

Protection Status and Checklist  
of the Vascular Plant Flora  
of the Wyoming Black Hills

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## INTRODUCTION

The Wyoming Black Hills consists of a rich mosaic of habitat types, ranging from dry upland forests of Ponderosa pine and Bur oak, to mesic woods dominated by Aspen, Paper birch, and American elm, mixed-grass prairie, montane grasslands, and wet meadows (Marriott et al. 1999). Although the Black Hills ecoregion covers less than 5% of the state of Wyoming, it contains nearly 38% of the state's vascular plant species. This high species richness has been attributed to the region's location at the crossroads of five of North America's ten major floristic provinces (Marriott 1985). Although currently dominated by species from the Cordilleran Forest Province (Rocky Mountains), the Black Hills flora is also represented by plants from the Northern Conifer (boreal forest), Eastern Deciduous Forest, Grassland, and Great Basins provinces (McIntosh 1931; Gleason and Cronquist 1964).

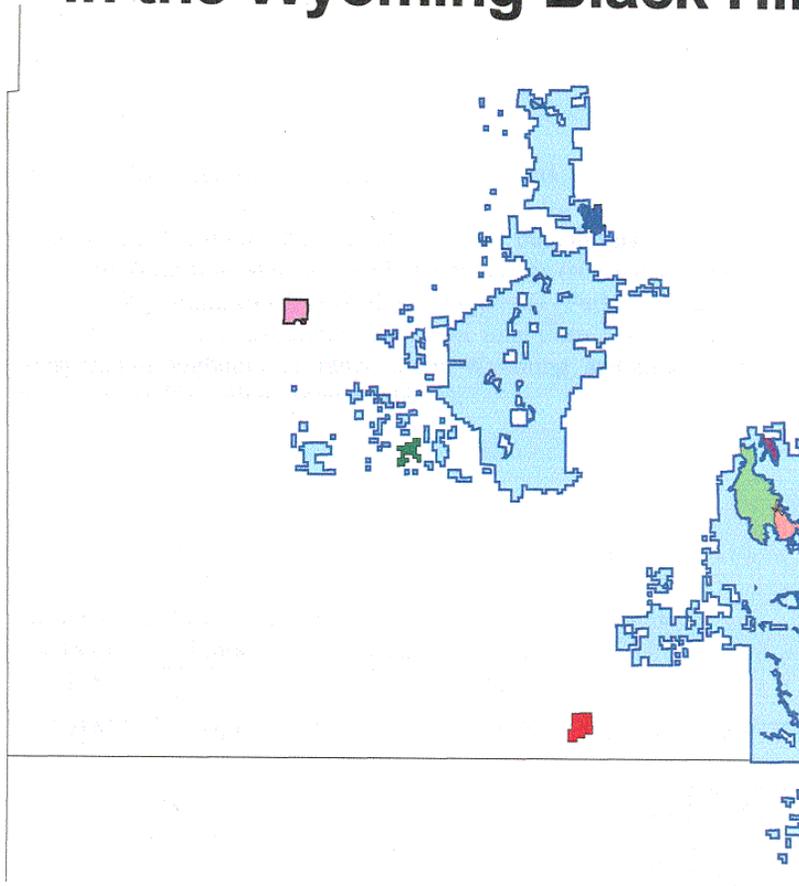
Through the efforts of the National Park Service, Black Hills National Forest, the Bureau of Land Management Newcastle Field Office, Wyoming State Parks Department, and The Nature Conservancy (TNC), at least nine special management areas have been set aside in the Wyoming portion of the Black Hills. These areas form the foundation of a protected-area network that may be critical for the long-term survival of the ecoregion's native animals and plants. In many cases, these areas were selected to protect important geological, historical, or recreational sites, rather than biological diversity. The purpose of our report is to assess how well this network protects both rare and abundant vascular plant species and to identify groups of species or habitats that may need additional conservation attention.

## METHODS

We derived a checklist of the vascular flora of the Wyoming Black Hills from regional floristic surveys (Marriott 1982, 1985), floras (Dorn 1977, 1992) and distribution maps and databases maintained by the University of Wyoming's Rocky Mountain Herbarium (RM) and Wyoming Natural Diversity Database (WYNDD). Additional information on the distribution of taxa by special management area was derived from species checklists and vegetation surveys (Fertig 2000a; Jones 1992; Ode and Marriott 1990; Marriott 1982, 1989a, 1989b, 1989c, 1991, 1993, 1995; Marriott et al. 1999; San Miguel and Marriott 1996; The Nature Conservancy 1996; USDA Black Hills National Forest 1996; USDI Bureau of Land Management) and data from WYNDD and the RM.

The protection status of each species was assessed using a 4-part scale originally developed by the US Geological Survey's National Gap Program for ranking the protection level of different management areas (Merrill et al. 1996). 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 occurred on Gap Status 1 lands that are permanently protected and managed to maintain biological processes. Such sites include designated wilderness areas, national parks and monuments, most national wildlife refuges, and Nature Conservancy preserves. A rank of 2 was given to species that occur in designated management areas that still allow some land uses that may reduce the quality of natural communities (Gap Status 2 lands). These lands include research natural areas (RNAs), special botanical areas (SBAs), late successional landscapes (LSLs), USFS historic sites, BLM areas of critical environmental concern (ACECs), and TNC easements.

# Figure 1. Special Management Areas in the Wyoming Black Hills



-  Black Hills NF
-  Upper Sand Creek SBA
-  Dugout Gulch SBA
-  Geis Springs LSL
-  Inyan Kara HS
-  Miller Creek LSL
-  Sand Creek LSL
-  Devils Tower NM
-  Wyoming Counties



A score of 3 was given to those species in which the best protected populations occur on public lands managed for multiple use. Gap status 3 lands include undesignated BLM and US Forest Service lands, wilderness study areas, and state parks. Lastly, species were ranked 4 if they occur only on private, state, or reservation lands with no legally binding protection mandate (Gap status 4 lands).

## RESULTS

### Summary of the Flora of the Wyoming Black Hills

The Wyoming Black Hills contain 1029 taxa of vascular plants, representing 37.4% of the entire state flora (Appendix A). Exotic (non-native) plants account for 148 of these taxa (14.4% of the total flora of the study area), a figure that is slightly higher than the state-wide average (Table 1). Unlike most regions of Wyoming, state and regional endemics (see Table 1 for definitions) account for less than 1% of the Wyoming Black Hills flora (9 species). Peripheral, disjunct, and sparse species represent 154 species and just under 15% of the total flora. The remaining 718 species (69.8%) are widespread throughout their range and in Wyoming, and are not considered conservation targets at the “fine filter” scale (Table 1).

Table 1.  
Geographic Distribution Patterns in the Wyoming Black Hills Flora

Distribution Pattern	WBH Total # Taxa	% of WBH Flora	WY Total # Taxa	% of WY Flora	Notes
Exotic	148	14.4%	337	12.2%	Taxa not native to WY or North America
Widespread	718	69.8%	1467	53.5%	Abundant in WY, occupying > 5% of the state and widely and continuously distributed outside the state
Sparse	17	1.6%	77	2.8%	Populations widely distributed across WY but small and restricted to specialized or uncommon habitats
Peripheral	108	10.5%	472	17.1%	Populations at the edge of a species' continuous global range, limited to < 5% of the state
Disjunct	29	2.8%	107	3.9%	Populations widely isolated in WY from the main, contiguous portion of a species' range
State and Regional Endemic	9	0.9%	292	10.6%	Total range restricted to a small geographic area, defined here as an area smaller than the state of WY.
Total # of Taxa	1029		2752		

Key: WBH = Black Hills Landscape. Statewide data from Fertig (1998). Exotics status based on Fertig (1999a).

State abundance patterns (Table 2) also indicate that most of the Wyoming Black Hills flora consists of relatively common species of low conservation priority. 633 taxa from the Black Hills area (61.5%) are currently ranked S2S3 to S5 in Wyoming, indicating that these species are moderately to very common within the state (Table 2). By contrast, only 96 species (9.3 %) are ranked in the two rarest categories: S1 (extremely rare) and SH (state historical, not observed since 1950).

Five of the state's six major biome types are represented in the flora of the Black Hills (Barbour and Billings 1999). (One typically alpine species, *Arenaria rubella*, is also present in the flora, but it occurs at much lower elevations than elsewhere in Wyoming.) In terms of species richness, the Rocky Mountain Forest biome accounts for the largest component of the flora (307 species, or 29.8 % of the total flora), followed by the Great Plains with 295 taxa (28.7%) (Table 3). Despite their small geographic area, wetlands contribute a high percentage (18.0%) of the total species richness. Only 49 species from the Eastern Deciduous Forest are present in the Black Hills (4.8% of the flora), but these taxa account for 92.5% of the species from this biome found in the entire state. The Intermountain Desert Steppe flora is barely represented in the ecoregion, with only 43 species (4.2% of the flora).

Table 2.  
State Abundance Patterns in the Wyoming Black Hills Flora

State Rank	WBH Total # taxa	% of WBH Flora	WY Total # taxa	% of WY Flora	Notes
SH	4	0.4%	46	1.7%	State Historical: taxa last observed prior to 1950
SR	0	0%	20	0.8%	State Reported: reported for WY, but confirmation is needed
S1	92	8.9%	468	17%	Known from less than 5 extant populations in WY or with a small population size
S1S2-S2	152	14.8%	627	22.8%	S1S2: known from 6-7 locations and a small population size; S2: known from 6-20 locations and a small to medium population size
S2S3-S3	270	26.2%	708	25.7%	Known from ca 20-75 locations with medium population size
S3S4-S4	169	16.4%	295	10.7%	Known from 75-100 locations and may be locally abundant in at least 1 major biome
S4S5-S5	194	18.9%	251	9.1%	Known from over 100 locations and often abundant in 2 or more major biomes.
SE	148	14.4%	337	12.2%	State Exotic: not native to WY or North America

Key: WBH = Wyoming Black Hills. Statewide data from Fertig 1998.

Table 3.  
Biome Types Represented in the Wyoming Black Hills Flora

Biome Type	WBH Total Taxa	% of WBH Flora	WY Total Flora	% State Flora
Alpine	1	0.1%	164	6%
Eastern Deciduous Forest	49	4.8%	53	1.9%
Great Plains	295	28.7%	404	14.7%
Intermountain Desert Steppe	43	4.2%	342	12.4%
Rocky Mountain Forests	307	29.8%	928	33.8%
Wetlands	186	18.0%	524	19%
Exotics	148	14.4%	337	12.2%

Key: WBH = Wyoming Black Hills. Statewide data from Fertig 1998.

#### Protection Status of the Flora of the Wyoming Black Hills

The Wyoming portion of the Black Hills currently contains only one area (Devils Tower National Monument) that is ranked Status 1 for protection of biological diversity by Gap (Merrill et al. 1996). 449 plant taxa are currently known from Devils Tower, representing 43.6% of the flora of the Wyoming Black Hills (Fertig 2000). An additional 199 species (19.4% of the flora) are found in areas ranked status 2 in the Gap system (Table 4, Appendix A). In the Black Hills Ecoregion, these areas include the Dugout Gulch and Upper Sand Creek special botanical areas, Geis Spring, Miller Creek, and Sand Creek late successional landscapes, Inyan Kara Historic Site, Whoop-up Canyon ACEC, and TNC easements. Combined, Status 1 and 2 lands at least minimally protect 63% of the vascular plant species in the Wyoming Black Hills. Of the remaining species, 23.5% occur on Status 3 Forest Service, BLM, and state park lands managed for multiple use and 13.5% are restricted to unprotected state or private Status 4 lands (Table 4). At least 50% of the plant species found in each of the major biomes in the Black Hills receive some protection, with the highest percentage afforded to Eastern Deciduous Forest, Rocky Mountain Forest, and Great Plains species (66.8-71.4%) (Table 4).

#### Protection Status of Rare Plant Species of the Wyoming Black Hills

WYNDD currently categorizes 77 plants as “species of special concern” in the Wyoming Black Hills (Fertig 2000b; Fertig and Beauvais 1999)\*. Of these species, only 30 (39%) occur at least once in Gap status 1 or 2 lands in the ecoregion (Tables 5, 6). 18 of the protected species are considered peripherals, 11 are significantly disjunct, and 1 is considered sparse throughout the state. 26 of the region’s 77 rare species belong to the Eastern Deciduous Forest biome, of which 12 (46.2%) are at least minimally protected. The Great Plains biome is represented by 27 rare plants, but only 10 receive any protection (37%), while Wetlands contain 15 rare species of which 4 (20%) are protected. The Rocky Mountain Forest biome has only 9 rare species, but 7 of these receive some protection (77.8%).

\* Since the publication of the 1999 edition of “Wyoming Plant and Animal Species of Special Concern, one rare plant species from the Black Hills (*Carex parryana* var. *parryana*) has been dropped due to its recently confirmed greater abundance across the state.

Table 4.  
Protection Summary for Vascular Plant Species in the Wyoming Black Hills

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

Key: **Protection Status** is based on a modified 4-part scale developed for ranking the protection status of different land areas for Gap Analysis (Merrill et al. 1996). Species ranked **1** occur on at least one site that is permanently protected from conversion of natural land cover and managed to maintain natural processes [designated Wilderness Areas, National Parks and Monuments, National Wildlife Refuges, and Nature Conservancy preserves]. Species ranked **2** occur on at least one site that is protected from conversion of natural land cover, but which may be subject to some management practices that reduce the quality of natural communities [BLM ACECs, Forest Service Research Natural Areas, Special Botanical Areas, and Late Successional Landscapes, National Park Service-managed National Recreation Areas, and TNC conservation easements]. Species ranked **3** occur on at least one site that is managed as public land for multiple use. [undesignated BLM, US Forest Service, and state park lands]. Species ranked **4** occur only on lands that lack legally binding mandates for management of natural land cover or species [private, state, and reservation lands].

Table 5.  
Protection Summary for Plant Species of Special Concern in the Wyoming Black Hills

	Status 1	Status 2	Status 3	Status 4
RARE PLANTS				
Total # Taxa n = 77	7 (9.1%)	23 (29.9%)	35 (45.4%)	12 (15.6%)
BIOME				
Eastern Deciduous Forest Species (EDF) n = 26	1 (3.8%)	11 (42.4%)	13 (50%)	1 (3.8%)
Great Plains Species (GRS) n = 27	5 (18.5%)	5 (18.5%)	9 (33.3%)	8 (29.7%)
Rocky Mountain Forest Species (RMF) n = 9	0	7 (77.8%)	2 (22.2%)	0
Wetland Species (WET) n = 15	1 (6.7%)	3 (20%)	8 (53.3%)	3 (20%)
DISTRIBUTION				
Disjunct n = 22	0	11 (50%)	11 (50%)	0
Peripheral n = 51	7 (13.7%)	11 (21.6%)	23 (45.1%)	10 (19.6%)
Sparse n = 4	0	1 (25%)	1 (25%)	2 (50%)

Key: **Protection Status** is based on a modified 4-part scale developed for ranking the protection status of different land areas for Gap Analysis (Merrill et al. 1996). Species ranked **1** occur on at least one site that is permanently protected from conversion of natural land cover and managed to maintain natural processes [designated Wilderness Areas, National Parks and Monuments, National Wildlife Refuges, and Nature Conservancy preserves]. Species ranked **2** occur on at least one site that is protected from conversion of natural land cover, but which may be subject to some management practices that reduce the quality of natural communities [BLM ACECs, Forest Service Research Natural Areas, Special Botanical Areas, and Late Successional Landscapes, National Park Service-managed National Recreation Areas, and TNC conservation easements]. Species ranked **3** occur on at least one site that is managed as public land for multiple use. [undesignated BLM, US Forest Service, and state park lands]. Species ranked **4** occur only on lands that lack legally binding mandates for management of natural land cover or species [private, state, and reservation lands].

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Table 6.  
Plants of Special Concern in the Wyoming Black Hills  
(pages 10-12)

Key: see key for Appendix A for explanation of codes and terms.







## DISCUSSION

Sixty-three percent of the vascular plant species of the Wyoming Black Hills are currently protected in Gap status 1 or 2 lands. This figure greatly exceeds the 39% protection score for the area's plant species of special concern. The existing protected area network does a relatively good job of conserving habitat for widespread or common species (the so-called "coarse-filter species), but is clearly inadequate for protecting the less common ("fine-filter") elements of the flora. The results from the Black Hills contrast sharply with those attained in comparable analyses of the flora of the Bighorn Range (Fertig 1999b) and Greater Yellowstone area (Fertig 2000c) in which protection scores for rare and common species were nearly equivalent.

The low level of protection for rare species in the Black Hills can be attributed to a number of factors. The Black Hills are the lowest mountain range in the state and lack significant areas of high elevation or alpine habitat – the so-called "rock and ice" areas that are typically afforded wilderness protection in other areas. The long history of human settlement in the Hills has resulted in a highly fragmented land ownership pattern, with relatively few lands in public ownership and most of these with well-established multiple use mandates (logging, mining, and livestock grazing). Until recently, few areas have been designated for natural resource protection, and most of these were established for recreation or to preserve unique geological or cultural features rather than native biological diversity. The high road density within the Hills has prevented many areas from being preserved at the landscape level.

The 1996 Black Hills National Forest Land Management Plan helped fill many of the holes in the protected areas network by establishing new special botanical areas and late successional landscapes in several paper birch, ironwood, aspen, bur oak, white spruce, and ponderosa pine habitat types that are noteworthy for their rare, disjunct, and sensitive plant species. Additional holes remain, however, especially in foothills prairie, sagebrush steppe, montane grassland, wetland, and low-elevation conifer forest habitat types on private, BLM, and Forest Service lands (Marriott et al. 1999). Certain geographic areas are also poorly represented, especially the Bear Lodge Mountains, Southeastern Foothills, and the fringe of Great Plains grasslands. An effort is still needed by federal agencies, TNC, and other land trusts to target these gaps in the protected area network. The current emphasis on coarse filter conservation will help address these deficiencies, but no strategy to conserve representative examples of the Black Hills flora can completely succeed without adequate attention to the fine filter plant elements.

This report has focused solely on presence/absence in protected areas and has not emphasized the amount of representation across the region that is necessary to ensure long-term species viability. For most species, little concrete information is available on minimum population size, distribution, or genetic variability needed to adequately assess viability. The Nature Conservancy (1997) has recommended a policy of conserving at least 5 high quality occurrences of a species dispersed throughout its range as a hedge against regional extirpation. Better information is needed on both common and rare species within the Black Hills to determine if these minimum representation goals are being met. More complete botanical inventory data are also needed at several existing "protected" areas to determine which species are actually present and in what abundance. Surveys are especially needed on TNC easements, the Geis Spring and Miller Creek late successional landscapes, and the BLM Whoop-Up Canyon ACEC.

Designation of special management areas is not, by itself, the complete solution for preserving representative examples of the Black Hills flora. Development and implementation of management strategies that promote or maintain the environmental conditions needed for the survival of each plant species are absolutely critical. Such strategies need not be restricted to Gap status 1 and 2 lands to achieve the long-term conservation of the botanical resources of the Black Hills. Ultimately, the success or failure of plant conservation efforts in the Black Hills depends on cooperation of multiple public and private partners and the recognition by all that these floral features have value and significance.

#### LITERATURE CITED

Barbour, M.G. and W.D. Billings. 1999. *North American Terrestrial Vegetation*, second edition. Cambridge Univ. Press.

Dorn, R.D. 1977. *Flora of the Black Hills*. Published by the author.

Dorn, R.D. 1992. *Vascular Plants of Wyoming*, second edition. Mountain West Publishing, Cheyenne, WY.

Fertig, W. 1998. Gap analysis of plants in Wyoming: first year progress report. Report prepared for the University of Wyoming Physics and Astronomy/PASS Center and Botany Department.

Fertig, W. 1999a. Non-native plants of Wyoming. *Castilleja* 18(2):7-10.

Fertig, W. 1999b. Protection status and checklist of the vascular plant flora of the Bighorn Landscape. Report prepared for the Nature Conservancy Wyoming Field Office by the Wyoming Natural Diversity Database, Laramie, WY.

Fertig, W. 2000a. Rare plants of Devils Tower National Monument. Report prepared for the National Park Service by the Wyoming Natural Diversity Database, Laramie, WY.

Fertig, W. 2000b. Target plant species and potential plant conservation sites in the Wyoming portion of the Black Hills Ecoregion. Report prepared for The Nature Conservancy Midwest Science Division by the Wyoming Natural Diversity Database, Laramie, WY.

Fertig, W. 2000c. Rare vascular plant species in the Wyoming portion of the Utah-Wyoming Rocky Mountains Ecoregion. Report prepared for the Wyoming Nature Conservancy by the Wyoming Natural Diversity Database, Laramie, WY.

Fertig, W. and G. Beauvais. 1999. *Wyoming Plant and Animal Species of Special Concern*. Wyoming Natural Diversity Database, Laramie, WY.

Gleason, H.A. and A. Cronquist. 1964. *The Natural Geography of Plants*. Columbia Univ. Press, New York.

Jones, G.P. 1992. Report on the survey for Hairy grama (*Bouteloua hirsuta* Lag. var. *hirsuta*) in the Whoop-Up Canyon Area of Critical Environmental Concern. Report prepared for the BLM Newcastle Resource Area by the Wyoming Natural Diversity Database, Laramie, WY.

Marriott, H. 1982. Devils Tower National Monument plant checklist. Report prepared for the Devils Tower Natural History Association.

Marriott, H. 1985. Flora of the northwestern Black Hills, Crook and Weston counties, Wyoming. Unpublished Master's thesis, Department of Botany, University of Wyoming, Laramie, WY.

Marriott, H. 1989a. Suitability investigation report for a proposed Bear Lodge Pass (Alva Summit) Special Botanical Area, Black Hills National Forest. Report prepared by the Wyoming Natural Diversity Database, Laramie, WY.

Marriott, H. 1989b. Suitability investigation report for a proposed Dugout Gulch Special Botanical Area, Black Hills National Forest. Report prepared by the Wyoming Natural Diversity Database, Laramie, WY.

Marriott, H. 1989c. Programs for monitoring rare and noxious plant species at Devils Tower National Monument, Wyoming. Report prepared for the National Park Service by the Wyoming Natural Diversity Database, Laramie, WY.

Marriott, H. 1991. Suitability investigation report for a proposed Upper Sand Creek Special Botanical Area, Black Hills National Forest. Report prepared by the Wyoming Natural Diversity Database, Laramie, WY.

Marriott, H. 1993. Sensitive plant species surveys on the Bear Lodge District, Black Hills National Forest. Report prepared by the Wyoming Nature Conservancy, Lander, WY.

Marriott, H. 1995. Devils Tower National Monument common wildflower checklist. Devils Tower National Monument.

Marriott, H., D. Faber-Langendoen, A. McAdams, D. Stutzman, and B. Burkhart. 1999. Black Hills Community Inventory, final report. The Nature Conservancy Midwest Conservation Science Center, Minneapolis, MN.

McIntosh, A.J. 1931. A botanical survey of the Black Hills of South Dakota. *Black Hills Engineer* 19:159-276.

Merrill, E.H., T.W. Kohley, M.E. Herdendorf, W.A. Reiners, K.L. Driese, R.W. Marrs, and S.H. Anderson. 1996. The Wyoming Gap Analysis Project Final Report. Department of Zoology and Physiology, Department of Botany, and Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming, Laramie.

Ode, D.J. and H. Marriott. 1990. Sensitive plant surveys in the northwestern Black Hills. Report prepared for the Black Hills National Forest Spearfish and Bearlodge Ranger Districts by the South Dakota Game, Fish, and Parks Department and the Wyoming Natural Diversity Database.

San Miguel, G.L. and H. Marriott. 1996. Devils Tower National Monument tree checklist. Devils Tower National Monument.

The Nature Conservancy. 1996. Vegetation sampling and classification of Devils Tower National Monument. The Nature Conservancy Midwest Regional Office, Minneapolis, MN. (available on the internet at [www.nps.gov/npsveg/DETO/methods.html](http://www.nps.gov/npsveg/DETO/methods.html)).

USDA Black Hills National Forest. 1996. Black Hills National Forest Revised Land and Resource Management Plan Final Environmental Impact Statement. Black Hills National Forest, Custer, SD.

USDI Bureau of Land Management. 1999. Final Environmental Impact Statement and Proposed Resource Management Plan for public lands administered by the Bureau of Land Management Newcastle Field Office, Newcastle, Wyoming. Bureau of Land Management Newcastle Field Office, Newcastle, WY.

Weber, W. A. 1982. Mnemonic three-letter acronyms for the families of vascular plants: a device for more effective herbarium curation. *Taxon* 31 (1): 74-88.

## Appendix A.

### Annotated Checklist of the Flora of the Wyoming Black Hills Ecoregion and Summary of Current Protection Status

The known vascular plant flora of the Wyoming portion of the Black Hills Ecoregion is listed alphabetically by family and by genus. Each species entry includes the family code (Fam), pertinent synonyms, global (Grank) and state rank (Srank) as determined by the network of Natural Heritage programs and WYNDD (see Appendix B for codes), and information on geographic distribution pattern (Dist), growth form (Form) and major biome type (Biome). The distribution of each species by land management area is indicated by an “X” for confirmed presence and “X?” for unconfirmed presence. The current protection status in Wyoming, based on Gap criteria, is indicated under the “Score” column.

#### Key:

Fam: Family acronyms are based on Weber (1982) and are usually the first three letters of the family name. Exceptions are the Adoxaceae (ADX), Aspleniaceae (ASL), Chenopodiaceae (CHN), Callitrichaceae (CLL), Commelinaceae (CMM), Convolvulaceae (CNV), Capparaceae (CPP), Caprifoliaceae (CPR), Crassulaceae (CRS), Caryophyllaceae (CRY), Dennstaedtiaceae (DST), Elaeagnaceae (ELE), Elatinaceae (ELT), Grossulariaceae (GRS), Hydrangeaceae (HDR), Juncaginaceae (JCG), Lemnaceae (LMN), Malvaceae (MLV), Oxalidaceae (OXL), Polygalaceae (PGL), Polygonaceae (PLG), Polemoniaceae (PLM), Primulaceae (PRM), Plantaginaceae (PTG), Rhamnaceae (RHM), Sparganiaceae (SPG), and Verbenaceae (VRB). Family taxonomy follows Dorn (1992).

Dist: Geographic Distribution Pattern. W = widespread (widely distributed rangewide and over most of Wyoming), S = Sparse (wide-ranging geographically, but restricted to small and specialized habitats that are widely scattered in Wyoming), P = Peripheral (wide-ranging globally, but at very edge of range in Wyoming), D = Disjunct (widely isolated in Wyoming from the main, continuous part of its range), R = Regional endemic (restricted to a small global range in Wyoming and 1-2 adjacent states), and E = State endemic (entire global range is restricted to the state of Wyoming).

Form: Growth form. TREE, SHRUB, GRASS (perennial graminoids), A-GRASS (annual graminoids), FORB (perennial forb), A-FORB (annual forb), and FERN (ferns and fern allies).

Biome: Major biome type. ALP = Arctic/alpine, EDF = Eastern Deciduous Forest, GRS = Great Plains, IDS = Intermountain Desert Steppe, RMF = Rocky Mountain Forest, and WET = Wetlands. Biome is left blank for non-native (exotic) species.

Land Management: DTNM = Devils Tower National Monument, DG SBA = Dugout Gulch Special Botanical Area, USC SBA = Upper Sand Creek Special Botanical Area, GS LSL = Geis Spring Late Successional Landscape, MC LSL = Miller Creek Late Successional Landscape, SC

LSL = Sand Creek Late Successional Landscape, IK HS = Inyan Kara Historic Site, WC ACEC = Whoop-Up Canyon Area of Critical Environmental Concern, TNC = TNC preserves or easements, BH NF = Black Hills National Forest, KSP = Keyhole State Park, New BLM = BLM Newcastle Field Office, and Priv = private or state lands.

Gap Status. Protection Status is based on a modified 4-part scale developed for ranking the protection status of different land areas for Gap Analysis (Merrill et al. 1996). Species ranked **1** occur on at least one site that is permanently protected from conversion of natural land cover and managed to maintain natural processes (designated Wilderness Areas, National Parks and Monuments, National Wildlife Refuges, and Nature Conservancy preserves). Species ranked **2** occur on at least one site that is protected from conversion of natural land cover, but which may be subject to some management practices that reduce the quality of natural communities (BLM ACECs, Forest Service Research Natural Areas, Special Botanical Areas and Late Successional Landscapes, National Park Service-managed National Recreation Areas, and TNC conservation easements). Species ranked **3** occur on at least one site that is managed as public land for multiple use. (undesignated BLM, US Forest Service, and state park lands). Species ranked **4** occur only on lands that lack legally binding mandates for management of natural land cover or species (private, state, and reservation lands).



## Appendix B.

### Natural Heritage Ranking System

WYNDD uses The Nature Conservancy's standardized ranking system to assess the global and state rarity of all plant and animal species, subspecies, and varieties. Each taxon is ranked on a scale of 1-5 (rarest to most common) based on population size, geographic range, habitat specificity, and downward trend at the state and global levels. Codes are as follows:

- G Global rank: based on the rangewide status of a species.
- T Trinomial rank: based on the rangewide status of a subspecies or variety.
- S State rank: based on the status of a taxon in Wyoming (state ranks may differ in other states).
- 1 Critically imperiled because of extreme rarity (5 or fewer extant occurrences, or very few remaining individuals), or because of some factor of a species' life history that makes it vulnerable to extinction.
- 2 Imperiled because of rarity (6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction.
- 3 Rare or local throughout its range or found locally in a restricted range (21-100 occurrences).
- 4 Apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.
- 5 Demonstrably secure, although the species may be quite rare in parts of its range, especially at the periphery.
- E Exotic (not native to North America)
- E\* Exotic in Wyoming (native to North America, but probably not native to Wyoming prior to this century and dependent on human disturbance for establishment).
- H Known only from historical records (last observed prior to 1950).
- U Status uncertain, more information is needed.
- Q Questions exist regarding the taxonomic validity of a species, subspecies, or variety.
- ? Questions exist regarding the assigned G, T, or S rank of a taxon.