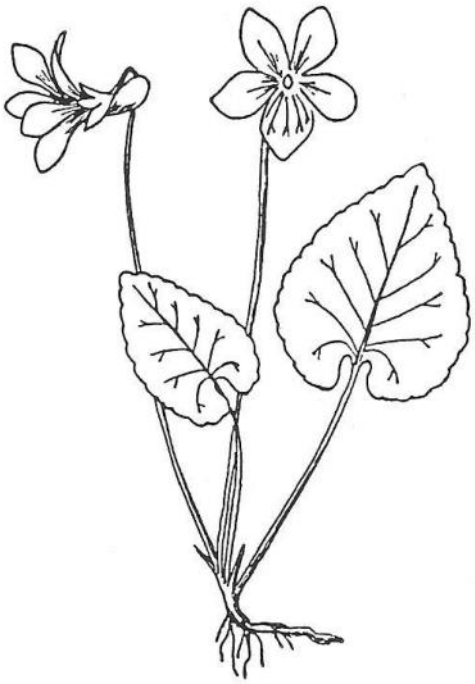
Since then, Black Hills National Forest has been a model of production-oriented forest management. Consider the fact that for most of its history the relatively small Black Hills National Forest annually produces more harvested timber than all of the other forests in the Rocky Mountain Region combined. That includes all the National Forests in Colorado (Arapaho-Roosevelt, Grand Mesa, Uncompahgre, Gunnison, Pike-San Isabel, Rio Grande, Routt, San Juan, and White River) plus three Wyoming National Forests (Bighorn, Medicine Bow, Shoshone). In 1996 for example, Black Hills NF harvested 65 million board feet (mbf) of lumber compared to 6 mbf on Shoshone NF, and 5 mbf on Bighorn NF. In terms of acreage, each year there is about 20,000 acres of forested land (public and private) in the Black Hills that receives some cutting/logging in one of four typical treatments: precommercial thinning, commercial thinning, seed cut, or overstory removal.

Timber harvest at this scale, necessitates road construction, so as a comparison, in 1996 there were 5 miles of road constructed/reconstructed on Shoshone NF, 3 miles on Bighorn NF, and 150 miles of road construction/reconstruction on Black Hills NF. After one-hundred years of timber management, it should not be surprising that the Black Hills has a higher road density than any other national forest.

In terms of livestock production, the Forest Service currently permits approximately 135,000 animal unit months of livestock grazing each year on Black Hills National Forest (that's about 25,000 head of livestock, mostly cattle).

While the Black Hills is clearly a "working forest," with a working human population, most people come to the Black Hills to play. There are approximately 140,000 permanent human residents of the Black Hills, but each summer about 4 million tourists pay a visit. That's about 25 visitors per resident. In just one economic measure, sport fishing alone is estimated to be worth $30 million annually, with tourists and residents logging about 500,000 angler-days each year. This angling industry is based primarily on trout (brook, rainbow & brown), which have been introduced into Black Hills waters which historically had a variety of native fishes but no trout.

These numbers should illustrate that the Black Hills National Forest is a forest with a lot of historically dependent industries with demands for timber production, demands for livestock forage, demands for recreation, demands for fire fighting. These numbers should also help imply why demands for forest preservation create such controversy. This battle is not new. The conflict between forest management and forest preservation originally had two champions: Gifford Pinchot (cited above) and John Muir (founder of the Sierra Club in 1892). Pinchot clearly won the first battle over the Black Hills. Today, the followers of John Muir are fighting that battle again.



Above: Great-spurred violet (*Viola selkirkii*) is a circumboreal species with disjunct populations in the South Dakota Black Hills and Colorado. It can be recognized by its leafless flowering stalks, minutely hairy heart-shaped basal leaves, and glabrous pale violet-purple flowers with an enlarged spur. This species is restricted to moist, mossy benches or rocky slopes in cool ravines. Great-spurred violet is listed as Sensitive by the US Forest Service. Illustration by W. Fertig.

Vegetation of the Black Hills

By Hollis Marriott

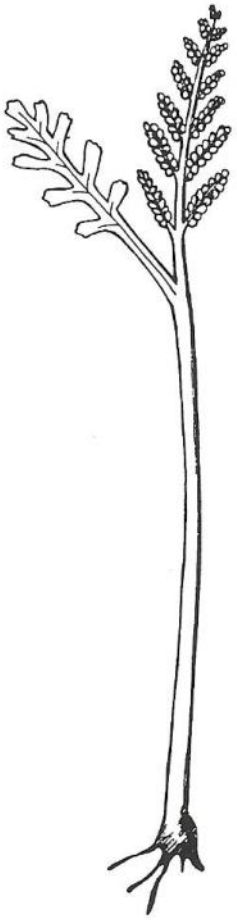
In 1999, the *Black Hills Community Inventory Final Report* was released by the Midwest Conservation Science Center of The Nature Conservancy. This report is based on three field seasons of research by the authors, as well as other earlier studies. Funding for the project was provided by Black Hills National Forest, The Nature Conservancy, local industries, and several other groups. Project goals were to classify and describe all vegetation types of the Black Hills, and to identify high-quality examples. The resulting classification consists of 68 "plant communities" (vegetation types). Eight of the sites surveyed are considered exemplary sites, with high-quality examples of multiple vegetation types in relatively-intact natural settings. Another six were recognized as "potential exemplary sites" for which additional survey is needed. Most surveys were done on public lands, and all sites considered exemplary are in public ownership.

The overview below is taken from the introductory section of the final report. The entire document is available from The Nature Conservancy (Jennifer Hall, 612-331-0708), and Black Hills National Forest (605-673-2251); there may be charges for reproduction and postage. The complete citation is: Marriott, H., D. Faber-Langendoen, A. McAdams, D. Stutzman and B. Burkhart. 1999. *Black Hills Community Inventory. Final Report.* Minneapolis: Midwest Conservation Science Center, The Nature Conservancy.

Much of the Black Hills is covered with Ponderosa pine forest. This is the most extensive vegetation type over much of the Central Core, Limestone Plateau, higher Minnekahta Foothills and Bear Lodge Mountains. More moist sites at higher elevations support White spruce forest. Pine forest intergrades with Ponderosa pine woodland at lower elevations. Pine woodland includes more open stands of ponderosa pine, often in association with grasses and other prairie species.

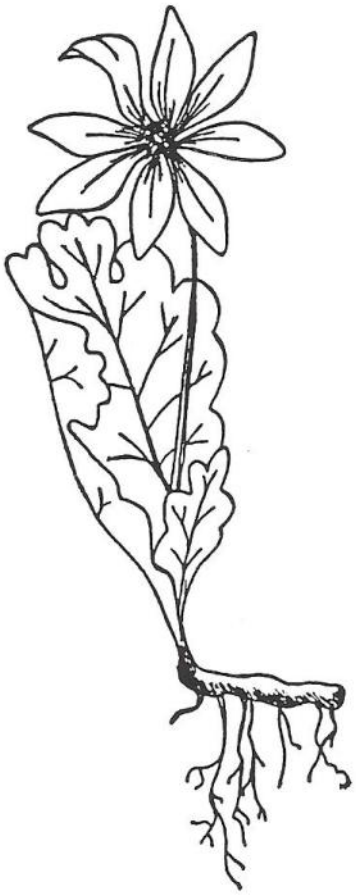
Hardwood-dominated vegetation occupies in both upland and riparian habitat. Aspen forest occurs on upland sites in the Central Core, Limestone Plateau, higher Minnekahta Foothills and Bear Lodge Mountains; occasional small stands are found at lower elevations. At lower elevations, Bur oak, often mixed with Ponderosa pine, can form large stands, especially in the northern and eastern parts of the Black Hills. On the northeastern perimeter, Bur oak savanna with a grassy or sparse understory covers broad exposures of Mowry shale.

Riparian hardwood vegetation includes Paper birch forest - common at higher elevations. At lower elevations, this type gives way to Bur oak with Ironwood. Other low-elevation riparian woodland types include cottonwood stands on floodplains, and a mix of hardwoods such as oak, ash, Boxelder, elm and hawthorn in draws and drainages.



Above: Prairie moonwort (*Botrychium campestre*) is known from a single location in the Black Hills and is listed as Sensitive by Black Hills National Forest. Robert Dorn first discovered this diminutive fern in 1973 in a sandy Ponderosa pine/aspen forest near the summit campground in Wyoming's Bear Lodge Mountains. Elsewhere in its range, *B. campestre* is typically found in untilled grasslands derived from loess, sand, or limestone. Attempts to relocate this species in 1989, 1993, and 1999 have been unsuccessful, perhaps due to its ephemeral life cycle (the single vegetative and fertile frond exists above-ground for only a brief period in early spring).

The summit campground is also famous as the home of the "outhouse selaginella" (*Selaginella rupestris*), an uncommon Black Hills fern-ally that was first discovered by the late C.L. Porter growing near the steps of the campground outhouse in 1962. *S. rupestris* (perhaps better known as the Ledge spike-moss) is still present at the site and is locally abundant on sandy soils with deep needle duff. Illustration by W. Fertig.



Above: Bloodroot (*Sanguinaria canadensis*) is named for the reddish-orange juice that exudes from its rhizome when broken. This member of the poppy family is known from only a handful of extant populations in the South Dakota Black Hills (no populations have ever been found on the Wyoming side). Bloodroot occurs on floodplain terraces and north-facing slopes with rich leaf litter in dense oak, birch, or pine woods. Although widespread from Nova Scotia and Manitoba south to Oklahoma and Florida, bloodroot is disjunct in the Black Hills and listed as Sensitive by the Forest Service. Illustration by W. Fertig.

At lower elevations, riparian shrublands are typically composed of a mix of shrubs such as Western snowberry, gooseberries, currants, and roses. High-elevation streams support several shrub types, including willows and Water birch. Non-riparian shrubland types are best developed at lower elevations. Stands of Big sagebrush are found in the outer part of the Hogback Rim. Silver sagebrush occasionally forms large stands in the grasslands of the Hogback Rim and Red Valley. Mountain mahogany shrubland is represented by extensive stands on steeply-dipping outcrops of Minnekahta limestone east of Newcastle. Thickets of Western snowberry are common in draws and on floodplains throughout the Hills.

Grasslands are most extensive at lower elevations. Dominant species include representatives of short-, mixed- and tall-grass prairies. At high-elevations, Black Hills montane grasslands occur in broad drainage bottoms on the Limestone Plateau and adjacent Central Core. The thin rocky soils on the summit of the Bear Lodge Mountains at Warren Peaks and on Cement Ridge south of Sundance, support a similar grassland type. Graminoid-dominated wet meadows and streambanks are common throughout the hills. Saline and alkaline wetlands are found in the Red Valley and some areas of the Hogback Rim.

In the Black Hills, vegetation types of higher elevations tend to be better characterized, as much of that land is publicly-owned and available for survey. There remain major information gaps for some low-elevation types, such as floodplain woodlands dominated by cottonwood and ash, and several woodland and savanna types dominated by Bur oak.

Floral Valleys of the Black Hills

By Hollis Marriott

Black Hills montane grasslands are large wildflower-rich meadows dominated by grasses such as Prairie dropseed, Porcupine grass, Timber oatgrass and Richardson's needlegrass. They occur at higher elevations, generally above 6000 ft. This type of vegetation is endemic (restricted) to the Black Hills, and is quite different in terms of species composition from the more common prairie types found at lower elevations. Montane grasslands, or "mountain meadows," were first described by Lt. Col. George A. Custer on his trip through the area in 1874:

> "Every step of our march that day was amid flowers of the most exquisite colors and perfume ... it was a strange sight to glance back at the advancing columns of cavalry, and behold the men with beautiful bouquets in their hands, while the head-gear of the horses was decorated with wreaths of flowers fit to crown a queen of May. Deeming it a most fitting appellation, I named this Floral Valley."

Mountain meadows in the Black Hills have been severely reduced with settlement since the late 1800s, and are ranked G1S1 (globally- and state-imperiled) by the Natural Heritage Network and The Nature Conservancy. In 1999, an inventory of Black Hills montane grasslands was carried out by Hollis Marriott

under a grant from the Wildlife Division of the SD Dept. of Game, Fish and Parks, with assistance from Black Hills National Forest and The Nature Conservancy.

This survey confirmed that Black Hills montane grassland is among the most endangered of vegetation types in the area. Of 76 stands visited, only 26 were considered of sufficient quality for in-depth survey, and of these, only seven are currently considered possible conservation sites. The most common factors contributing to poor quality are exotics (especially Timothy, Smooth brome, non-native clovers and Canada thistle), heavy utilization by livestock, heavy cover of native increaser species (especially Rigid goldenrod and Western snowberry), cultivated fields, gravel and dirt roads, and residences and other developments. Subdivision for summer and year-round residences has recently become a significant threat to remaining montane grasslands. Two of the larger grasslands seen on private lands in 1999 had already been subdivided, with lots for sale.

The potential montane grassland conservation sites identified in 1999 are composed primarily of land managed by Black Hills National Forest. It is hoped that the Forest Service will consider special designation (e.g. Research Natural Area or Special Botanical Area) for at least several of these sites to ensure that our remaining Floral Valleys receive the protection they need.

Which Spruce is This?

By Dave Ode
[from *Dakota Flora* series in *Conservation Digest*]

> "The Black Hills Spruce ... being a tree native to the state of South Dakota and by its name definitely designating this state as its own, and being a tree of noble attributes, is hereby named to be the state tree of South Dakota."
> SD Codified Law 1-6-11 (1947)

During the Pleistocene when glacial ice covered most of eastern South Dakota, large portions of western South Dakota were covered with spruce forests. In fact, on Minnechaduza Creek in the sandhills along the South Dakota - Nebraska border, there is a large wetland where spruce cones and pollen can still be found buried beneath fifteen feet of wet peat and sand. This material has been carbon dated to 12,600 years ago.

As the climate became warmer and drier, the glaciers melted and the spruce forest retreated northward, leaving behind one last remnant population that found refuge in the cool, moist Black Hills. This isolated population of White spruce (*Picea glauca*) has become known as "Black Hills Spruce" and has become the genetic stock for almost all of the White spruce used for ornamental and shelterbelt plantings in the Northern Great Plains region.

White spruce is one of the dominant trees of the vast boreal forest that extends from the northeastern US across Canada to Alaska. The wood of white spruce is very light weight, soft, straight-grained and light yellow in color. Its lumber is sometimes used for interior finishing, but its primary use -- especially in eastern Canada -- is for paper pulp.

Because its lumber is of little value, many of the spruce forests in the Black Hills have been converted to ponderosa pine through management. But the spruce forests that remain are a wonderful collection of boreal plants and animals. They are forests of narrow pyramidal spires, and at their feet grow orchids and wintergreens. Among their boughs, the Northern Flying Squirrel finds refuge. Black Hills Spruce are often draped with a lichen called Old Man's Beard (*Usnea cavernosa* and *U. sorediifera*). These shrouded densely-shaded forests create an eerie world, one that you just might imagine is inhabited by nisses, trolls and dwarves.

Above: Black Hills spruce (a.k.a. white spruce or *Picea glauca*). This species can be recognized by its pendent, papery cones with broad, rounded, smooth margins. The related Engelmann spruce (*P. engelmannii*) is more widespread in the mountains of Wyoming (but is absent from the Black Hills) and differs in having cones with pointed and uneven (erose) margins. Occasionally, the two species will hybridize. Illustration by C.L. Porter.

A Botanical Crossroads

By Hollis Marriott

The Black Hills have long been known as a botanical crossroads or melting pot. Five of the ten North American floristic provinces of Gleason and Cronquist (*The Natural Geography of Plants*, 1964) are well-represented in the local flora: Great Basin, Grassland (Great Plains), Eastern Deciduous Forest, Cordilleran (Rocky Mountain) Forest and Northern Coniferous Forest. Affinities are strongest with the Cordilleran Forest province, represented by the extensive stands of Ponderosa pine that cover the Black Hills. The Northern Coniferous Forest province contributes spruce and Paper birch forests, common at higher elevations. Grasslands are extensive at lower elevations. The Eastern Deciduous Forest province is represented at lower elevations by hardwood species such as Bur oak, Green ash, Ironwood (Hophornbeam) and American elm. Sagebrush grasslands composed of Great Basin species occur near the western and southern perimeters of the uplift.

Arthur McIntosh, Professor of Biology at the South Dakota State School of Mines in Rapid City (now SD School of Mines and Technology), analyzed the affinities of the Black Hills flora in 1931 ("A botanical survey of the Black Hills of South Dakota" in the *Black Hills Engineer* Vol. 19). Each of 600 species (less than half of the current known number for the flora unfortunately) was assigned to one of ten biogeographic categories. McIntosh found the Rocky Mountain region to be best represented, followed by the grasslands of the Great Plains. This analysis was updated by Bob Dorn in his *Flora of the Black Hills* (1977), based on a known flora of 1260 species. He found the Great Plains to be best represented with about 30% of the species, followed by the Rocky Mountain region with 25%. The deciduous forests of eastern North America contributed 5% of the flora, and northern coniferous forests contributed about 1%. The Great Basin was represented by about 4% of the species. The remainder were either widespread, introduced or possibly endemic.

These statistics describe numbers of species. A somewhat different impression may be had in travelling through the Black Hills, as some species are much more abundant than others. After driving miles of highway lined with Ponderosa pine, it would be easy to think that the Black Hills flora is mainly Rocky Mountain in nature. But one doesn't have to look long to find representative species from these major floristic provinces. Many are common in the Black Hills, even though they may be widely separated from their main overall range. The following checklist includes representative plants likely to be seen in the Black Hills, arranged by floristic province. Those readers that come to the field trip in July can use it to chart their progress in enjoying the flora of the Black Hills.

An Abbreviated Checklist of Common Black Hills Plants

GREAT BASIN
- ___ Big sagebrush
- ___ Bluebunch wheatgrass

GREAT PLAINS
- ___ Leadplant
- ___ Little bluestem
- ___ Big bluestem
- ___ Side-oats grama
- ___ Needle-and-thread
- ___ Porcupine grass
- ___ Prairie clovers (white and purple)
- ___ Yellow owl clover
- ___ Purple coneflower
- ___ Yellow coneflower
- ___ Blanket flower (Gaillardia)

ROCKY MOUNTAINS
- ___ Ponderosa pine
- ___ Rocky Mountain juniper
- ___ Quaking aspen
- ___ Common juniper
- ___ Oregon grape
- ___ Kinnikinnik (Bearberry)
- ___ Mountain ninebark
- ___ Thimbleberry
- ___ Wild raspberry
- ___ Heart-leaf arnica
- ___ Silvery lupine

NORTHERN CONIFEROUS FORESTS
- ___ White spruce
- ___ Paper birch
- ___ Bebb willow
- ___ Bunchberry
- ___ Spurred gentian
- ___ Small blue columbine
- ___ Monkshood
- ___ Dwarf blackberry

EASTERN DECIDUOUS FORESTS
- ___ Bur oak
- ___ American elm
- ___ Ironwood (hophornbeam)
- ___ Nannyberry
- ___ Beaked hazel
- ___ Bittersweet
- ___ May flower (False lily-of-the-valley)
- ___ Red columbine
- ___ Wild sarsaparilla

The Protection Status of the Flora of the Wyoming Black Hills

By Walter Fertig

Through the efforts of the US Forest Service, National Park Service, Bureau of Land Management Newcastle Field Office, Wyoming state parks, and The Nature Conservancy, nine areas in the Wyoming portion of the Black Hills have been designated as special management areas. These sites form the foundation of a protected areas network in the Wyoming Black Hills and may be the best hope for the long-term protection of the region's fauna and flora. Many of these areas, however, were set aside for their recreational value or to preserve geologic phenomena, rather than for their biodiversity significance. Thus, an important question arises: how successful is this network in protecting species richness in the Black Hills?

This past spring, Brooke Oblad (an undergraduate at the University of Wyoming) and I decided to find this out. We first compiled species checklists for each management area in the Black Hills (including National Park Service, US Forest Service, BLM, state, and private lands) using information from floristic and vegetation mapping studies and specimens from the Rocky Mountain Herbarium. We then determined the protection score for each species using a 4-part scale developed by the US Geological Survey's National Gap Analysis Program to measure the protection level of different management areas. The score for each species was based on the highest possible protection score for any individual population. Species were ranked 1 if at least one population occurs on Gap status 1 lands that are permanently protected from conversion of natural land cover and where management emphasis is on the perpetuation of natural ecological processes. In the study area, only Devils Tower National Monument is currently ranked Gap status 1. A rank of 2 was given to species that occur in Forest Service special botanical areas, late successional landscapes, and historic sites, BLM areas of critical environmental concern, or Nature Conservancy easements. The management emphasis in these areas stresses preservation, but other uses are still allowed which may not be compatible with wildlife values. Species were ranked 3 if they occurred on public lands managed for multiple use and 4 if they were found only on private or state lands with no legally-binding protection mandate.

We found that of 1029 vascular plant species currently known from the Wyoming Black Hills, 449 (43.6%) are found in Status 1 protected areas (Devils Tower National Monument) and an additional 199 taxa (19.4%) occur in Status 2 areas (Dugout Gulch and Upper Sand Creek special botanical areas, Geis Springs, Miller Creek, and Sand Creek late successional landscapes, and Inyan Kara historic site on Black Hills National Forest and the BLM Whoop-Up Canyon ACEC). These 648 species (representing 63% of the total flora) are considered to be at least minimally protected. The remaining 37% of the Wyoming Black Hills flora are found on public or private lands managed for multiple use and are not considered protected at present. The protection status of the entire flora, broken down by major biome type, is shown in Table 1 below.

Table 1.
Protection Status of the Flora of the Wyoming Black Hills
(see text for details)

	Protection Score			
	1	2	3	4
Total # Taxa n = 1029	449 (43.6%)	199 (19.4%)	242 (23.5%)	139 (13.5%)
Alpine spp. n = 1	0 (0%)	0 (0%)	1 (100%)	0 (0%)
E. Deciduous Forest spp. n = 49	11 (22.4%)	24 (49.0%)	13 (26.5%)	1 (2.1%)
Great Plains spp. n = 295	177 (60.0%)	20 (6.8%)	56 (19.0%)	42 (14.2%)
Intermountain Desert Steppe spp. n = 43	21 (48.8%)	3 (7.0%)	12 (27.9%)	7 (16.3%)
Rocky Mtn. Forest spp. n = 307	130 (42.3%)	87 (28.3%)	70 (22.8%)	20 (6.5%)
Wetland spp. n = 186	48 (25.8%)	47 (25.2%)	60 (32.3%)	31 (16.7%)
Exotic spp. n = 148	62 (41.9%)	18 (12.1%)	30 (20.3%)	38 (25.7%)

At least 50% of the plant species found in each of the major biomes in the Black Hills receive some protection, with the highest degree afforded to the Rocky Mountain Forest, Eastern Deciduous Forest, and Great Plains species. (The alpine biome is the one exception, but in the Black Hills this type is represented by only one species, *Minuartia rubella*). Although these numbers are encouraging, more work remains to be done to ensure that 100% of the native flora is at least minimally represented in the protected areas network. In particular, lowland prairie, sagebrush steppe, wetland, and forest habitat types are inadequately represented in the existing network. Many of the best examples of these sites may occur on private lands or on Black Hills National Forest. Furthermore, our analysis indicated that rare species are also poorly represented. Of the 77 vascular plants considered "species of special concern" by the state natural heritage program, only 30 (39%) are presently found on status 1 or 2 lands in the study area. The final protected areas network for the Wyoming Black Hills will need to give greater consideration to these "fine filter" species if the goal of protecting locations for all species is to be attained.

Books for the Black Hills Explorer

This is a short list of resources available to naturalists at loose in the Black Hills. For further reading, check the bookstores in the state and national parks in the area.

General

Froiland, S. G. 1990. *Natural History of the Black Hills and Badlands.* Sioux Falls, SD: Augustana College, Center for Western Studies. paperback, 225 pp.
This book is highly recommended to those interested in all aspects of Black Hills natural history. It provides good overviews of the vegetation, ecology and conservation needs of the area, as well as a look at human history.

Raventon, E. 1994. *Island in the Plains - a Black Hills Natural History.* Boulder, CO: Johnson Books. paperback, 272 pp.
The author starts with general background on the natural history of the Black Hills, and then proceeds with in-depth descriptions of a dozen of the more fascinating sites, as well as inside peeks at the naturalists involved.

Plants

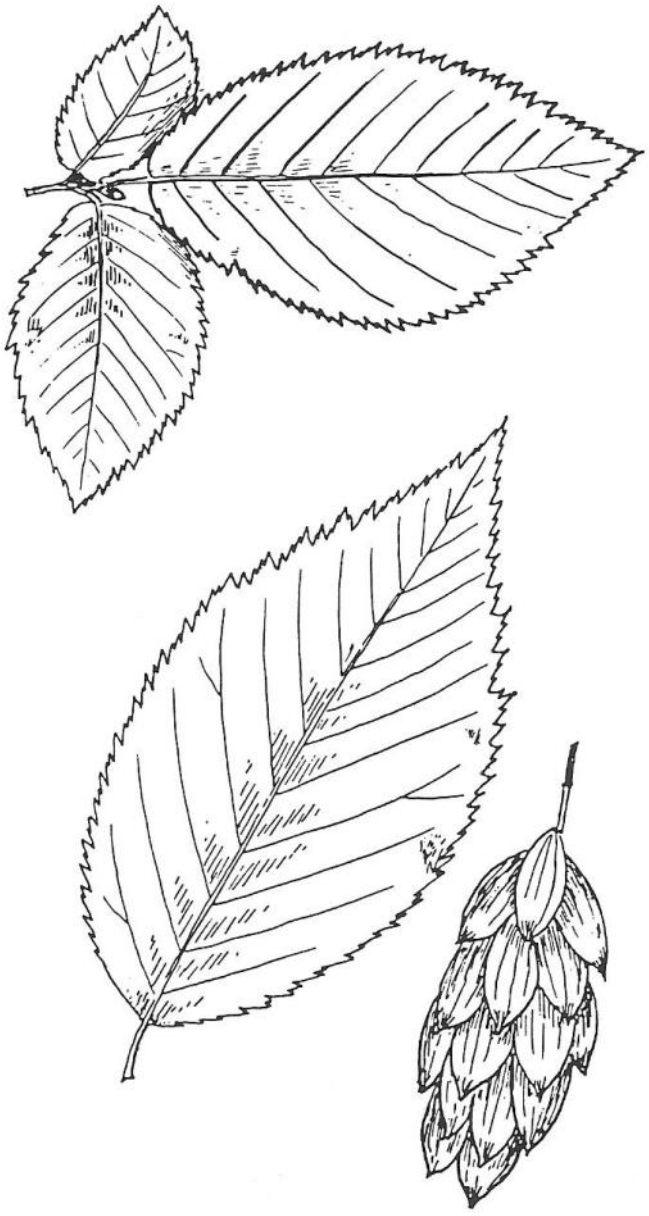
Dorn, R. D. 1977. *Flora of the Black Hills.* Cheyenne, WY: Mountain West Publishing. paperback, 377 pp.
A compact paperback suitable for use in the field; contains keys to all species of vascular plants (no separate descriptions). Out-of-print, unfortunately, but available through libraries.

Great Plains Flora Association, T. M. Barkley, ed. 1986. *Flora of the Great Plains.* Lawrence: Univ. Press of KS. hardcover, 1392 pp.
Currently the best comprehensive resource for the Black Hills flora; contains keys and detailed descriptions, along with Great Plains and rangewide distribution information. A heavy book.

Larson, G. E. and J. R. Johnson. 1999. *Plants of the Black Hills and Bear Lodge Mountains.* Brookings, SD: SD State Univ. Coll. of Agric. & Biol. Sci. paperback, 608pp.
This recent release includes 600 of the more common or significant plants of the Black Hills. For each, there are brief descriptions of the plant and its habitat, and wonderful color photographs. This book should work well for lay botanists, and for any user is an excellent complement to the more technical floras.

Geology

Gries, J. P. 1996. *Roadside Geology of South Dakota.* Missoula, MT: Mountain Press Publ. Co. paperback, 358 pp.
Not surprisingly, close to half of this book is devoted to the Black Hills. The author states that this book is not for geologists (though they might enjoy it) but for those interested in learning more about the fascinating landscapes and rocks of the area. It includes both general descriptions and tour routes with many points of interest. HM



Above: Hop-hornbeam (*Ostrya virginiana*) is a small round-topped tree that grows up to 40 feet tall. This member of the birch family (Betulaceae) can be recognized by its sharply double-toothed ovate leaves and drooping 2-inch long catkins of papery fruiting scales that resemble clusters of hops. Hop-hornbeam is primarily an eastern forest species, with disjunct populations in shady, north-facing canyons in the Black Hills. Illustration by C.L. Porter.

Black Hills Field Trip Itinerary

Friday, July 21
4 PM: Leave from Devils Tower National Monument campground for a late afternoon - evening tour of Ponderosa pine woodlands, hardwood draws and mixed-grass prairies.

Camping at Devils Tower will be arranged. Lodging is available at DT Lodge B&B, DT KOA (cabins), and in Hulett and Sundance (motels, reservations recommended.)

Saturday, July 22
9 AM: Meet new arrivals at the rest area on I-90 on the east side of Sundance. Tour the higher Black Hills via good gravel roads, with stops for the following:

Short hike into Dugout Gulch Botanical Area, featuring a rich mix of eastern, boreal and Rocky Mountain plant species.

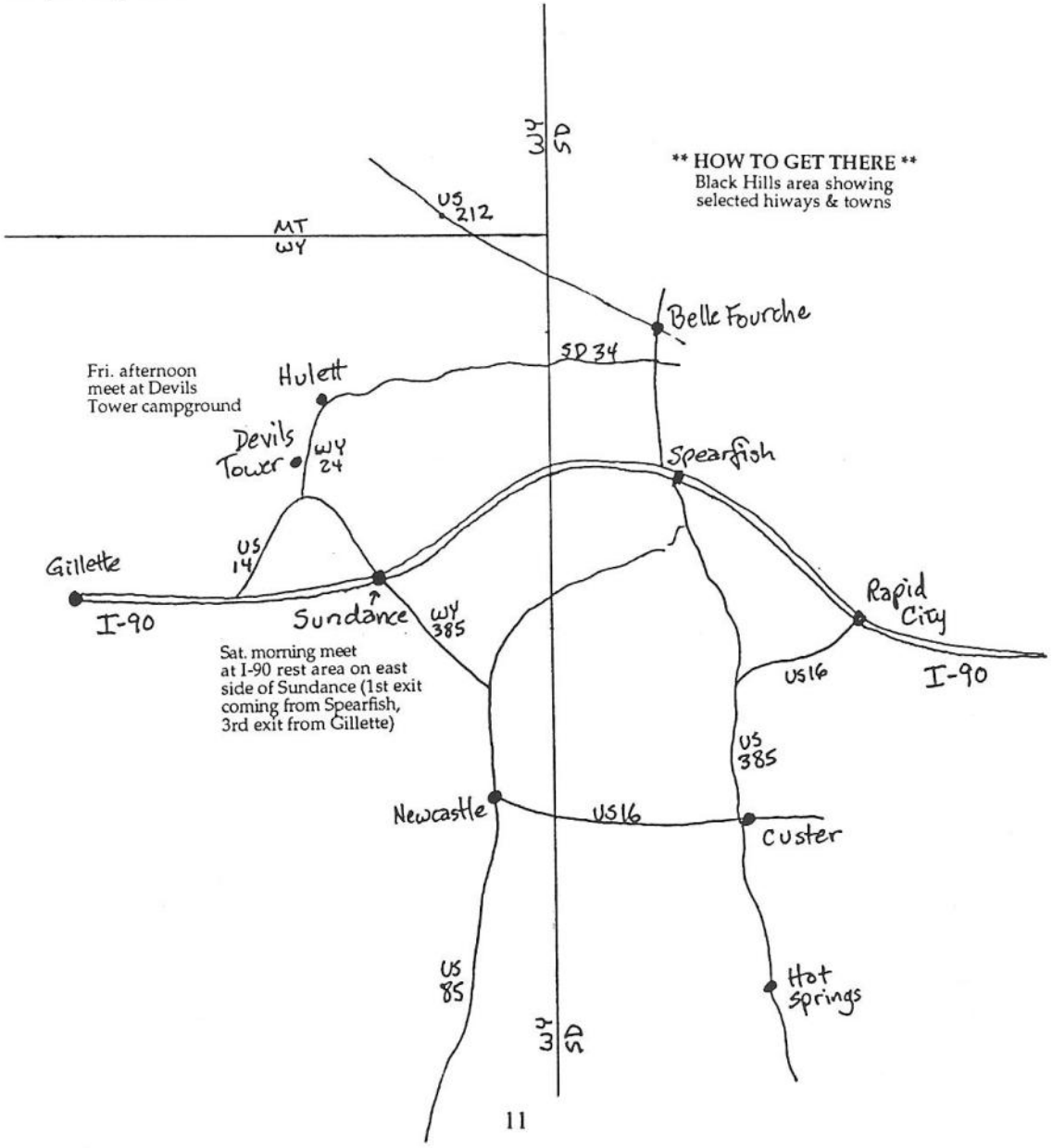
Tour of boreal spruce forests and wetlands around Black Fox Campground.

Wildflower-viewing in Black Hills mountain meadows (nice grasses also!).

Time permitting: hike up Odakota Mountain, the little-known second highest point in the Black Hills, or visit Bear Mountain Lookout.

Spend Saturday night near Custer, SD. Camping will be arranged; lodging is available in Custer - reservations recommended.

Sunday, July 23
Easy-to-moderate half-day hike based on interest, time and weather. Possibilities include Hell Canyon in the scenic limestone country near Jewel Cave National Monument, Harney Peak - the high point of Black Hills, and fern treasure-hunting among the granite spires and fins of the Black Hills Needles. HM



Yes, Yes – An Arboreal Mess!

First straighten out the messes below, putting one letter on each blank to spell the common names of six Black Hills trees.

M U L L P I W D
_ _ _ _ _ _ _ _
X X

H E R B R I P P A C
_ _ _ _ _ _ _ _ _
X X

K R O U B A
_ _ _ _ _ _
X

R O C K Y H E C R E H
_ _ _ _ _ _ _ _ _ _ _
X X

E X B R O D E L
_ _ _ _ _ _ _
X

I T H E S C R E W U P
_ _ _ _ _ _ _ _ _ _
X X

Now arrange the **X**'d letters to verify that your answers are correct!

_ _ _ _ _ _ _ _ _ _ _ (By Hollis Marriott)

Wyoming Native Plant Society
PO Box 3452
Laramie, WY 82071

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 the Wyoming Native Plant Society, return the membership form below 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)